Henry P. Roybal
Commissioner, District 1

Anna Hansen
Commissioner, District 2

Rudy N. Garcia
Commissioner, District 3

SANTA FE COUNTY

Anna T. Hamilton
Commissioner, District 4

Hank Hughes
Commissioner, District 5

Gregory S. Shaffer
County Manager

June 9, 2022

SANTA FE COUNTY
IFB 2022-0183-PW/APS
CHUPADERO WATER-SEWER CORPORATION
WATER SYSTEM IMPROVEMENTS

ADDENDUM NO. 1

Dear Proponents,

This addendum is issued to reflect the following immediately. It shall be the responsibility of interested Bidders to adhere to any changes or revisions to the IFB as identified in this Addendum No. 1. This documentation shall become permanent and made part of the departmental files.

THE DEADLINE FOR ALL BIDS HAS BEEN EXTENDED TO: THURSDAY, JUNE 23, 2022 AT 2:00PM

Attachment A: Pre-Bid Meeting Sign-In Sheet

Attachment B: Spec Book

Please add this Addendum No. 1 to the original proposal documents and refer to proposal documents, hereto as such. This and all subsequent addenda will become part of any resulting contract documents and have effects as if original issued. All other unaffected sections will have their original interpretation and remain in full force and effect. Responders are reminded that any questions or need for clarification must be addressed to Amanda Patterson-Sanchez, Procurement Specialist Senior at apatterson-sanchez@santafecountynm.gov.

SANTA FE COUNTY

PRE-BID CONFERENCE
IFB 2022-0183 PW/APS
CHUPADERO WATER-SEWER CORPORATION WATER SYSTEM IMPROVEMENTS
June 1, 2022 AT 10:00AM

NAME	COMPANY	TELEPHONE	E-MAIL ADDRESS
Amanda Patterson Sanchez	SFC Purchasing	(505) 992-6753	apattersonsanchez@santafecountynm.gov
Daniel Gonzales	TLC Plumbing Utility	(505) 697-0613	dgonzales@TLCPlumbing.com
JAIME CRUZ	FILE CONSTRUCTION	(505) 400 3611	JCRUZ@FCONST.COM
Gabriel Serna	New Image	505-603-9510	
Johnny Manzanares	New Image	505-699-0166	New Image Mgmt @ Hotmail.com
BILL TAYLOR	SFC	505-986-6373	WTAYLOR@SANTAFECOUNTYNM.GOV
JIM GREEN	SFC - Utilities	505-992-3045	jgreen@santafecountynm.gov

Attachment B

Specifications

Water System Improvements
Chupadero Water-Sewage Corporation
Santa Fe County, New Mexico
September 2020

WATER SYSTEM IMPROVEMENTS
Chupadero Water-Sewage Corporation
September 2020

SPECIFICATIONS TABLE OF CONTENTS

The technical material and data contained in the specifications were prepared under the supervision and direction of the Engineer of Record, Jerry A. May, P.E., whose seal as a Professional Engineer licensed to practice in the state of New Mexico is affixed below.

Jerry A. May, PE **Date:**
New Mexico PE License #16176

All questions about the meaning of intent of these documents shall be submitted only to the Engineer of Record stated above, IN WRITING, for interpretations.

WATER SYSTEM IMPROVEMENTS
CHUPADERO WATER-SEWAGE CORPORATION
SEPTEMBER 2020

SECTION 01 0001 – GENERAL REQUIREMENTS AND INFORMATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT INFORMATION

A. Project Identification – Water System Improvements
   1. Project Location – Chupadero, Santa Fe County, New Mexico
   2. Owner – Chupadero Water-Sewage Corporation, Renee Roybal, President
   3. Engineer – Martin/Martin Consulting Engineers, Jerry A. May, PE-Engineer of Record
   4. Regulatory Agencies – NMED Drinking Water Bureau: Patrick Castillo, PE.;Albuquerque

B. Contract Documents
   1. Project Manual
   2. Drawings
   3. Addendums issued during bidding

C. Access to Site – Contractor shall have full use of the identified project site (temporary access agreement) for construction operations during the construction period.

D. Project Completion – Contractor shall return project site to existing conditions.

E. Summary
   The work includes: installation, startup, and testing a new water treatment system within new well house and treatment building, connection to existing water system, equip new well with submersible well pump, drop pipe and electrical for groundwater supply well No. 5. All work shall be coordinated with the Engineer.

1.3 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
2. AI - Asphalt Institute; www.asphaltinstitute.org
3. ANSI - American National Standards Institute; www.ansi.org
4. ASTM - ASTM International; www.astm.org
5. AWWA - American Water Works Association; www.awwa.org
6. DHI - Door and Hardware Institute; www.dhi.org
7. ICBO - International Conference of Building Officials; (See ICC).
8. ICC - International Code Council; www.iccsafe.org
9. ISO - International Organization for Standardization; www.iso.org
10. NAIMA - North American Insulation Manufacturers Association; www.naima.org
11. NFPA - National Fire Protection Association; www.nfpa.org.
12. NMCID– New Mexico Construction Industries Division; www.rld.state.nm.us/construction
13. NMED – New Mexico Environment Department; www.env.nm.gov
14. NMED CPB – NMED Construction Programs Bureau; www.env.nm.gov/construction-programs
15. NMED DWB – NMED Drinking Water Bureau; www.env.nm.gov/drinking_water
16. NMFA – New Mexico Finance Authority; www.nmfa.net
17. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org
18. NMDOT – New Mexico Department of Transportation; www.dot.state.nm.us
19. OSE – New Mexico Office of the State Engineer; www.ose.state.nm.us
20. PPI – Plastic Pipe Institute; www.plasticpipe.org
21. SAE - SAE International; www.sae.org
22. TPI - Turfgrass Producers International; www.turfgrasssod.org
23. TRI - Tile Roofing Institute; www.tileroofing.org
24. UL - Underwriters Laboratories Inc.; www.ul.com

1.5 SUBMITTALS

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

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

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

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

E. Transmit each submittal with Engineer accepted form.

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

G. <u>Any submittal submitted more than 2 times to Engineer shall require payment from Contractor to Owner for Engineer additional services invoiced at current contracted hourly billing rates.</u>

1.6 OPERATION AND MAINTENANCE MANUAL

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions

B. Format: Submit operations and maintenance manuals in the following format:

   1. PDF electronic file **<u>preferred</u>**. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.

      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

   2. **Or** Three (3) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at least **30** days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least Seven (7) days before commencing demonstration and training.

E. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

F. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

G. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

H. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

I. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents

J. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

K. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Cross-reference to related systems in other operation and maintenance manuals.

L. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

M. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

N. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

O. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.7 JURISDICTION

A. Where jurisdictional specifications differ, the more stringent requirements shall govern.

END OF SECTION 01 0001

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Slabs-on-grade
2. Grade beams

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Design Mixtures: For each concrete mixture.
C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.03 INFORMATIONAL SUBMITTALS

A. Material certificates.
B. Material test reports.
C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.05 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.
B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.04 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
2. Fly Ash: ASTM C 618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.

1. Maximum Coarse-Aggregate Size: as indicated on the drawings.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330/C 330M, with size as indicated on the Drawings.
D. Air-Entraining Admixture: ASTM C 260/C 260M.
E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.06 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 for reinforced concrete that will be dry and protected from moisture in service, percent by weight of cement.
D. Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.07 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion structural normal-weight concrete mixture as noted on Drawings, unless aggregates are “potentially reactive” with alkalis based on the ASTM C 295 or ASTM C 1260 or ASTM C 1293 testing limits of Section 5.1 of “Guide Specification of Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). When aggregates are “potentially reactive”, compliance with Section 5.2 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association) must be established through ASTM C 1567 testing for proposed alternate concrete mixture. Submit test reports in accordance with Part I of this Specification.

2.08 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

    1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer, Structural Engineer or Architect as applicable.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

    1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.06 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.07 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

   1. Apply scratch finish to surfaces indicated.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of roof covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Testing and Special Inspections: As indicated on drawings.

END OF SECTION 03 3000

SECTION 26-0100 – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

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 ELECTRICAL DIVISION INDEX

26-0100	General Provisions
26-1100	Raceways
26-1200	Wires and Cables
26-1300	Outlet Boxes
26-1330	Cabinets
26-1400	Wiring Devices
26-1500	Motors
26-1550	Motor Starters
26-1600	Panelboards
26-1900	Relays and Contactors
26-4500	Grounding

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: 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 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, 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

A. 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 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 Owners Representative 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 Owners Representative.

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.

D. All equipment and material that is provided shall meet the Buy American Act.

2.3 ALTITUDE

A. Equipment affected by altitude shall perform satisfactorily the function intended at the altitude of the project site.

PART 3 - EXECUTION

3.1 GENERAL

A. 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 before starting work. Commencement of work signifies this Contractor's acceptance of the prevailing conditions.

3.2 TEMPORARY POWER AND LIGHTING

A. 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 Owners Representative.

3.3 UTILITIES

A. GENERAL: The Drawings reflect requirements of the serving utilities based on information derived from representatives of the utilities.

3.4 EXCAVATION

A. Comply with Earthwork section.

3.5 PERFORMANCE TESTS

A. Thoroughly test all fixtures, services and all circuits for proper operating conditions and freedom from grounds 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 Owners Representative 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 substantial completion and after 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. 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 owner to prove acceptability.

E. Furnish all instruments and labor for testing.

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.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) 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 Owners Representative 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 Civil 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. Civil Drawings shall take precedence over Electrical Drawings. The Contractor shall investigate the civil 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, 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 or other trades with all locations subject to the approval of the Engineer.

B. Verify 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 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, telephone, power, and secured computer.

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 Brady #B-350 permacode thin film pipe 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. Stencils to be painted on with legible contrasting colors without abbreviations. Painting shall be in accordance with DIVISION - FINISHES.

G. Approved Electrical Conduit Color Codes:

120/208 Volt	Black
Grounding	Green
110 Volt Control	Black/White

G. Identify all receptacle 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 Owners Representative and Owner.

3.10 WARRANTY

A. Deliver originals of all guarantees and warranties on this portion of the work to the Owner's Representative. Warrant all equipment, materials and workmanship for one year in accordance with the terms of the Contract.

3.11 PRODUCT HANDLING

A. 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

A. 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 Owner's Representative. Changes to the Electrical System shall be documented on a set of "Record Drawings" on a daily basis.

END OF SECTION 26 0100

SECTION 26-1100 - 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 26-0100.

C. Grounding: Section 26-4500.

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.

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 80, 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, or die-cast only.

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.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. Conduit Systems: Rigid steel conduit, IMC, rigid non-metallic conduit or EMT unless otherwise specified.

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 installed outside the perimeter of the building. Rigid non-metallic conduit is not permitted to be surface mounted in ducts, plenums or other air handling spaces. All 90 degree bends 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 Owners Representative 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 Owners Representative.

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 Owners Representative 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 Owners Representative. 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.

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. 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.

D. 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 Owners Representative. 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

A. Identify per Section 26-0100.

3.4 CLOSING OF OPENING

A. 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. 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 26 1100

SECTION 26-1200 – WIRES AND CABLES

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 26-0100.

C. Grounding: Section 26-4500.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES (600 VOLTS)

A. Type:

1. Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volt insulation unless otherwise specified or noted on the Drawings. Stranded conductors for No. 6 and larger and where elsewhere specified or noted on the Drawings.
2. All conductors shall be copper. Aluminum conductors will be permitted only on 600 volt and above systems.

B. Insulations: Type THWN insulation unless otherwise specified or noted on the Drawings. Type THWN minimum or type XHHW filled cross-linked polyethylene 90 degree C. thermosetting insulation for conductors larger than No. 6 and elsewhere as required by NEC.

C. Size: No. 12 minimum unless otherwise specified or noted on the Drawings. Not less than NEC requirements for the system to be installed.

D. Color Coding: Phase, neutral and ground conductors color-coded in accordance with NEC. Connect all conductors of the same color to the same phase conductors.

	Phase A	Phase B	Phase C	Neutral
120/240V/1 Phase	Black	Red	-----	White
208Y/120V/3 Phase	Black	Red	Blue	White

Ground shall be Green for all systems.

E. Conductors No. 12 and 10 shall be solid color compounded for the entire length and each like color shall be connected only to the particular phase throughout the project. Conductor sizes larger than No. 10 may

be color-coded at each termination and in each box or enclosure with six inches of half-lapped 3/4" pressure sensitive, plastic tape of respective colors in lieu of solid color compound.

2.2 VERTICAL CABLE SUPPORTS

A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used without metallic sheath.

2.3 CONNECTORS AND LUGS

A. For copper conductors No. 6 and smaller: 3M Scotch-Lok or T & B Sta-Kin, or equal compression or indent type connectors with integral or separate insulating caps.

B. For copper conductors larger than No. 6: Solderless, indent, hex screw, or bolt-type pressure connectors, properly taped or insulated.

2.4 TAPE

A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-1000. Equal to 3-M Super 88 Tape.

2.5 FEEDER CIRCUITS

A. Single conductor feeder cables shall be of the size and type as indicated on the Drawings. Sizes shown are for copper conductors unless otherwise noted on Drawings.

2.6 BRANCH CIRCUITS

A. Branch circuits shall be No. 12 AWG copper minimum and shall be larger AWG size where indicated on Drawings. Where branch circuits exceed 70 ft. in length, the AWG size shall be increased to accommodate voltage drop.

B. Branch circuits to all equipment, fixtures and outlets shall include a white neutral and green wire equipment ground.

2.7 TERMINATIONS

A. Cold shrink stress-relief cones shall be installed at all terminations where shielded cable is used and shall be installed in strict accordance with the recommendations of Electro-Products Division/3M.

PART 3 - EXECUTION

3.1 WIRE AND CABLE TESTS (600 VOLTS)

A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Owners Representative, and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all

instruments, equipment and personnel required for testing, and conduct tests in the presence of the Owner's Representative. Submit written reports of the tests and results when requested by the Engineer.

3.2 SPLICES (480 VOLTS AND UNDER)

A. Permitted only at outlets or accessible enclosures. Conductor lengths shall be continuous from termination to termination without splices unless approved by the Engineer.

3.3 PULL WIRES

A. In each empty conduit, except underground conduits, install a plastic line having tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard-drawn copper pull wire or a plastic line having a tensile strength of not less than 200 pounds.

3.4 RACEWAYS

A. Install in rigid conduit, EMT, or flexible metallic conduit, unless otherwise specified or noted on the Drawings.

3.5 CABLE BENDS

A. Radius or bends not less than ten times the outer diameter of the cable.

3.6 CONDUCTOR PULL

A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture collected have been swabbed out.

3.7 FEEDER IDENTIFICATION

A. Tag feeder circuits in each enclosure with wrap-around circuit designation labels.

3.8 CONNECTORS AND LUGS

A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.9 BUNDLING

A. Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two-ply lacing or nylon straps.

END OF SECTION 26 1200

SECTION 26-1300 - 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 26-0100.

C. Grounding: Section 26-4500.

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.

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

D. 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.

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

2.2 PULLBOXES

A. 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.

PART 3 - EXECUTION

3.1 OUTLET BOXES

A. 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.

3.2 PULLBOXES

A. Provide additional pullboxes wherever necessary to meet requirements for maximum lengths of conduit runs and maximum numbers of bends as specified under "Conduit and Fittings".

3.3 IDENTIFICATION

A. Identify all exposed junction and pullboxes according to the system carried by means of painted-on stencils or labels with legible letters and contrasting colors without abbreviations. In general, use yellow color. Painting shall be in accordance with DIVISION - FINISHES.

END OF SECTION 26 1300

SECTION 26-1330 - 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 26-0100.

C. Grounding: Section 26-4500.

PART 2 - PRODUCTS

2.1 GENERAL

A. 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 373-6 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.

2.2 FEED THROUGH GUTTERS

A. 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

A. 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

A. 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

A. 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

A. 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

A. 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

A. 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 and bottoms not less than 12" above floor. The height above floor of the highest over current device handle shall not exceed 6'-6".

END OF SECTION 26 1330

SECTION 26-1400 - 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 Provisions: Section 26-0100.

C. Grounding: Section 26-4500.

PART 2 - PRODUCTS

2.1 RECEPTACLES

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

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

2.2 PLUG CAPS

A. 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.

2.3 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.

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

PART 3 - EXECUTION

3.1 DEVICE PLATES

A. Install with alignment tolerance of 1/16" and all edges in continuous contact with wall surfaces.

END OF SECTION 26 1400

SECTION 26-1500 – MOTORS

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 26-0100.

C. Grounding: Section 26-4500.

PART 2 - PRODUCTS

2.1 GENERAL

A. Motors will be furnished with the equipment they are intended to operate and therefore generally will be furnished under other sections of these specifications. Furnish nameplates indicating manufacturer, horsepower, phase, cycle, voltage, RPM, type of motor windings, NEMA design and type of enclosure.

2.2 SIZE

A. Adequate for the duty to be performed without exceeding their full rated load or safe operating temperature when the driven equipment is operating at specified capacities with ambient temperatures and altitude compensation simulating actual job conditions.

2.3 TYPE

A. Suitable for the application but not less than Class A insulation and continuous duty classification, based on 40 degrees C. ambient temperature with drip proof frames and totally enclosed for exterior use. Conform to design, construction and performance requirements of NEMA and the Rotating Electrical Machinery Standards of ANSI.

2.4 VOLTAGE RATING

A. NEMA Standard to correspond to circuit voltage serving the motor. Motors operating on 208 volt systems shall be rated 200 volts or shall be specifically wound for the voltage. Rated and covered by the plus or minus 10% rated voltage warranty for 208 volts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accordance with related work specified in other sections of these Specifications and standard industry practice.

END OF SECTION 26 1500

SECTION 26 1550 – MOTOR STARTERS

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 26-0100.

C. Grounding: Section 26-4500.

1.2 SUBMITTALS: Submit complete shop drawings, control diagrams and descriptive literature.

PART 2 PRODUCTS

2.1 GENERAL: Starters shall be as specified in this section unless modified by other sections of these Specifications or by details or control diagrams on the Drawings. Provide NEMA Type 3R enclosures, unless otherwise noted or required, with doors arranged for padlocking. Equipment starters with contactors to break each ungrounded line to the motor. Starters shall be as manufactured by Franklin, General Electric, ITE, Square D, or Cutler-Hammer.

2.2 RATING: Each starter shall have a horsepower rating not less than the rating of the motor it controls. Starters and all their related component parts shall be designed and properly coordinated for the rating and characteristics of the motors furnished under the various sections of the specifications. Motor starters and overcurrent devices shall be ambient temperature compensated.

2.3 OVERLOADS: Provide ambient temperature compensated thermal overcurrent devices in each ungrounded phase. Provide a suitable reset device for resetting over current trip on the starter front. Overcurrent device ratings shall not exceed code maximums and shall be as recommended by the motor manufacturer for the application.

2.4 CONTROLS

A. Control circuit conductors shall be grounded in accordance with the NEC and shall be arranged so that an accidental ground will not start the motor.

B. Energy for control circuits and indicating lights shall be 120 volts.

C. Provide manual start-stop pushbuttons mounted in starter case unless automatic devices are shown elsewhere on Drawings or specified.

D. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for the purpose and have an adequate horsepower rating. When the automatic control device does not have such a rating, a magnetic starter shall be used, with the automatic control device actuating the pilot control circuit.

E. Starters controlled by automatic devices shall be provided with hand-off-automatic selector switch mounted on starter case and connected so motor can be manually operated regardless of the position of the automatic control device. Selector switch shall not be connected to supersede any safety device or safety interlock.

F. Provide starters with a sufficient number of auxiliary contact (N.O. and/or N.C.) to afford the control and interlocking required. Provide additional relays if required to obtain the correct control.

PART 3 EXECUTION

3.1 GENERAL: Provide each motor with a motor starter of proper design to meet the requirements of the motor and drive.

3.2 INSTALLATION: Install and connect in accordance with related work specified in other sections of these Specifications and standard industry practice.

END OF SECTION 26 1550

SECTION 26-1600 - 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 Provisions: Section 26-0100.

C. Cabinets: Section 26-1330.

F. Grounding: Section 26-4500.

1.2 SUBMITTALS

A. 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

A. 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 Eaton Cutler-Hammer and shall be circuit breaker or fusible type as scheduled.

2.2 CABINETS

A. Each panelboard shall be enclosed in a single sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 26-1330, Cabinets.

2.3 DOOR-IN-DOOR

A. Both surface and flush panels shall be door-in-door NEMA 3R. 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

A. 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

A. 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 SPACE ONLY

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

2.7 DIRECTORIES

A. Provide circuit directories on the inside face of the door of each panel.

2.8 LABELS

A. 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.

2.9 SKIRTS

A. 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

A. 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

A. Circuit numbering shown on the Drawings is based on pole position in the panelboard and not consecutive numbering.

3.3 PHASE ROTATION

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

END OF SECTION 26 1600

SECTION 26-1900 - 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 Requirements: Section 26-0100.

C. Grounding: Section 26-4500.

PART 2 - PRODUCTS

2.1 GENERAL

A. Electromagnetically 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 Industrial Control Equipment. Relays and contactors shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer.

2.2 RATINGS

A. As indicated on the Drawings or required, suitable for the application.

2.3 CONTACTS

A. 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

A. NEMA 1 for surface mounting in dry locations. Flush mounted with hinged door and flush latch where indicated. Sound-absorbing enclosures where located in or adjacent to occupied areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect in accordance with related work specified in other sections of these Specifications.

END OF SECTION 26 1900

SECTION 26-4500 - 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 Provisions: Section 26-0100.

C. Raceways: Section 26-1100.

D. Outlet Boxes: Section 26-1300.

E. Wires and Cables: Section 26-1200.

F. Wiring Devices: Section 26-1400.

G. Motors: Section 26-1500.

H. Motor Starters: Section 26-1550.

G. Cabinets: Section 26-1330.

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

A. 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 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.

3.3 GROUNDING CONDUCTORS

A. The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250-94, 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.

3.4 GROUND CONNECTIONS

A. 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.

3.5 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 a megger, 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 a megger, 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 Owners Representative.

END OF SECTION 26 4500

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Additional information concerning earth moving may be found on the civil drawings, in the project Geotechnical Baseline Report (if performed) and current edition APWA standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

C. Additional information concerning earth movement is not applicable to this project.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrades for slabs-on-grade, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures including over excavation of existing unsatisfactory on-site soil materials and replacement with structural fill.
3. Drainage course for slabs-on-grade.
4. Subbase course for asphalt or concrete paving.
5. Subsurface drainage backfill for walls and trenches.

B. Related Sections include the following:
1. Division 31 Section “Trenching and Backfilling” for excavating and backfilling of utilities.

C. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including any erosion and sediment control and water quality permits required by Santa Fe County and/or the State of New Mexico including NMED.

1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill approved by Geotechnical Engineer and/or Engineer of Record.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of all material of whatever character required for the work encountered above subgrade elevations and to lines and dimensions indicated, including boulders. See Section 3.4 for definition of unclassified and classified excavation.

G. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed or approved by Engineer and the testing and inspections agency to correct unsatisfactory conditions. Authorized additional excavation and replacement material will be paid for according to Contract Provisions for changes in the Work.

H. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.

I. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation including disposition of overexcavated materials and other work resulting from slides, cave-ins, swelling, upheaval, or remedial work, as well as remedial work directed by Engineer, shall be without additional compensation.

J. Fill: Fill is all material placed to raise the grade of the site or to backfill excavation, upon which the Contractor's Geotechnical Engineer has made sufficient tests and observations to enable him to issue a written statement that, in his opinion, the fill has been placed and compacted in accordance with the requirements of these specifications.

K. Structural Fill: Select granular material for use below floor slabs or structures and to 5-feet-0-inches beyond building lines. Base course or on-site material may be used if approved by the Geotechnical Engineer.

L. Underslab Gravel: Imported Class 6 road base per New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction (current addition) or material approved by Geotechnical Engineer.

M. Rock Excavation: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for Bulk Excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation which in the Geotechnical Engineer's opinion cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,090 lbf (125 kN) and stick-crowd force of not less than 18,650 lbf (83 kN); measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp (157-kW) flywheel power and developing a minimum of 48,510-lbf (216-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

P. Utilities: Include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: Provided by Contractor from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Comply with applicable codes, ordinances, regulations, references and standards in effect at bid date:

1. Uniform Building Code (UBC) or International Building Code (IBC) per jurisdiction criteria.
2. American Society for Testing and Materials (test methods as specified hereafter)(ASTM).
3. State and local codes.

B. In case of conflict between the above codes, regulations, references and standards and these specifications, the more stringent requirements shall govern.

C. Testing Agency: The Contractor will employ a qualified independent Geotechnical testing agency. Contractor shall furnish testing agency access to work, facilities and incidental labor required for testing. Notify the testing and inspection agency not less than 48 hours in advance of all work requiring testing.

D. All materials and operations under this section of the specifications shall be executed under the supervision of Engineer who will place qualified personnel on the site during earth moving operations as necessary.

The Engineer and/or their representative shall approve all foundation excavations and give written or electronic approval of the completed foundations to the Contractor at the following times:

1. When excavations are first open.
2. Just prior to placing of concrete, shall test and control the fill compaction, approve the materials and method of placing and compacting and give written approval to the Engineer that all bearing surfaces and fill requirements have been inspected.
3. The Contractor shall be responsible to notify the Engineer when tests are to be made.

E. For approval of imported or on-site fill material, notify the Engineer at least four (4) working days in advance of intention to import material, designate the proposed borrow area and permit the Engineer to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material. The Engineer report on the acceptability shall be final and binding.

F. Reference Standards:

Compaction Standard: Standard Proctor Density ASTM D698.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locations, sizes and depths or invert elevations of existing utilities as shown on the drawings are believed to be correct, but may not be absolutely so. Such information is therefore presented only as approximations, and should be verified prior to construction. Protect from damage any sewer, water, gas, electric, phone or other pipe lines or conduits uncovered during the work until they have been examined by the Engineer. If such lines are found to be abandoned and not in use, remove affected sections without extra cost. If such lines are found to be in use, carefully protect and carry on work around them. If Engineer deems it advisable to move such lines, Owner will pay cost of moving. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Contact utility-locator service for area where project is located before excavating.
2. Notify Engineer not less than two (2) days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Engineer's written permission.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

C. Remove all existing fill deemed by Engineer to be unsatisfactorily placed.

D. Existing Contours and Elevations: Contours and spot elevations of existing ground elevations at the site, and approximate elevations of finish grade cuts, fills, and excavations for the Work are shown on Drawings. Contours and elevations for existing ground lines are believed to be correct, but may not be absolutely so. Existing contours and elevations should therefore be considered approximate, and should be verified at the site prior to construction.

E. Verification of Existing Conditions: Visit the site prior to submission of bids. Verify existing conditions, elevations, and contours. In the event of discrepancies between existing conditions and those indicated on the Contract Documents or survey, contact the Engineer for clarification.

F. Existing Benchmarks: Carefully preserve and maintain existing benchmarks, monuments, property line pins, and other reference points. If disturbed or destroyed, restore or replace by a Professional Land Surveyor at no additional cost to Owner.

G. Frost Protection: When freezing temperatures may be expected, do not excavate to the full depth indicated unless the footing or slabs are to be poured immediately after the excavation has been completed. If placing of concrete is delayed, protect the bottoms of excavations from frost until concrete is placed.

1.7 WARRANTY

Settlement in backfill, fill or in structures built over backfill or fill, which may occur within the specified project warranty period, shall be corrected at no cost to the Owner. Any structures damaged by settlement shall be restored to their original condition by the Contractor, at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Shall meet approval of Engineer and shall be free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Clean, on-site, natural soils, or imported materials, as approved by the Engineer. This soil with rocks or gravel approaching 3-inch size in any dimension shall not be used for utility trench bedding material.

C. Unsatisfactory Soils: Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups, as identified by the Geotechnical Engineer.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Approved by Engineer.

E. Structural Fill: Approved by Engineer.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1 ½-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting the following gradation requirements (per NMDOT specifications):

Standard Sieve	% Passing
3/8”	100%
#4	45-100%
#16	30-85%
#20	25-60%
#30	5-20%
#100	0-10%

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1 ½-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage and Separation Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288. Utilize Mirafi 140N or as recommended by Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls, which are shown in Sediment Control Plan Drawings, during earth moving operations. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and rights-of-way.

C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

D. Cold Weather Work: Prevent frost from entering bearing stratus upon which construction will take place or in areas where fill will be placed in that season.

3.2 EXPLOSIVES

A. Explosives: The use of explosives is not permitted.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: All excavation (other than rock excavation) is considered as unclassified and is defined as removal of all material encountered, regardless of soil type. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include soil materials, and obstructions. Unclassified excavation is considered normal excavation and no extra costs will be allowed.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove material of every nature or description encountered in obtaining required lines and grades. Excavate and/or place and compact fill to provide for building pad elevation(s) required by drawings.

3. Excavate wide enough at foundations and retaining walls to permit erection and removal of forms, application of damp proofing or waterproofing.
4. Pitch grading around excavations to prevent water from running into excavated areas.
5. Pre-rip hardpan and soft bedrock with single-tooth ripper or other suitable equipment to facilitate excavation with conventional earth-moving equipment.
6. Bearing soils disturbed by excavating equipment must be recompacted to 95 percent of maximum Standard Proctor Density (ASTM D698) prior to placing concrete.
7. Exposed areas which will receive fill once properly cleaned, shall be scarified to a minimum depth of 8-inches, conditioned to near optimum moisture content, and compacted.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth excavation and rock excavation. Do not excavate rock until it has been classified and cross sectioned by Engineer.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

C. Stability:

1. Slope sides of excavations in compliance with OSHA requirements and local codes or ordinances. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Continuously monitor cut slopes for distress. Take all necessary precautions to safeguard workers, structures, and utilities.
3. Provide all necessary shoring, sheeting, or bracing of sides of excavations required to prevent caving, erosion, and gullying. Provide underpinning of existing structures or other improvements adjacent to excavations which are subject to damage.

D. Unanticipated Conditions: Notify the Engineer immediately upon finding evidence of previous structures or filled materials which penetrate below designated excavation levels, groundwater or water-bearing strata, or other conditions which are not shown or which cannot be reasonably assumed from existing surveys and geotechnical reports. Secure the Engineer's instructions before proceeding with further work in such areas.

E. Rock Excavation: Includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction. Rock excavation in unconfined areas is defined as removal and disposal of material which in the Engineer's opinion, cannot be excavated without continuous and systematic drilling and blasting, or continuous use of a suitable ripper or other special equipment.

1. Unanticipated Rock Excavation: Rock excavation that is not indicated on existing surveys or which cannot be reasonably assumed from geotechnical studies of the site and which could not have been anticipated without extensive investigations. Unanticipated rock excavation shall be subject to change order procedures or previously agreed upon unit prices.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10-foot. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
4. Excavation Below Slab on Grade: Over excavate clays and claystone within the proposed footprint of the building slab-on-grade to a minimum depth as recommended in Geotech Report and replace with on-site or imported materials as approved by Geotechnical Engineer.

B. Existing man-made fill shall be removed under structures as required by the Geotechnical Engineer.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

B. Scarify subgrade soils beneath exterior slabs, sidewalks and pavements to a minimum depth of 8-inches, moisture condition and recompact as specified.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Refer to Division 31 Section “Trenching and Backfilling,” for excavating and backfilling of utilities.

3.7 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Remove and replace soft areas. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or other equipment approved by Engineer.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 psi (17.2 MPa), may be used when approved by Engineer. If approved by Engineer, structural fill placed at 100 percent ASTM D698, 2 percent below to 1 percent above optimum moisture may be used.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials in approved locations without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
8. Acceptance of subgrade by Engineer.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Refer to Division 31 Section “Trenching and Backfilling,” for excavating and backfilling of utilities.

3.12 SOIL FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
2. In areas of fill, scarify natural soil following removal of unsatisfactory material, to a depth of 8-inches.

B. Place and compact fill material in layers to required elevations per the Geotechnical Report and as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill or structural fill as approved by Engineer.
4. Under building slabs, use engineered fill or reconditioned on-site soils or imported fills of native soils as approved by Engineer.
5. Under footings and foundations, use engineered fill or reconditioned on-site soils or imported fills of native soils as approved by Engineer.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to optimum or to 3 percent over optimum moisture content for clay soils, or within 2 percent of optimum moisture content for granular soils. Refer to geotechnical report for additional recommendations.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content beyond the tolerances described above and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under exterior flatwork, slabs, steps, and pavements, scarify and recompact top 8 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Underfootings and interior floor slabs, excavate to approved natural soils, in fill condition, compact to 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. Compact foundation wall backfill to 95 percent.
5. Compact scarified subgrade soils to 95 percent.
6. Compact retaining wall backfill to 95 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 feet.
2. Walks: Plus or minus 0.10 feet.
3. Pavements: Plus or minus 0.10 feet.
4. Grading inside Building Lines: Finish subgrade to a tolerance of ½-inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.16 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile if required by Geotechnical Engineer on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D698, ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Perform field moisture tests in accordance with ASTM D3017. Tests will be performed at the following locations and frequencies at a minimum:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than 2 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet (30 m) or less of wall length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 2000

SECTION 31 2333 – TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Additional information concerning trenching and backfilling may be found on the civil drawings and current edition APWA standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

C. Additional information concerning earthwork may be found in the Geotechnical Baseline Report, if provided.

1.2 SUMMARY

A. This Section includes the following:
   1. Excavating and backfilling for utility trenches.

B. Related Sections include the following:
   1. Division 31 Section “Earth Moving” for soil materials, site excavating, filling and grading.
   2. Division 33 Section “Water Utility Piping and Appurtenances” for water pipe installation.

C. Shoring Design: Provide the services of a professional engineer to design all shoring, bracing, and underpinning required to protect the safety of workers and integrity of adjacent existing structures or other improvements.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as backfill approved by Engineer.

E. Unclassified Excavation: Removal of all material of whatever-character required for the work encountered above subgrade elevations and to lines and dimensions indicated, including boulders.

F. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed or approved by Engineer and the testing and inspections agency to correct unsatisfactory conditions. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

G. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.

H. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation including disposition of overexcavated materials and other work resulting from slides, cave-ins, swelling, upheaval, or remedial work, as well as remedial work directed by Engineer, shall be without additional compensation.

I. Rock Excavation: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,090 lbf (125 kN) and stick-crowd force of not less than 18,650 lbf (83 kN); measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp (157-kW) flywheel power and developing a minimum of 48,510-lbf (216-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: Includes on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

L. Controlled Low Strength Material (CLSM): Controlled Low Strength Materials (CLSM) consists of a well-graded mixture of mineral aggregates, cementitious materials, water and admixtures. Other common names for CLSMs include: flowable fill, flowfill, non-shrink backfill, fly ash fill and controlled density fill.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of traceable plastic warning tape.

B. Samples: Contractor to submit representative samples of all materials proposed for use in bedding and trench backfilling operations to the testing and inspections agency for analysis and determination of compliance with the requirements specified herein.

C. Material Test Reports: Provided by Contractor from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil and gravel material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

D. Pre-Excavation Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit one (1) copy to each Owner and Engineer before earthwork begins.

1.5 QUALITY ASSURANCE

A. Testing Agency:

1. All testing and inspections required herein will be performed by an independent testing and inspection agency employed by the Contractor.
2. Notify the testing and inspection agency not less than 48 hours in advance of all work requiring testing or inspection services.

B. Regulatory Requirements: Comply with all applicable requirements of the Occupational Safety and Health Administration and local and State rules, regulations, and ordinances concerning shoring, bracing, or sloping of excavations and safety of workers. Safety of workers is the responsibility of the Contractor.

C. Coordination: Coordinate scheduling and procedures for trench excavation, bedding, and backfilling with other Sections whose work relates to or is affected by this work.

D. Pre-Construction Conference: Conduct conference at Project site as directed by Engineer prior to start of construction. Contractor to comply with requirements, which also may be included in Division 1 Section "Project Management and Coordination", if specified.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locations, sizes and depths or invert elevations of existing utilities as shown on the drawings are believed to be correct, but may not be absolutely so. Such information is therefore presumed only as approximations and should be verified prior to construction. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Engineer not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer’s written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

C. Existing Bench Marks: Carefully preserve and maintain existing bench marks, monuments, property line pins, and other reference points. If disturbed or destroyed, restore or replace them at no additional cost to the Owner.

D. Verification of Existing Conditions: Visit the site prior to submission of bids. Verify existing conditions, elevations, and utility locations. In the event of discrepancies between existing conditions and those indicated on the Contract Documents or survey, contact the Engineer for clarification.

1.7 WARRANTY

Settlement in backfill, fill or in structures built over backfill or fill, which may occur within the specified project warranty period, shall be corrected at no cost to the Owner. Any structures damaged by settlement shall be restored to their original condition by the Contractor, at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Utility Trench Bedding Materials:

1. Granular Bedding: Well graded mixture of sound mineral aggregate complying with Class 67 (Modified) gradation in accordance with the following table:

Class 67 (Modified) Gradation

Nominal Size	Percent Passing by Weight
¾”	90-100
3/8”	20-55
No. 4	5-10
No. 8	5-10

In the event the excavation or over excavation for bedding is below the water table, the sub-bedding material shall consist of ¾-inches to 1-1/2-inches rock (or larger if approved), placed in accordance with the Agency have authority.

2. Sand Bedding: Clean, well-graded sand, not more than 5% by weight passing a No. 200 sieve.
3. Native Soil Bedding: Native soil may be used for bedding as long as it’s free of organic matter or stones (2” diameter or greater) and other deleterious materials and < 20% passes a number 200 sieve. Native soil used for bedding must meet gradation above.

B. Utility Trench Backfill Materials:

1. Existing soils obtained from trench excavations, including granular or aggregate base course from removed pavements, broken and pulverized claystone or claystone-sandstone bedrock may be used for backfilling (not bedding) trenches, provided it meets any special requirements of the Utility Agency and Engineer. Bedrock must be processed and broken or pulverized so that the maximum particle or fragment size does not exceed three-inches (3-inches).

C. State Highway Backfill Materials:

1. State Highway base and subbase materials shall be provided and installed in accordance with NMDOT Specifications Division 200 Earthwork, Section 203 – “Excavation, Borrow and Embankment” and Section 207-“Subgrade Preparation”.
2. Santa Fe County backfill materials shall also be followed. The more stringent of NMDOT and Santa Fe County specifications shall govern.

D. Unsuitable Utility Trench Materials: Materials unsuitable for bedding and backfilling include highly organic soils, ASTM D2487 Group PT topsoil, and soils containing roots, vegetable matter, trash, and debris.

2.2 ACCESSORIES

A. Shoring and Bracing: Provide all materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good and serviceable condition, as required for safety and by governing authorities.

B. Excavate Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
- Red: Electric.
- Yellow: Gas, oil, steam, and dangerous materials.
- Orange: Telephone and other communications.
- Blue: Water systems.
- Green: Sewer systems.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work of this Section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.2 PREPARATION

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Protect and maintain erosion and sedimentation controls, which are shown in Sediment Control Plan Drawings as applicable.

3.3 Existing Utilities

A. General: Location of existing utilities shown on the plans are approximate only. The Contractor shall be responsible to locate all existing underground utilities in areas of the work. If utilities are to remain in place, provide protection during excavation and backfilling operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavations, consult the Engineer immediately for direction. Cooperate with the Utility Agency in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Utility Agency.

B. Active Utilities: Do not interrupt existing utilities serving facilities occupied and used by the Owner or by adjacent properties, except when permitted in writing by the Engineer, and then only after acceptable temporary utility services have been provided. Remove or relocate utilities only as indicated or specified.

a. Inactive Utilities: Report inactive or abandoned utilities encountered in excavating or grading operations, and remove, plug, or cap as required. In the absence of specific requirements, plug or cap such utility lines at least 5-feet -0-inches outside new building walls, or as required by local requirements.

b. Removal: Demolish and completely remove from the project site all existing underground utilities indicated to be removed. Coordinate with at least 48 hours in advance Utility Agencies for discontinuance of services if lines are active.

C. Protection of Persons and Property:

1. Provide all necessary measures to protect workmen and passersby. Barricade open excavations occurring as part of the work, as required by municipal or other authorities having jurisdiction.
2. Protect adjacent streets, structures, and other improvements from damage caused by settlement, undermining, washout, and other hazards created by trench excavations.
3. Protect subgrades and trench bottoms soils against freezing temperatures or frost.

4. Provide protective insulating materials as necessary.

3.4 SHORING AND BRACING

Provide shoring and bracing of excavations as required for safety and by governing authorities. Carry down shoring and bracing as excavation progresses. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

3.5 PAVEMENT REMOVAL AND REPLACEMENT

Where trenches or other utility excavations are made in existing paved areas, saw-cut pavement surface to create a clean break line. Cut pavement a minimum of 12-inches beyond trench width on each side of trench; remove and dispose of existing surface course and aggregate base course, leaving a 12-inches wide undisturbed subgrade lip on each side of trench.

After trench has been backfilled and compacted, place new pavement in accordance with applicable requirements of Division 32 Sections as applicable, for asphaltic or Portland cement concrete pavement and in accordance with NMDOT and Santa Fe County Specifications.

3.6 EXPLOSIVES

A. Explosives: The use of explosives is not permitted.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated on the drawings.

Clearance: 12 inches (300 mm) each side of pipe or conduit or as indicated in the drawings.

Slope sides of trenches or provide shoulders in accordance with OSHA requirements and as required by Utility Agency standards. Continuously monitor cut slopes and trenches for distress or movement. Provide all necessary shoring and bracing required to protect the life and safety of workmen performing excavation or installing piping or conduit.

B. Excavate Trench Bottoms: Excavate trenches a minimum of 3 inches (75 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course and backfill with a 6-inches layer of crushed stone or gravel prior to installing pipe unless otherwise indicated in drawings.

3.8 BEDDING OF PIPES:

After completion of trench excavation and before installation of piping, install not less than 3-inches of approved bedding material in trench bottom for support of pipe unless otherwise indicated in drawings. Dig bell holes in bedding deep enough to provide a minimum of 2-inches clearance between the bell and bedding material unless otherwise indicated in drawings. Fully support pipe on bedding material for the full length of the pipe barrel. After pipe is adjusted for line and grade, and all jointing is complete, carefully place and tamp bedding material under the haunches of the pipe and in the previously dug bell holes.

Install bedding to a minimum depth of 12-inches above top of pipe prior to starting placement of compacted backfill unless otherwise indicated in drawings. Lightly compact or tamp bedding material in a manner to avoid displacement of or damage to the pipe.

3.9 STORAGE OF SOIL MATERIALS

Stockpile borrow soil materials and excavated satisfactory soil materials in approved locations without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 UTILITY TRENCH BACKFILL

After installation of utility piping or lines have been completed, locations recorded, trash or other debris removed from excavations, and bedding placed and approved, backfill promptly as work and weather conditions permit. Do not backfill trenches until all required pipe system tests and inspections have been made, unless partial backfilling is required to restrain pipe under test pressures. Use care in backfilling to avoid damage or displacement of pipe systems.

Place backfill on subgrades free of mud, frost, snow, or ice.

Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

Place backfill materials in layers not more than 8-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4-inches in loose depth for material compacted by hand operated tampers.

Use hand held tools or compacting devices for trench backfill, until a minimum compacted thickness of 3-feet -0-inches above top of pipe is achieved. Mechanical or power compactors may be used thereafter.

Before compaction, moisten or aerate each layer of backfill to specifications.

Compact each layer to not less than 95% of maximum standard Proctor density (ASTM D698). Thoroughly compact by means of mechanical tampers areas which cannot be properly compacted by means of rolling equipment.

Backfill to subgrade elevation shown for finish grading, topsoil placement, or paving.

Place and compact initial backfill of satisfactory soil, free of particles larger than 2 inch in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.

Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

Backfill voids with satisfactory soil while installing and removing shoring and bracing.

Place and compact final backfill of satisfactory soil to final subgrade elevation.

Install warning tape directly above utilities, 12 inches (300 mm) below finished grade unless otherwise indicated in drawings.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Perform field moisture tests in accordance with ASTM D3017. Tests will be performed at the following locations and frequencies at a minimum:

D. Trench Backfill: The density tests shall be performed during backfilling at specified depths in the trench to ensure that the required density and moisture is obtained throughout. For trenches less than 30-inches in depth, density tests shall be taken within 18-inches above the top of pipe or conduit and at the surface/toplift as a minimum. For trenches greater than 30-inches in depth, density tests shall be taken within 18-inches of the top of the pipe or conduit, and at 2-foot vertical intervals to the top of the trench with the final test at the surface/toplift.

E. For utility mains conduct one (1) set of tests per 250 feet of linear trench at specified depths and for service lines conduct one (1) test per every service line per utility type at specified depths. At a minimum, test intervals and quantities shall meet or exceed the requirements of the local utility agency.

F. When testing agency reports that backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
C. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
D. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
E. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.13 CLEANING AND ADJUSTMENT

A. Cleanup: Remove excess materials not required for backfilling purposes, including excess spoil material, accumulated debris, and rubbish from site. Burning of waste material is prohibited.

3.14 RESTORATION

A. Adjacent Improvements: Restore all fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began at no additional cost to Owner.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 2333

SECTION 33-1100 - WATER UTILITY PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Additional information concerning water distribution systems may be found on the civil drawings. In case of conflict between the drawings and the information specified herein, the more stringent requirements shall govern.

C. Related Standards:
1. AWWA C651, Disinfecting Water Mains
2. New Mexico Environment Department Construction Programs Bureau Recommended Standards for Water Facilities, 2006.
3. New Mexico Environment Department Drinking Water Bureau Drinking Water Regulations.
4. New Mexico Environment Department Radiation Control Bureau Regulations.

1.2 SUMMARY

A. This Section includes water-distribution piping, appurtenances, and specialties for the following:

1. Public water mains/distribution.
2. Flush hydrants.
3. Valves.

B. Work Included: As applicable and as required, excavation, exploratory excavation (pothole), backfill, bedding, soil stabilization, ground water removal, connection to existing mains, and installation of pipe, thrust blocks, thrust restraints, valves, fittings, valve boxes, and all necessary appurtenances. Also includes removal and replacement of existing paving or concrete where required, haul and import of adequate backfill material to meet compaction requirements and removal of existing thrust blocks where necessary. Includes abandonment of valves and existing mains as required.

C. Related work:

1. Division 31 Section “Earth Moving”
2. Division 31 Section “Trenching and Backfilling”
3. Division 33 Section “Submersible Pumps and Well Appurtenances”
4. Division 46 Section “Packaged Water Treatment System and Appurtenances” for installation of uranium treatment system.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. Water Service: Exterior domestic-water service piping.

C. The following are industry abbreviations for pipe materials:

1. PVC: Polyvinyl chloride plastic.
2. CIP: Cast iron pipe.
3. DIP: Ductile iron pipe.
4. CU: Copper pipe.
5. HDPE: High density polyethylene

D. Trench Excavation: Excavation of all material encountered along trench other than rock excavation.

E. Rock Excavation: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for Bulk Excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation which in the Geotechnical Engineer's opinion cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,090 lbf (125 kN) and stick-crowd force of not less than 18,650 lbf (83 kN); measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp (157-kW) flywheel power and developing a minimum of 48,510-lbf (216-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

F. For this project rock excavation is considered incidental to the project.

1.4 SUBMITTALS

A. Product Data: For the following as applicable:

1. Piping specialties.
2. Fittings.
3. Valves, valve boxes and accessories.
4. Water meters and accessories.
5. Protective enclosures.
6. Fire or flush hydrants.

B. Field Quality-Control Test Reports: From Contractor.

C. Test Reports: Submit two (2) copies of laboratory gradation tests for bedding and trench stabilization materials, concrete mix design, asphalt mix designs, and compression test.

D. Permits: Submit copies of all permits issued for project. Contractor is responsible for obtaining all applicable utility agency, City, County, and State Permits for the project that have not already been obtained by the Engineer.

E. Locates: Contractor shall amend as-built drawings for any substantial deviations of utility locations and for locations of any previously unknown utilities and must submit two (2) copies of utility locate drawings/receipts prior to beginning construction.

F. As-Built Drawings: Provide Engineer with copies of redlined, as-built plans upon completion of construction. Substantial deviations from the drawings 3 feet horizontal or 1 foot vertical shall be surveyed and be certified by a New Mexico Licensed Professional Land Surveyor.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, material profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated.

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying water, including tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF/ANSI Standard 61 Compliance: all piping, valves, water meters shall comply with NSF/ANSI Standard 61: Drinking Water System Components – Health Effects

G. NMED Recommended Standards for Water Facilities, 8.1.2: pipe and joint materials which are not subject to permeation of organic compounds shall be used in areas of groundwater contaminated by organic compounds.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner’s Representative not less than two days (48 hours) in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner’s Representative written permission.

B. Immediately pump or bail out water found in excavations, whether rain or seepage. Coordination and use of electric power is the Contractor's responsibility. Excavations must be kept free from water at all times.

C. It shall be the responsibility of the Contractor to take all measures and furnish all equipment and labor necessary to control the flow, drainage and accumulation of water as required to permit completion of the work under this section to avoid damage to all work at no additional cost to the Owner.

D. It shall be the responsibility of the Contractor to take all measures and furnish all material, equipment and labor necessary to provide adequate backfill material as specified herein.

E. Water Service shall remain operational at all times until service changeover is completed. Provide Owner of residences with water as needed during outages.

1.8 PROJECT RECORD DOCUMENTS

A. Maintenance of Documents: Store documents apart from drawings used for construction. File submitted documents in accordance with the specification's section numbers. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes.

B. Recording: Label each document "PROJECT RECORD" in neat, large, printed letters. Record information concurrently with construction progress. Do not cover work until required information is recorded. Marking of project records shall be legible and with a dark pen or pencil. Ink shall not be water based due to easy smearing. Mark drawings to record actual construction including field dimensions, elevations, details, changes made by a modification, details not on original drawings, horizontal and vertical locations of underground utilities and appurtenances referenced to a minimum of two permanent surface improvements, and depths of various elements of work in relation to project datum. All horizontal and vertical information is to be certified by a New Mexico Licensed Professional Land Surveyor.

C. Submission: Accompany submittal with transmittal letter in duplicate containing date, project title and number, Contractor's name, address and telephone number, title and number of each record document, and signature of Contractor or his authorized representative. Contractor shall submit two drawings,

substantial deviations shall be surveyed and certified by a New Mexico Licensed Professional Land Surveyor depicting all as-built information to the Engineer.

1.9 PROTECTION

A. Barricades and Safety Provisions: Place and maintain until completion of work adequate barricades, construction signs, warning lights and guards to avoid property damage and protect persons from injury. Flares with open flames will not be permitted. Protect all materials, equipment, pipe and earth piles that may serve as hazards to vehicular or pedestrian traffic by barricades or guards and warning lights.

B. Shoring: Provide and maintain all sheeting, shoring and bracing required to safely retain earth banks. Protect adjoining grades and structures from caving, sliding, erosion or other damage, and suitable forms of protection against bodily injury; all in accordance with applicable codes and governing authorities.

Do not remove any sheeting unless the pipe strength is sufficient to support the trench loads based on trench width measured to the back of sheeting. Remove sheeting and shoring gradually as excavation backfilling progresses to protect the construction or other structures, utilities or property. Do not attempt removal of sheeting in one operation after backfilling is complete.

C. All work must comply with latest OSHA requirements.

D. Utilities: Protect from damage existing utility lines shown on drawings or locations of which are made known to contractor prior to work and utility lines constructed during construction operations of the project. Hand excavate within six inches of known piping or objects to prevent damage from equipment. Before commencing work, obtain information concerning location, type, and extent of concealed existing utilities on the site and adjacent properties. Repair damage to utilities at no cost to the Owner.

E. Granular Fill: Protect existing granular fill adjacent to existing structures from dirt that would impede free drainage. Remove and replace any portions of granular fill that become contaminated with dirt.

F. Drainage: Maintain the excavations and site free from water throughout the work. Remove any water encountered in the trench to provide firm subgrade, to permit joints to be made dry at the final grade, and to prevent entrance of water into the pipeline. Accomplish the foregoing by the use of sumps and gravel blankets, well points, or drain lines. Contractor shall obtain all permits associated with dewatering.

1. Rock, gravel, and other appurtenances used to keep trenches free from water or used to add support to installed piping is considered incidental to construction and all costs shall be the responsibility of the Contractor.

G. Survey Control Monuments and Range Boxes: Protect existing survey control monuments from damage. Contractor will be responsible for replacement or repair of any monument damaged or destroyed. Replacement of monuments must be performed by a qualified land surveyor.

1.10 COORDINATION

A. Coordinate connections to water main, laterals, service lines and service meters with the Owner.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Ductile-Iron Pipe And Fittings sizes 3-inches – 42-inches

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, thickness Class 52 with cement-mortar lining, AWWA C104 with mechanical-joint, bell- and plain-spigot end.
   a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, pressure rating 250 psi or 350 psi, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and high-strength, low alloy steel bolts such as Cor-Ten.
   c. All fittings cement – mortar lined, AWWA C104.
   d. Bituminous outside coating one mil thick for underground installation.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, thickness Class 52 with cement mortar lining, AWWA C104 with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

   a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   b. Gaskets: AWWA C111, rubber.
   c. Cement mortar lined, AWWA C104.
   d. Bituminous outside coating one mil thick for underground installation.

B. Copper Tube And Fittings sizes ¾-inches – 2-inches

1. Soft Copper Tube: ASTM B 88, Type K BURIED, water tube, annealed temper.

   a. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Hard Copper Tube: ASTM B 88, Type K water tube, drawn temper.

   a. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. PVC Pipe And Fittings size 3/4-inches – 12-inches

1. PVC, Schedule 40: Solvent weld fittings, ASTM D1785

2. PVC, Schedule 80: solvent welded fittings, ASTM D 1785. 3/4-inches – 3-inches
   a. PVC, Schedule 80 Solvent Weld Fittings: ASTM D 2467.

3. PVC, AWWA C900 or AWWA C909, DR 25, Class 165, with bell end with gasket and spigot end.

a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, pressure rating 250 psi, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1) Gaskets: AWWA C111, rubber.
2) Cement mortar lined, AWWA C104.
3) Bituminous coating one mil thick.

b. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. HDPE Pipe, Tubing And Fittings size 3/4-inches – 6-inches

1. For this project, HDPE pipe shall be rated at 160 PSI (SDR 11).

2. Polyethylene Pipe: AWWA C901-02 and ASTM D3035 for sizes up to 3" IPS diameter, AWWA C906-99 and ASTM F714 for sizes 4" IPS diameter and above.

a. Each production lot of pipe shall be tested for melt index, density, percent carbon, dimensions and ring tensile strength.

b. Permanent co-extruded blue color stripes in outside surface of pipe.

c. Molded fittings in accordance with ASTM D3261.

d. Polyethylene flange adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder.

3. HDPE Joints:

a. Use butt fusion joining technique for joining pipe segments installed.

b. When joining HDPE pipe at ends of directional drilling runs fusion bond to the adjacent pipe section.

c. Use butt fusion, socket fusion, or electrofusion coupling joining technique.

d. Mechanical couplings are not permitted for joining of directionally drilled pipe sections, as applicable.

2.2 PIPING SPECIALTIES

A. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.

1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.

B. Mechanical Joint Restraint

1. General: All mechanical joint restraints shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111 and C153.
2. Description: The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.
3. Pressure: The mechanical joint restraint device for ductile iron pipe shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
   The mechanical joint restraint device for PVC shall have a working pressure of at least 160 psi with a minimum safety factor of 2:1.
4. Acceptable Manufacturer: The mechanical joint restraint devices shall be of the type listed below or equal, and approved by Engineer:

For Ductile Iron Pipe:

EBAA Iron, Inc.	Megalug 1100 series	(4-inches – 36-inches)
Uni-Flange	Series 1400	(4-inches – 36-inches)

For PVC Pipe:

EBAA Iron, Inc.	Megalug 2000 PV series	(4-inches – 12-inches)
Uni-Flange	Series 1500	(4-inches – 12-inches)

2.3 CORROSION-PROTECTION ENCASEMENT FOR PIPING

A. Encasement for Underground DIP and CIP Piping: AWWA C105, PE film, Type I, Class A, Grade E-1 (ASTM D1248), 1200 lbs per square inch minimum tensile strength, 300% elongation, 800 v/mil thickness minimum dielectric strength, minimum thickness, tube or sheet.

2.4 GATE VALVES AND ISOLATION VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturer[s]:

   a. American Cast Iron Pipe Co.; American Flow Control Div. (resilient seated only)

   b. Grinnell Corporation; Mueller Co.; Water Products Div.

   c. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

   d. McWane, Inc.; Kennedy Valve Div. (resilient seated only)

   e. United States Pipe and Foundry Company. (resilient seated only)

f. Manufacture pre-approved by agency having jurisdiction.

g. Approved equal.

2. Nonrising-Stem, Metal-Seated Gate Valves: 3-inches – 12-inches size AWWA C500, parallel seats, gray- or ductile-iron body and bonnet; with fully bronze mounted double-disc gate, bronze gate rings, bronze stem, and stem nut. Valves shall be furnished with 2-inch square wrench nuts. The wrench nut shall comply with 3.15 of AWWA C500. Stem seal shall consist of O-rings in accordance with 3.12 of AWWA C500. The valves shall open by turning to the right.

   a. Minimum Working Pressure: 200 psig.

   b. End Connections:

      1) Flanges: Flanges shall be sized and drilled in accordance with ANSI B16.1 Class 125. Flanges shall be machined to a flat surface with serrated finish in accordance with AWWA C207.

      2) Mechanical Joint: All components of this type of joint shall conform to AWWA C111. The tee-head bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usually, ductile iron Durabolt or equal.

   c. Interior Coating: Complying with AWWA C550.

   d. Bolting Material: Bonnet and gland bolts and nuts shall be either fabricated from a low alloy-steel for corrosion resistance or electro plated with zinc or cadmium. The hot dip process in accordance with ASTM A153 is not acceptable.

3. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Valve stem shall have a minimum yield strength of 40,000 psi, minimum elongation of 2-inches of 12%, and shall be per ASTM A276, type 304 or 316; or AISI 420. Wrench nuts in accordance with 4.11 of AWWA C509. Stem seal shall consist of two (2) O-rings in accordance with Section 4.8 of AWWA C509. The valves shall open by turning to the right.

   a. Minimum Working Pressure: 200 psig.

   b. End Connections:

      1) Flanges: Flanges shall be sized and drilled in accordance with ANSI B16.1 Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.

      2) Mechanical Joint: All components of this type of joint shall conform to AWWA C111. The tee-head bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten Usalloy, ductile iron Durabolt or equal.

   c. Interior Coating: Complying with AWWA C550.

d. Bolting Material: Bonnet and gland bolts and nuts shall be either fabricated from a low alloy-steel for corrosion resistance or electro-plated with zinc or cadmium. The hot-dip process in accordance with ASTM A153 is not acceptable.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: 4-inches – 20-inches. Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

1. Manufacturer(s):

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

b. Grinnell Corporation; Mueller Co.; Water Products Div.

c. International Piping Services Company.

d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

e. McWane, Inc.; Kennedy Valve Div.

f. United States Pipe and Foundry Company.

g. Manufacture pre-approved by agency having jurisdiction.

2. Tapping Sleeve: Stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve. Steel plate used in fabrication shall conform to ASTM A36 or A285 Grade C.

3. Valve: AWWA, cast-iron, nonrising-stem, resilient seated gate valve with one raised face flange mating tapping-sleeve flange. Outlet end of the valve shall have a standard mechanical joint end conforming to AWWA C111. The face of the mechanical joint shall have a sufficiently smooth and even surface to allow a tight O-ring seal with the tapping equipment. Accessories for the mechanical joint consisting of the gasket, gland and fasteners shall be furnished. The tee-head bolts and hexagon nuts shall be fabricated from a high-strength low alloy steel known in the industry as Cor-Ten, Usalloy, ductile iron Durabolt or equal. Comply with gate valve requirements herein.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include extension of length required for depth of burial of valve, plug with lettering "WATER,". Valve boxes shall be the three-piece adjustable screw type. The top section shall be 16-inches long. The following patterns are acceptable:

- Tyler screw-type 6-inch cast iron valve box assembly series 6860 with No. 160 oval base.
- D & L Supply Series M-9000 with No. 160 oval base Sigma Model No. VB630.
- Star Pipe Model No. VBD160DMWW
- Western States Pipe Model No. VBDEN

- Olympic Foundry Inc. Model No. 450VB
- Castings Inc. CI. 160B Oval Base
- Or approved equal

1. Operating Wrenches: Contractor to provide one steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturer[s]:

	Corp Stop	Curb Stop	
1.	Ford Meter Box Company, Inc. (The).	F-600, FB600	B-22
2.	Grinnell Corporation; Mueller Co.; Water Products Div.	H-15000	H-15204
3.	Jones, James Company.	J-1500	J-1902, J-1901
4.	Hays	5200	4304
5.	McDonald, A. Y. Mfg. Co.	4701	6100
6.	Cambridge Brass	102	202
7.	Manufacture pre-approved by agency having jurisdiction.		

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine. Double bronze strapped for use with DIP and PVC and cement asbestos pipe and meet requirements of jurisdiction.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.

2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material (copper to copper).

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch diameter barrel. Manufacturer Tyler 6500 Series, 5-feet extension, 94E stop box Buffalo Type or D&K M-9081 and M-9082; for 1 ½ - 2-inch Tyler 6870 Series, 4 ¼-inch shaft.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 WATER METERS

A. Water meter shall be furnished by the Contractor. Contractor is responsible for all costs associated with purchase of materials necessary to install service line and meter.

B. Provide a flow meter as indicated in the Drawings. Meter shall display instantaneous flow in gallons per minute and include a totalizer.

C. Description: Unless otherwise indicated on plans, AWWA C700 (3/4-inches – 2-inches), displacement-type, frost proof, copper alloy with not less than 75% copper main case. Register flow in gallons. Stainless steel piston/disc spindles, thrust rollers, bearing plates, chamber diaphragms and external fasteners.

D. Description: Unless otherwise indicated on plans, AWWA C702 (3-inches – 16-inches), compound-type, copper alloy with not less than 75% copper main case. Register flow in gallons.

E. Remote Registration System: Utility company standard; encoder type complying with AWWA C707. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
   1. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
   2. Visible Display Units: Comply with utility company requirements for type and quantity.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. See Section 312000 – “Earth Moving”

B. Exploratory Excavation: It shall be the Contractor's responsibility to excavate and locate all existing utilities which may affect construction of the water facilities. All exploratory excavations shall occur far enough in advance to permit any necessary relocation to be made with minimum delay and to verify existing vertical and horizontal location to determine alignment for the proposed water line. All costs incurred by the Contractor in making exploratory excavations shall be considered to be included in the unit price bid for constructing each section of water line or the associate structures.

C. Unstable Trench Bottom

Where trench does not have sufficient strength to support pipe and bedding, or stream crossings are encountered, use one of following methods to repair trench bottom as approved by Engineer. A minimum depth of repair is 2-feet.

1. Embankment: Clear and strip existing surface of all unacceptable material. Place embankment material as discussed and agreed to in writing by Engineer, compact to 95% AASHTO T99.
2. Aggregate Trench Bottom, percent by weight passing square mesh sieves: 1-½”, 90-100; 3/4", 50-90; No. 4, 30-50; No. 200, 3-12.

3.2 PIPING APPLICATIONS

A. Contractor to field verify location of existing water utilities.

B. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

C. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

D. Do not use flanges, unions, or keyed couplings for underground piping.

E. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
5. Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe: ASTM A795.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

B. Pipe Jointing:

1. General: Cut pipe for inserting valves, fittings, or closure pieces in neat and workmanlike manner with no damage to pipe or lining. Leave smooth end at right angles to axis of pipe.
2. Mechanical Joints: Thoroughly clean last 8-inches of spigot and inside bell to remove oil, grit, tar, and other foreign matter. Coat spigot and gasket with solution furnished by pipe manufacturer. Slip cast-iron gland on spigot end of pipe with lip extension of gland toward spigot end. Coat gasket with joint lubricant and place on spigot end of pipe to be laid, with thick edge toward gland.

Push entire section forward to seat spigot in bell of pipe in place. Press gasket into place within bell, even around entire joint. Move ductile-iron gland along pipe into position for bolting all nuts with suitable torque wrench. Alternately tighten nuts 180 degrees apart to produce equal pressure on all parts of gland.

Pipe Size Inches	Bolt Size Inches	Range of Torque Ft.-Lb.
3"	5/8	45 - 60
4"-24"	3/4	75 - 90

3. Push-on Joints: Thoroughly clean exterior 4-inches of pipe spigot and inside of adjoining bell to remove all oil, grit, tar, and other matter. Place gasket in bell with large round side of gasket pointing inside pipe bell. Apply thin film joint lubricant over gasket's entire exposed surface. Wipe spigot end of pipe clean and insert into bell to contact gasket. Force pipe into bell to manufacturer's jointing mark.
4. Flanged Joints: Thoroughly clean faces of flanges of all oil, grease, and other material. Thoroughly clean rubber gaskets and check for proper fit. Assure proper seating of flanged gasket. Tighten bolts so pressure on gasket is uniform. Use torque wrenches to ensure uniform bearing. If joints leak when hydrostatic test applied, remove and replace gaskets and retighten bolts.

C. Thrust Restraint: Install in accordance with New Mexico Standard Specifications for Public Works Construction. Removal of existing thrust blocks and rodding is the sole responsibility of the Contractor.

Any damage caused by the removal of thrust blocks, regardless of size, or rodding shall be paid for by Contractor.

3.4 PIPING INSTALLATION

A. General: Deliver, handle, store, and install in accordance with the pipe manufacturer's recommendations and the applicable paragraphs of AWWA C600, AWWA C603, and ASTM D2321.

Carefully examine all pipe and fittings for cracks and other defects. Groove in bells of ductile iron pipe to be full and continuous or be rejected. Remove all foreign matter from interior and ends of pipe and appurtenances before lowering into trench. Carefully lower all pipe, fittings, valves, and hydrants into trench piece by piece to prevent damage to pipe materials, protective coatings, and linings. Do not dump into trench. If pipe cannot be lowered into trench and into place without getting earth into it, place heavy, tightly woven canvas bag over each end and leave in place until joints are made. During pipe laying, place no debris, tools, clothing or other materials in pipe.

Keep trenches free from water during pipe laying and jointing. Dewatering of trench considered as incidental to construction and all costs included in contract prices. When pipe laying is not in progress, close open ends of pipe by watertight plug, or other means approved by Engineer.

Dewatering shall be accomplished by the use of well points, sump pumps, rock or gravel drains placed below subgrade foundations or subsurface pipe drains. All water shall be disposed of in a suitable manner without being a menace to public health or causing public inconvenience. No water shall be drained into other work being completed or under construction. Obtain all necessary permits for dewatering.

The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe floatation.

Water shall not be allowed to rise until the concrete has set a minimum of twenty-four (24) hours, and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

Deflection of Pipe: Do not exceed deflection limits for each type of pipe as recommended by pipe manufacturer. Typical values are:

1. Ductile Iron: Length = 18 Ft.

	Maximum Deflections in Feet					
Pipe Size in Inches	3	4	6	8	10	12
Bell - Tite	1.57					1.57
Mechanical Joint	2.60		2.23	1.68		
Locked Mechanical Jt.	.94	.86	.63	.47	.39	.30
Super Lock				1.26		
River Cross				4.66		

B. Water-Main Connection: Tap water main according to requirements of Owner, New Mexico Environment Department, and/or APWA standards and of size and in location indicated.

C. Make connections larger than 2-inches with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections 2-inches and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install curb valve in water-service piping with head pointing up and with service box.

E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

G. Bury piping with depth of cover over top at least 48-inches.

H. Install new water piping and connect to new water meter.

3.5 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 UTILITIES ENCOUNTERED

Protection of all existing gas, water, sewer services, drains, cable, telephone lines and electric lines encountered during construction is the Contractor's responsibility. If utilities are disturbed, they shall be maintained and/or restored to original condition at the Contractor's expense. Backfill around utilities shall be adequately compacted to assure permanent stability.

3.7 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Notify Engineer or Owner's Representative at least 24 hours in advance of pipe being laid in any trench. Cover no pipes until observed by Engineer. Notify Engineer or owner's Representative at least 48 hours before pipe is to be tested. All water mains are to be disinfected, flushed, and hydrostatically tested per New Mexico Environment Department Drinking Water Bureau Regulations, AWWA and APWA standards.

C. Hydrostatic Testing (Non HDPE Pipe):

1. General: Make pressure and leakage tests on all newly laid pipe. Test two or more valved sections not to exceed 1,000 feet. Test first section of pipe laid to verify if watertight. Lay no additional pipe until first test section has passed tests.

2. Furnish following equipment and materials for tests, unless otherwise directed by Engineer:

   1 Graduated containers
   2 Pressure gauges
   1 Suitable hose and suction pipe as required

3. Testing Procedure: Test each 1,000 feet of line installed while trench is partially backfilled and joints are left exposed for examination for leaks. Do not conduct pressure tests until 48 hours after placement of concrete thrust blocks. After pipe has been partially backfilled, slowly let water into line. Vent to allow air in line to be released. Flush line as necessary for cleaning. Leave water in line for 24 hours prior to pressure test. Test at 1-1/2 times working pressure, calculated for low point of test section, or 150 psi, whichever is greater. Valve off pump and hold pressure in line for test. Test for two hours or as agreed to by Engineer. At end of test, operate pump until test pressure is again attained. Calibrate container of water for pump suction to determine amount of water to replace leakage.

4. Prepare reports of testing activities and submit to Engineer within three (3) days of completion of testing

5. Leakage Allowance: Leakage is quantity of water necessary to refill line at end of test period. No installation will be accepted until leakage is less than:

ALLOWABLE LEAKAGE PER 1000' OF PIPE IN GPH

Avg. Test Pressure	Nominal Pipe Diameter - in.				
psi	6	8	10	12	18
200	0.64	0.85	1.06	1.28	1.91
175	0.59	0.80	0.99	1.19	1.79
150	0.55	0.74	0.92	1.10	1.66
125	0.50	0.67	0.84	1.01	1.51
100	0.45	0.60	0.75	0.90	1.35

For pipe with 18' nominal lengths. To obtain recommended allowable leakage for pipe with 20' nominal lengths, multiply the leakage calculated from the table by 0.9. If pipeline under test contains sections of various diameters, allowable leakage will be sum of computed leakage for each size. Reduce allowable leakage proportionately for sections less than 1,000 ft.

D. Hydrostatic Testing HDPE Pipe

1. Hydrostatic testing shall be performed in accordance with ASTM F2164-13, *Standard Practice for Field Leak Testing of Polyethylene Pipe.*

2. Hydrostatic leak testing may be conducted on the full system, or in sections. The test liquid shall be potable water.

3. Maximum permissible test pressure is measured at the lowest elevation in the test section.

4. Maximum permissible test pressure is the lower of:
   a. 150% of the system design operating pressure provided that all components in the test section are rated for the test pressure, or
   b. the pressure rating of the lowest pressure rated component in the test section.

5. Test pressure must be reduced in elevated temperatures (above 90 degrees F) as per manufacturer's recommendations

6. Gradually pressurized the test section to test pressure of 150% of the system design pressure, and maintain test pressure for three (3) hours during initial expansion phase while PE pipe expands

7. Test Method: Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test liquid. If test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.

8. Prepare reports of testing activities and submit to Engineer within three (3) days of completion of testing.

3.8 Disinfection and Sampling Plan

A. General: In accordance with AWWA C651, AWWA C652 and AWWA C653 for disinfection of water mains, water storage facilities, and water treatment plants, and as approved by the New Mexico Environment Department Drinking Water Bureau (NMED DWB). Packaged water treatment system and well submersible pump shall be disinfected per NMED DWB and Santa Fe County specifications as applicable and per manufacturer specifications. Drop pipe, well casing, and screen, shall be disinfected per NMED DWB and Santa Fe County specifications as applicable. Acceptable chlorine disinfectants are calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite tablets.
   1. Each product / chemical added directly to water during production of treatment, including treatment in storage and distribution, shall conform to NSF/ANSI 60 – Drinking Water Chemicals – Health Effects.

B. New piping, water treatment system, and well pump piping, casing and appurtenances shall be disinfected and tested prior to connection to existing potable water piping, placement in service, and abandonment of existing infrastructure, as indicated on drawings. **Disinfection of the treatment system shall be coordinated with the equipment manufacturer so as not to damage the ion exchange media.**

C. **The Contractor shall certify the disinfection of all identified components of this project using the affidavit provided at the end of this section. The affidavit shall be notarized and provided when disinfection and subsequent bacteriological testing is completed**

D. Chlorine-Water Solution Method:

Chlorine Required to Produce 25 mg/L Concentration

in 100 feet of Pipe - by Diameter

Pipe Diameter In.	100 Percent Chlorine Lb.	1 Percent Chlorine Solution Gal.
4	.013	.16
6	.030	.36
8	.054	.65
10	.085	1.02
12	.120	1.44
16	.217	2.60

Induce chlorine solution into pipe line at a continuous feed rate to attain a concentration of 25 mg/L free chlorine. Engineer approved field methods or meeting concentration of free chlorine include test strips and colorimetric testing. All chlorine concentration field testing must be witnessed by the Engineer and results shall be submitted to the Engineer.

E. Tablet Method: May not be used on solvent welded plastic pipe. May be used only when all foreign materials have been kept out of pipe. If ground water has entered pipe during installation and tablets have been installed, flush main and use chlorine-water solution method. Do not use if temperature is below 5 degrees C. Place tablets with non-toxic adhesive in each pipe length in top of pipe in accordance with following table:

Number of 5-g Hypochlorite Tablets
Required for Dose of 25 mg/L*

Pipe Diameter in.	Length of Pipe Section, ft. 13 or less	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

F. Chlorination Test: Assure valves are closed on existing system to prevent chlorine solution flowing into existing system. Retain 25 mg/L chlorinated water in pipe line for minimum of 24 hours. During retention period operate all valves and hydrants to disinfect. At end of 24 hour period, chlorine concentration in tested system shall be no less than 10 mg/L throughout length tested. When section being tested meets minimum 10 mg/L chlorine after 24 hours, flush main. Water samples taken for bacterial analysis shall show no presence of coliform organisms. If water in the pipe does not meet the governing health agency requirements, repeat disinfection procedure, at Contractor's expense, until requirements are met. Furnish all test results to the Engineer.

*Based on 3.25 g available chlorine per tablet, any portion of tablet rounded to next higher number.

G. As applicable, clean, disinfect, and test any existing or new water supply storage tank and any temporary water supply storage tank before being placed into service. The entire tank interior shall be disinfected with potable water with a chlorine concentration of at least 25 mg/L (ppm). At the completion of 24 hours and with a minimum chlorine concentration of 10 mg/L the contents of the tank shall be sampled and tested for bacterial analysis as per above Section E.

H. All valves, fittings, submersible pumps, misc. pipe and other equipment shall be dipped in a 25 mg/L chlorine solution prior to installation, unless disinfected and tested as part of another system during work on this project.

I. Source water sampling is not required for this work, as new water sources are not part of this project.

3.9 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 31 Section "Trenching and Backfilling" for underground warning tapes.

3.10 OPERATION OF VALVES

Contractor is responsible for operating any valves necessary to complete project. Contractor is required to provide Owner 24 hours' notice prior to said operation.

3.11 CLEANUP AND RESTORATION

Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Deposit all waste material in designated waste areas. Grade and shape disposal site. Complete topsoil and reseeding of site, if required. Where disposal sites are not designated, remove and dispose of all waste material off site.

END OF SECTION 33 1100

Attachment – Disinfection Certification

CERTIFICATION OF DISINFECTION OF WATER FACILITIES

I,_____, hereby certify that the facilities constructed under the project Vista Redonda Groundwater Supply Uranium Treatment were disinfected in accordance with the Disinfection Plan submitted under Specification Section 33 13 13 – Disinfection of Domestic Water Systems and with the following American Water Works Association (AWWA) standards:

C651 – AWWA Standard for Disinfecting Water Mains

C652 – AWWA Standard for Disinfection of Water-Storage Facilities C653 – AWWA Standard for Disinfection of Water Treatment Plants C654 – AWWA Standard for Disinfection of Wells

Contractor:_____

Signature:_____

Printed Name: _____

Title:_____ Date: _____

Notary Certification:

State of _____

(County) of _____

Signed or attested before me on_____by _____

SEAL:

_____

Notary Public

My Commission Expires: _____

SECTION 33 11 36 – SUBMERSIBLE PUMPS AND WELL APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including any General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Additional information concerning the water system may be found on the civil drawings. In case of conflict between the drawings and the information specified herein, the more stringent requirements shall govern.

1.2 SUMMARY

A. This Section includes the following:
   1. Submersible pump
   2. Pump controller
   3. Drop pipe

B. Related work:
   1. Division 33 Section “Water Utility Piping and Appurtenances”

C. Scope of work
   1. Contractor shall remove existing submersible pump and associated drop pipe and electrical wiring. Provide as a complete assembly submersible pump, surge protection, discharge (drop) pipe, re-utilize existing pump controller, surge/overload/underload protection and new electrical service from the pump controller to the pump. Pump shall be complete package, from one supplier, with all necessary appurtenances required to provide an automatic, smooth operating and reliable pumping system. The manufacturer shall supply a complete set of general arrangement drawings, electrical power schematics and control schematics in the operation and maintenance manual.
   2. Furnish all labor, materials, equipment, and services for installation of submersible pump system per the recommended factory installation procedures and all National, State and local jurisdictional requirements.
   3. Furnish and install electrical service and all field connections between electrical service and submersible pump. The electrical installation and all components shall be in accordance with the National Electrical Code (NEC), National Fire Protection Association (NFPA), New Mexico Environment Department (NMED), Santa Fe County, and in accordance with these specifications. Where jurisdictional specifications differ, the more stringent requirements shall govern.
   4. Coordinate with electrical and mechanical contractors at all points of interface to ensure a full and functioning system.

1.3 DEFINITIONS

A. Domestic Water Piping: Domestic-water service piping and appurtenances.

B. The following are industry abbreviations for pipe materials:
1. PVC: Polyvinyl chloride plastic.
2. CIP: Cast iron pipe.
3. DIP: Ductile iron pipe.
4. CU: Copper pipe.

1.4 REFERENCES

A. American Iron and Steel Institute (AISI):
1. 303 Stainless Steel.
2. 304 Stainless Steel.
3. 316 Stainless Steel.
4. 316L Stainless Steel.
5. 4130 Heat Treated Alloy Steel.
6. 4140 Heat Treated Alloy Steel.
7. 8620 Heat Treated Alloy Steel.
8. 17-4 Stainless Steel.

B. American National Standards Institute (ANSI):
1. B-16.1 - Specification for Pipe Flanges.
2. B-16.5 - Specification for Pipe Flanges.
3. B1.20.1- Specification for Pipe Threads, General Purpose, Inch

C. American Society of Testing and Materials (ASTM):
1. A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

D. American Water Works Association (AWWA):
1. C110 - American National Standard for ductile iron and gray iron fittings, 3-inch through 48-inch for water and other liquids.
2. C200 - Steel Water Pipe.
3. C206 - Field Welding of Steel Water Pipe.
4. C207 – Steel Pipe Flanges.
5. C208 – Dimensions for Fabricated Steel Water Pipe Fittings
6. C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
7. C218 – Liquid Coatings for Aboveground Steel Water Pipe and Fittings.
8. C219 - Bolted, Sleeve-Type Couplings for Plain End Pipe.
9. C220 – Standard for Stainless-Steel Pipe.
10. C500 – Metal-Seated Gate Valves for Water Supply Service

E. Factory Mutual (FM).

F. Hydraulic Institute (HI) Standards.

G. National Association of Corrosion Engineers (NACE):
1. SP0188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

H. International Electrotechnical Commission (IEC).

I. International Organization for Standardization (ISO):
1. 281 – Rolling Bearings: Dynamic Load Ratings and Rating Life.
2. 9001 – Quality Management Systems.

J. National Electric Code (NEC) Standards.

K. National Electrical Manufacturers Association (NEMA).

L. NSF International
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

M. Occupational Health and Safety Administration (OSHA):
1. Part 1926 – Safety and Health Regulations for Construction.

N. Underwriters Laboratory (UL).

1.5 SUBMITTALS

A. Product Data: For the following:
1. Product data including:
a. Name, address, toll-free phone number, and email address for manufacturers.
b. Name, address and phone number of closest service representative.
c. Pump and motor name plate data:
1) Manufacturer.
2) Model.
3) Serial number.
4) Maximum flow rating in gpm.
5) Shutoff head in feet.
d. Descriptive literature, brochures, catalogs, cut sheets, and other detailed descriptive material
e. Equipment manufacturer's cut sheets and specifications.
f. Pump performance curves including flow, head, efficiency, and power.
g. Motor performance chart including torque, current, power factor, input/output kilowatts and efficiency. Include data on starting and no-load characteristics.
h. Technical manuals.
i. Wiring and schematic diagrams.
j. Equipment specifications with complete bill of materials showing materials of construction, part numbers, etc.
k. Equipment weights and lifting points.

l. Typical installation guides.
m. Technical manuals.
n. Shop drawings, including detailed drawings, anchorage patterns, assembly weights, and dimensions.
o. Detailed electrical data, wiring diagrams, and electrical shop drawings.
p. Start-up instructions including lubricant requirements, electrical requirements, etc.
q. Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances, and points of connection for ancillary services (electrical, seal water, drains, etc.).
r. Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, description of construction complete with illustrative drawings, and any other pertinent information.
s. ABMA B10 bearing life calculations
t. Certificates:
    1) Certification of compliance of materials with applicable ASTM specifications.
u. Delegated design submittals.
v. Test and evaluation reports:
    1) Performance curve for the pumping unit(s) superimposed on the system curve for the particular pumping application. With the performance curve, include efficiency isopleths and NPSHR variation with flow. Where required in the specific pump sections, the performance curve should be certified in accordance with ANSI/HI M100 Pump Standards.
    2) Certified performance curves plotted against shutoff to 150% of design flow at the conditions specified herein and shall be submitted for the following parameters as a function of pump capacity rotative speed and TDH at the design temperature:
        a) Total developed head
        b) Brake horsepower required
        c) Efficiency of pump
        d) Required NPSH
        e) Actual speed
        f) Minimum recommended submergence
    3) Plot curve to be easily read at scales consistent with the performance requirements
w. Manufacturers' installation instructions.
    1) Short-term and long-term storage requirements.
    2) Typical installation instructions.
    3) Lifting points and handling instructions.
x. Source quality control submittals:
    1) Provide certified test reports covering each material utilized sufficient to determine conformance with applicable ASTM standards.
y. Field or site quality control submittals.
z. Manufacturer reports:
    1) Installation, inspection, and start-up report.
aa. Qualifications statements.

2. Certificates

a. Product Certificates: Signed by Manufacturers certifying that products furnished comply with requirements.
b. Certification of compliance of materials with applicable ASTM specifications.
c. Quality Certifications: Submit ISO 9001, or similar certification, that may be held by the Manufacturer.

B. Shop Drawings: Not applicable

C. Field Quality-Control Test Reports: From Contractor.

D. As-Builts: Provide Owner with copies of redlined, as-built plans upon completion of construction.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, material, and dimensional requirements of piping and specialties and are based on the specific system indicated.

B. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction (NMED, Santa Fe County) for potable-water-service piping, including materials, installation, testing, and disinfection. Where jurisdictional specifications differ, the more stringent requirements shall govern.

C. Pump components shall bear label, stamp, or other markings of specified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Storage and handling requirements:
1. Protect equipment and materials from exposure to elements and keep thoroughly dry.
2. Store pump, motor, and electrical equipment in watertight warehouse or other comparable enclosure at maintained temperature of 50 degrees Fahrenheit.
3. Contractor shall handle pumps using equipment with adequate load capacity to handle the weight of the pump.
4. Contractor shall handle pumps to protect coatings and equipment from damage.
5. Contractor shall handle pumps in accordance with manufacturer's recommendations.
6. Contractor shall keep products off the ground using pallets, platforms, or other supports.
7. Contractor shall store in accordance with manufacturer's recommendations.

C. Contractor shall inspect nameplates during unloading process and notify Engineer of cracked, flawed or otherwise defective material and verify compliance with approved submittals and specifications.

1. Contractor shall remedy loss or damage to equipment, pipe, valves, and accessories and appurtenances at no cost to the Owner in accordance with Manufacturer's requirements and at the approval of the Owner or remove any defective material or material not meeting specifications from the site at no cost to the Owner.

D. Contractor shall verify that the nameplate data conforms with standards and approved submittals.

E. Handle all equipment and materials to prevent damage and to prevent entrance of dirt, debris, and moisture.

F. Store plastic materials protected from direct sunlight.

G. Packaging Waste Management: Contractor shall dispose of all waste packaging materials in accordance with Contract Documents, applicable local, State, and Federal regulations.

1.8 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner written permission.

B. Existing utilities have been shown on the drawings with as-built and available information; however, the Contractor shall verify the size, material, depth, dimensions, and pipe type before construction.

C. Where valves connect to existing piping, verify the diameter, pipe material, pipe elevation, and pipe location prior to connecting. Use suitable and proper fittings to suit conditions encountered.

D. Environmental Requirements: Except by specific written authorization, cease concreting when descending air temperature in shade and away from artificial heat falls below 35 degrees F. and there is frost in subgrade. When concreting is permitted during cold weather, temperature of mix shall not be less than 60 degrees F. at time of placing.

E. It shall be the responsibility of the Contractor to take all measures and furnish all equipment and labor necessary to control the flow, drainage and accumulation of water as required to permit completion of the work under this section to avoid damage to all work and Owner property at no additional cost to the Owner.

F. Water Service shall remain operational at all times until service change-over is completed. Water outage for change-over shall be a maximum of 8 hours. Provide Owner with potable and fire-service water as needed during outages.

G. All supplied wetted materials shall be NSF 61 approved.

1.9 PROJECT RECORD DOCUMENTS

A. Maintenance of Documents: Store documents apart from drawings used for construction. File submitted documents in accordance with the specification's section numbers. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes.

B. Recording: Label each document "PROJECT RECORD" in neat, large, printed letters. Record information concurrently with construction progress. Do not cover work until required information is recorded. Marking of project records shall be legible and with a dark pen or pencil. Ink shall not be water based due to easy smearing. Mark drawings to record actual construction including field dimensions, elevations, details, changes made by a modification, details not on original drawings, horizontal and vertical locations of underground utilities and appurtenances referenced to a minimum of two permanent surface improvements, and depths of various elements of work in relation to project datum. All horizontal and vertical information is to be certified by a licensed Professional Land Surveyor.

C. Submission: Accompany submittal with transmittal letter in duplicate containing date, project title and number, Contractor's name, address and telephone number, title and number of each record document, and signature of Contractor or his authorized representative. Contractor shall submit electronic drawings depicting all as-built information to the Engineer.

1.10 PROTECTION

A. Barricades and Safety Provisions: Place and maintain until completion of work adequate barricades, construction signs, warning lights and guards to avoid property damage and protect persons from injury. Flares with open flames will not be permitted. Protect all materials, equipment, pipe and earth piles that may serve as hazards to vehicular or pedestrian traffic by barricades or guards and warning lights.

B. All work must comply with latest OSHA and State of New Mexico Occupational Safety and Health requirements.

C. Utilities: Protect from damage Owner property shown on drawings or locations of which are made known to contractor prior to work and utility lines constructed during construction operations of the project. Before commencing work, obtain information concerning location, type, and extent of concealed existing utilities on the site and adjacent properties. Repair damage to any property at no cost to the Owner.

1.11 SPARE PARTS

1. Supply all manufacturer recommended spare parts for each pump and special tools.
2. All spare parts shall be properly protected for long term storage and packed in containers which are clearly identified with indelible markings on the outside as to the stored contents.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE PUMP

A. Manufacturers:
1. Schaefer, 4 in. Stainless Steel Tri-Seal Model No. 20LD7S4-PE with Check Valve, and Motor 2243038602G
2. Or approved equal.

B. Operating conditions
1. Pumps shall be able to perform over entire operating range
2. Head-capacity curves shall be constantly falling from shutoff head
3. Brake horsepower of each motor shall not be exceeded at any point on the pump curve.
4. Pump, impeller, bowls, shaft and keys material: Stainless steel. Carbon or mild steel will not be permitted in the pump.
5. Motor: Capable of continuous operation under water, with protected submersible power cable.

C. Submersible Pump

1.	Number of Pumping Units:	1
2.	Pump Capacity:	20 gpm
3.	Pump Total Dynamic Head (TDH):	685 feet
4.	Minimum pump & motor efficiency:	75 percent
5.	Fluid Type:	Water
6.	Maximum Motor Rotational Speed:	3450 RPM
7.	Maximum Motor Horsepower:	5 HP, 1 Ph
8.	Discharge:	1.25 inch
9.	Maximum Pump Size	4-inch
10.	Number of stages:	26
11.	Motor Lead Length:	340 Feet (field verify)
12.	Motor operation capability	Continuous
13.	Available Electric Service: 240V, 1 Ph	

D. Pump Design
1. General
   a. Multiple stages shall be furnished for submersible pump.
   b. Accessible adjusting assembly for the shaft shall be provided for vertical adjustment to properly position impellers.
   c. Pump shall be provided with the capability of preventing any damage to the pump or driver that is created by reverse rotation as result of water receding in the discharge column or by upthrust conditions.
   d. Provide locking plates and/or lock-tight on all bolts in the pump bowls and for other pump parts to prevent bolts entering the pump suction if loose.
   e. Pumps shall be provided with lifting lugs or eyebolts to lift entire pump assembly out of well.
2. Bowl assembly
   a. Provide flanged connections with bolted stage connections

b. Shall be provided with replaceable bowl or impeller wear rings on enclosed impellers
c. Bowl assembly shall be balanced (statically and dynamically) to eliminate vibration
d. Shall be free of sand holes, blowholes, or other faults and shall be accurately machined and fitted to close tolerances
e. Shall be capable of withstanding hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times the shut-off head, whichever is greater
f. Intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection
g. All intermediate bowls shall be of identical design
h. All intermediate bowls shall be interchangeable
i. All bowls shall be fitted with sleeve type bearings of bronze alloy
j. Discharge bowl shall be used to connect bowl assembly to the discharge pipe
k. Extra-long bronze bearing packed with non-soluble grease shall be provided in the top bowl and extended into discharge bowl
l. Bearing shall have a threaded cast iron cap or plug at the top to protect the bearing from abrasives
m. Hub of discharge bowl should be such that the bearing can be easily removed through the top of the hub
n. Thrust ring shall be above the top impeller to prevent excessive vertical thrust

3. Impellers
   a. Shall be enclosed
   b. Shall be secured to impeller shaft using keys, threaded type lock collets or tapered collets
   c. Shall be free from defects and accurately cast, machined, balanced, and filed for optimum performance and minimum vibration
4. Motor adapter
   a. Cast 303 stainless steel for rigid, accurate alignment of pump and motor. Easy access to motor mounting nuts using standard open end wrench.
5. Shaft coupling
   a. Shall be capable of transmitting the total torque and total thrust of the bowl assembly in either direction of rotation.
6. Suction screen
   a. Shall be basket-type
   b. Openings of screen shall not be more than 75% of the minimum opening of the water passage through the bowl or the impeller.
7. Discharge pipe check valve
   a. 1.25 in. swing check valve or spring loaded check valve provided by pump manufacturer
8. Discharge (drop) pipe
   a. 1.5-inch Schedule 40 galvanized steel discharge pipe shall have a maximum section length of 21 feet and connected by threaded sleeve type galvanized coupling.
   b. Ends of pipes shall have ANSI B1.20.1 standard tapered pipe threads.
   c. 1.5 in. x 1.25 in. galv. pipe reducers required for new 1.5 in. drop pipe connection to new pump.
9. Submersible electric cable
   a. Pump cable shall be sized to limit the voltage drop to no more than 5 percent.

b. The cable shall have three separate conductors and a ground and shall be included in a single continuous jacketed assembly.
c. Insulation shall be water and oil resistant, and suitable for continuous immersion
d. Shall extend the full length of the discharge pipe and from the surface plate to electrical controller.
e. Cable should be adequately secured to discharge pipe by plastic ties at 10-foot intervals or 2-inch water proof tape.

10. Materials
    a. Bowl: Cast iron in accordance with ASTM A48 Class 30
        1) Minimum tensile strength of 30,000 psi (2069 bar)
        2) Sleeve type bearings: bronze
    b. Impellers: 316L stainless steel
    c. 304 stainless steel
        1) Inlet screen.
        2) Check valve and check valve housing
        3) Shaft coupling
        4) Pump shaft
        5) Cotter pin
        6) Nuts, bolts, and washers
        7) Cable guard
    d. Shaft sleeve: 316 stainless steel or ceramic
    e. Bearing: Viton
11. NSF 61 and 372 approved

E. Electrical equipment
1. Motors
    a. Shall be a heavy duty canned type of NEMA design.
    b. Shall be capable of continuous operation under water at the specified conditions outlined above.
    c. A suitable thrust bearing shall be incorporated in the lower end of motor adequate to receive the entire hydraulic thrust load of the pump unit plus the weight of the rotating parts regardless of the direction of rotation.
    d. Motor shall have a 1.15 service factor.
    e. Rated 230V, 1 PH, 60 Hertz.
    f. Additional requirements as specified in Electrical Specifications.
    g. Motor leads shall be of sufficient length so that they may be spliced above the bowl assembly.
    h. Leads shall be protected by a 304 stainless steel cable guard held in place with stainless steel banding.
    i. As motor lead exit the top of the cable guard it shall be properly protected to prevent damaging or cutting the lead by the cable guard material.
    j. NSF 61 and 372 approved

2.2 PITLESS ADAPTER
1. Manufacturer:
    a. Merrill Manufacturing (Storm Lake, Iowa)
    b. American Granby, Inc. (Liverpool, New York)

c. Simmons Manufacturing Company (McDonough, Georgia)
d. Or approved equal
2. Material: Bronze
3. Inlet and Discharge Size: 1-1/2” NPT
4. Wetted surfaces shall be lead free

2.3 CONTROLLER

A. Manufacturers:
1. Franklin Electric Model 282 113 8110 (Standard)
2. Or Approved Equal

B. Supplied Power
1. Controller shall work properly with utility grid power source. Provide phase booster as required for project.

C. Approvals
1. The Pump Controller shall meet the requirements of the latest edition of NFPA 20 and shall be listed by Under-writers Laboratories (UL) and Factory Mutual (FM) Approved and carry the CE marking for pump service controller.

D. Starting Type
1. The controller shall be of the combined manual and automatic type designed for full voltage starting.

E. Ratings
1. The Controller shall have a withstand rating of 10,000 symmetrical amperes @ 230V single phase
2. The horsepower rating of the controller shall not exceed 7.5 HP.

F. Construction
1. The controller shall include an inverse time nonadjustable circuit breaker operated by an externally mounted handle.
2. The circuit breaker shall be mechanically interlocked such that the enclosure door cannot be opened when the handle is in the on position except by a tool operated defeater mechanism.
3. The controller manufacturer shall manufacture the contactor, circuit breaker, pushbuttons, and enclosures. Brand-labeled components will not be accepted.

G. Enclosure
1. The controller shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, powder baked finish, freestanding enclosure.

2.4 PUMP PROTECTION SYSTEM, as applicable. (Pump motors 5 HP or less)

A. Manufacturers:
1. Franklin Electric PumpTec-Plus

2. Or approved equal

B. Supplied Power
1. Controller shall work properly with utility grid power source.

C. Approvals
1. Shall be listed by Under-writers Laboratories (UL) E104778.

D. Additional Requirements
1. Over/Underload Protection
2. Over/Under voltage protection
3. Transient surge protection
4. Rapid cycle detection
5. Fault and run indicator lights
6. Motor HP contactor
7. Heavy duty terminal blocks
8. Adjustable automatic restart timer
9. Snapshot calibration
10. Continuous calibration memory

E. Enclosure
1. The controller shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, powder baked finish, freestanding enclosure.

2.5 WELL SECURE ENCLOSURE, as applicable.

A. Manufacturers:
1. Baker Water Systems Division Monitor Protective Well Enclosure
2. Or approved equal

B. Requirements
1. Internal release SS pins and lifting eyelet for ease of removal
2. Shielded SS locks for safety and ease of lid removal
3. Durable steel construction
4. Powder coated interior and exterior
5. Base ring for easy installation
6. Shielded screened vents

PART 3 - EXECUTION

3.1 SOURCE QUALITY CONTROL

A. Factory test pump for capacity, power requirements, efficiency at specified rated head, shutoff head, operating extremes, and as many other points as necessary for accurate performance curve plotting.

B. Perform tests and prepare test reports in accordance with Hydraulic Institute Standards.

C. Refer to submittal requirements for test reports.

3.2 INSPECTION

A. Verify that structures, piping, and equipment are compatible.

3.3 INSTALLATION

A. Make electrical connections required for proper pump operation.

B. Install in accordance with pump manufacturer's instructions, Hydraulic Institute, and as specified.

C. Test pump connections for piping stresses after final alignment and bolting adjust if necessary.

D. Adjustment:
1. Start-up: Start-up equipment system and make adjustments required to place system in proper operating condition.

E. Field Start Up Services:
1. Provide for the manufacturer's field service representative a minimum of a one, 8-hour day on-site to inspect installation and witness testing

F. SANITARY SEAL

G. Sanitary Well Seal, as applicable: Metal casing cap, with holes for piping, cables and one in. plugged hole for well sounder that fits into top of casing and is removable, waterproof, and vermin proof.

3.7 WATER-QUALITY TESTINGS

A. Bacteriological Testing: The Contractor shall collect properly preserved samples for bacteriological analysis. It is the Contractor's responsibility to ensure that the sampling port is properly disinfected. Residual chlorine must be non-detectable. Bacteriological testing shall be performed and approved results received prior to the completion of the pumping. Bacteriological tests shall include the following:

Microorganism/turbidity	
contaminant	**MCL**
total coliforms	absent
E. coli	absent
fecal coliform	absent

MCL - maximum contaminant level

mg/L - milligrams per liter

B. The water shall be deemed unacceptable if bacteria are present. It is the Contractor's responsibility to see that the well is so tested, and if results are unacceptable, to continue to disinfect the well. Additional bacteriological samples shall be submitted to the laboratory as necessary to verify effectiveness of disinfection.

3.4 CLEANUP AND RESTORATION

A. Disinfect pump, drop pipe, and all wetted surfaces including casing and screen per Specification Division 33 Section "Water Utility Piping and Appurtenances.
Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps. Limit to maximum 200 ppm and immediately pump out to obtain a maximum 1.0 ppm residual.

B. Restore all pavements, curbs, gutters, utilities, fences, irrigation ditches, yards, lawns, and other structures or surfaces to condition equal to or better than before work began, and to satisfaction of Engineer. Restore disturbed ground to previously existing or newly identified in the Drawings, grade with native soil. Deposit all waste material in designated waste areas. Grade and shape disposal site. Complete topsoil and reseeding of site, if required or identified. Where disposal sites are not designated, remove and dispose of all waste material off site.

END OF SECTION 33 1136

ECTION 32 31 13 - CHAIN LINK FENCES AND GATES

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.

B. Additional information concerning chain link fences and gates may be found on the civil drawings, in the project geotechnical report and agency having jurisdiction construction standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences industrial.
2. Gates: swing.

B. Related Sections:

1. Division 31 Section "Site Clearing" site stripping, grubbing, stripping and stockpiling topsoil.
2. Division 31 Section “Temporary Erosion and Sedimentation Control” for erosion and sedimentation control measures.

C. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including building permits required by the agency having jurisdiction.

1.3 APPLICABLE REFERENCE STANDARDS

A. ASTM A-90, Test Method for Weight of Coating on Zinc-Coated (galvanized) Iron or Steel Articles.

B. ASTM A-121 - Zinc Coated (Galvanized) Steel Barbed Wire.

C. ASTM A-123 - Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.

D. ASTM A-153, Zinc Coating (hot dip) on Iron and Steel Hardware.

E. ASTM A-392, Zinc-Coated Steel Chain Link Fence Fabric.

F. ASTM A-446, Steel Sheet, Zinc-Coated (galvanized) by the Hot-Dip Process, Structural (physical) Quality.

G. ASTM A-569, Steel, Sheet and Strip, Carbon (0.15 maximum), Hot-rolled, Commercial Quality.

H. ASTM A-824, Metallic Coated Steel Marcelled Tension Wire for use with Chain Link Fence.

I. ASTM B-117, Method of Salt Spray (fog) Testing.

J. ASTM F-567 - Standard Practice for Installation of Chain Link Fence.

K. ASTM F-626, Fence Fittings.

L. ASTM F-669, Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.

M. ASTM F-1083, Pipe, Steel, Hot-Dipped Zinc coated (galvanized) Welded for Fence Structures.

N. FS RR-F-00191 - Fencing, Wire and Post, Metal (Chain Link Fence Fabric).

O. Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Voluntary Standard for Chain Link Fence installation.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

C. Shop Drawings: Include plans, elevations, sections, details, final grading, gate swing, gates, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

D. Shop drawings that are non-conforming to the above will be rejected.

E. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

F. Product Test Reports: For framing strength according to ASTM F 1043.

G. Field quality-control reports.

H. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Polymer finishes.
2. Gate hardware.

I. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Single Source Responsibility: Obtain chain link fences and gates, including accessories, fitting and fastenings, from a single source.

C. Single Contractor: Provide chain link fences, gates, concrete, excavation, backfill, fittings, fastening hardware and accessories as complete units controlled by a single contractor.

D. Erector’s Qualifications: Erector shall have a minimum of five (5) years experience in furnishing and erection of fencing of equal quality and size.

E. In case of conflict between the above codes, regulations, references and standards and these specifications, the more stringent requirements shall govern.

1.6 OPERATING AND INSTRUCTION MANUALS

A. Maintenance and operating instructions shall be furnished in four (4) sets for all components specified herein and shall include parts lists, contact personnel and schedule of necessary maintenance activities.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing fences. Verify dimensions by field measurements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Conform to the applicable requirements of Division 1 and the following:

1. Delivery: Load products in such a manner that they may be transported and unloaded without being damaged. Deliver products to project site cartoned or crated to provide protection during transit and project site storage. Time delivery to avoid delaying other trades whose work is dependent on this work. Coordinate delivery timing with Contractor.
2. Storage: Place all products in storage location as directed. Do not store products on or in a manner that might cause distortion or damage to the products or the supporting structures. Repair or replace damaged products as directed.
3. Markings: Tag all products with markings which shown proper installation locations.
4. Defective Products: Items found to be defective either through manufacturing, transit damage, field installation, etc. shall be replaced within a three week period. Special shipment and manufacturing arrangements shall be arranged to accomplish this requirement.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.148 inch (9 gage).

a. Mesh Size: 2 inches (50 mm)

b. Aluminum-coated steel wire.

c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Knuckled at both selvages
4. Inner fence must pass the following fabric tension test: Apply a force of 30 pounds perpendicular to the fence fabric at the center of a panel. The fabric mesh should not deflect more than 2-1/2-inches and should return to its original position when released; each fence panel must meet this test requirement.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Dimensions shown for pipe are outside dimensions.
3. Standard weight (Schedule 40) in conformance to ASTM F-1083, minimum yield strength of 25,000 psi and galvanized with a zinc coating not less than 1.8 ounces per square foot.
4. High strength pipe with steel complying with ASTM A-446 (Grade D) or ASTM A-569, minimum yield strength of 50,000 psi and an exterior galvanized with zinc not less than 0.9 ounces per square foot; a chromate conversion coating and a minimum 0.3 mils of clear acrylic. Interior coating shall

be galvanized with zinc not less than 0.9 ounces per square foot (min. of 1.53 mils thick) or a minimum 0.6 mils thick zinc rich paint with a 91% load per square foot.

5. End, Corner and Pull Posts: Weights (±-5%); Minimum sizes as follows:

   a. For fence heights of 72" (6ft) or less: 2.375" o.d. x 3.65 lbs/ft (Schedule 40) or 2.375" o.d. x 2.92 lb/ft steel pipe (high strength).
   b. For fence heights 84" (7ft) to 108" (9ft) 2.875" o.d. x 5.79 lb/ft steel pipe (Schedule 40) or 2.875" o.d. x 4.64 lb/ft steel pipe (high strength).

6. Line Posts: Weights (±-5%); Minimum sizes as follows:

   a. For fence heights less than 72" (6ft) : NPS 1.5"; 1.90" o.d. x 2.72 lb/ft steel pipe Schedule 40).
   b. For fence heights 72" (6ft) to 108" (9ft); NPS, 2-inch; actual OD, 2.375"; weight 3.65 pounds/ft. (Schedule 40) or 2.375" o.d. x 2.62 lb/ft steel pipe (high strength).
   c. Fence post must pass the following tension test: Apply a force of 50 pounds perpendicular to the direction of the fence at the middle of each post. The post must not deflect more than 3/4" at the location where the force is applied. Each post must meet this requirement.
   d. Posts to be vertical within four (4) degrees in two planes.

7. Top Brace Rails:

   a. Braces and rails for all fence heights shall be 1.66" x 2.27 lb/ft steep pipe (Schedule 40) or 1.66" x 1.82 lb/ft steel pipe (high strength).
   b. Rails will be required to use expansion type couplings approximately 6" long, for each joint on continuous runs. Provide means for attaching rails and braes securely to all line, gate, corner, pull and end posts.
   c. Top rails are required bracing at gates.
   d.

8. Gate Posts: Gate posts for swing gates shall be:

Gate Leaf Width	Gate Post Dimensions
6 ft or less	2.875: o.d. x 5.79 lb/ft (Schedule 40) or 2.875" o.d. x 4.64 lb/ft (high strength)
Over 6 ft to 12 ft	4.000" o.d. x 9.11 lb/ft (Schedule 40) or 4.00ft o.d. x 6.56 lb/ft (high strength)
Over 12 ft to 18 ft	6.625" o.d. x 18.97 lb/ft (Schedule 40)
Over 18 ft to 24 ft	8.625" o.d. x 28.55 lb/ft (Schedule 40)

Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts. Use same material as top rail for brace, and truss to line posts with 0.375" diameter road and adjustable tightener.

B. Accessories:

1. Galvanizing: Provide galvanized products as required for a complete installation.
2. Post Tops: Weather-tight closure cap (for tubular posts), one cap for each post, secured to post with tack welds. Barbed wire or barbed tape outriggers shall use 3/8” plain pin rived flush.
3. Tension wire: Shall be 9 gage minimum diameter crimped coil or marcelled spring hard-tempered carbon steel wire with a zinc coating of 1.2 ounces per sq. ft. of surface or greater.
4. Field Applied Galvanizing Repair Paint: Welded areas shall be repaired per ASTM A-780, Standard Practice for Repair of Damaged Hot-Dip Galvanized Coatings, Annex A2, using zinc-rich paints which contain a minimum of 94% zinc dust by weight.
5. Stretcher Bars: One piece lengths equal to full height of fabric, with minimum cross-section of 3/16-inches x ¾-inches. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post.
6. Stretcher Bar Bands: Space not over 15-inches o.c., to secure stretcher bars to end, corner, pull, and gate posts.
7. Wire Tires: For typing fabric to all line, gate, end, corner and pull posts, use wire ties space 12" o.c. For typing fabric to all rails and braces, use wire ties spaced 16" o.c. For tying fabric to tension wire, use 16 gage stainless steel wire COE or 11 gage galvanized hog rings spaced 12" o.c. Tie wire min. 9 gage galvanized steel.

C. Gates and Hardware:

1. Fabricate swing gate perimeter frames of pipe diameters per Gate Schedule. Metal and finish to match framework. Provide horizontal and vertical members to ensure proper gate operation and for attachment for fabric, hardware and accessories. Space so that frame members are not more than 8 ft. apart.
2. Assemble gate frames by welding for rigid connections. Use same fabric wires at top and bottom edges. Attach stretcher to gate frame at not more than 15" o.c.
3. Attach hardware to provide security against removal or breakage. Install diagonal cross-bracing consisting of 3/8" (0.375”) diameter adjustable lengths truss rods on gates to ensure frame rigidity without sag or twist.
4. Gate Hardware: Furnish the following malleable iron hardware and accessories for each gate:

    a. Hinges: Size, quality and material to suit swing gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide minimum of one (1) pair of hinges for each leaf.
    b. Vertical support posts consist of one set of double 4" OD posts located at both the center and end of gate travel. The locking column and one additional 4" OD post supports the gate at the lock end, as shown on the drawings.
    c. The locking column is constructed of a 4"x13# "H" beam with removable steel cover, secured with security screws.
    d. Gate Latches: stops, and keepers shall be provided as appropriate for all gates. Latches shall have a plunger-bar or center drop rod of full gate height arranged to engage the center stop, except that for single leaf gates, gate latch shall be as detailed. Latches shall be arranged for locking with specified locking hardware.
    e. Locks
        1) Type 3 - Manual Swing Gate Lock - Southern Steel Company; San Antonio, TX (320-533-1231). Model No. 1050SD Manual Lock (No electrical components) or equal.
        2) Type 4 - Manual Sliding Gate Lock - Southern Steel Company; San Antonio, TX (320-533-1231). Model No. 1050RD Manual Lock (No electrical components or equal).

5. Fence Modifications: Key access ports shall be installed where two sides locks, or access is required on two sides as specified.
6. All gates shall have the capability to be locked with a medium security padlock.
7. All gates shall be constructed so they provide security equal to the fence adjoining them.
8. All gates, in the closed position, must reach to within five (5) inches of paved surfaces and within two (2) inches of other surfaces.
9. Maximum clear distance between gate posts and gate is five (5) inches (in the closed position).

2.3 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

C. Concrete: Concrete utilized to set posts in augured holes shall be a 4,000 psi concrete mix per the applicable concrete specification section.

2.4 FENCE GROUNDING (When Applicable)

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Install products in perfect alignment free from warp twist or distortion; plumb, level and true; in accordance with final shop drawings, manufacturer's instructions and recommendations for particular conditions of installation in each case.

D. All installation and details shall conform with approved shop drawings, coordinate with electronic security and electrical contractors.

E. Prior to the installation of any fence, all necessary clearing and grading on both sides of the fence shall be performed by the Contractor. Grading shall be done in such a manner as to provide a straight or flat surface in order to construct a fence line with no gaps greater than 2-inches between the bottom of the fence fabric and the ground.

F. For welded construction, comply with AWS Code for procedures, appearance, quality of welds and for methods of correcting welded work.

G. All welded joints shall be continuous along line of contact unless shown otherwise, and shall be ground smooth and flush to adjoining surfaces.

H. Touch up galvanized surfaces after field welding with galvanizing repair compound specified.

I. Stake out fence lines and terminal and pull post locations.

J. Underground utilities shall be located prior to starting construction.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.
    c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c maximum.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 16 gage stainless steel wire. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 3 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade of surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals when applicable and as recommended by the Manufacturer, except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 250 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

E. Fence Fabric Grounding:

1. Ground fence fabric at 100-feet intervals by attaching both fence fabrics at ground level to a 5/8" diameter, 8-feet long copper grounding rod. Drive the rod into the ground between the fences except for 6-inches. Connect the rod above ground to a No. 8 wire to the fabric 18-inches to 20-inches and connect the No. 8 wire to the fabric with a straight copper split bolt connector.

F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

G. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Contractor shall employ a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.9 CLEANING

A. Upon completion of the fences installation, clean up all waste material resulting from the operation.

END OF SECTION 32 31 13

WATER SYSTEM IMPROVEMENTS
CHUPADERO WATER-SEWAGE CORPORATION
SEPTEMBER 2020

SECTION 40 9001 – STORAGE TANK LEVEL CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Additional information concerning the storage tank level control system may be found in the Drawings. In case of conflict between the drawings and the information specified herein, the more stringent requirements shall govern.

C. Related Standards:
   1. New Mexico Environment Department Construction Programs Bureau Recommended Standards for Water Facilities, 2006.
   2. New Mexico Environment Department Drinking Water Bureau Drinking Water Regulations.

1.2 SUMMARY

A. This Section includes information for the storage tank level control system.

B. Work Included: Installation of a water storage tank level control system for an existing 20,000 gal. water storage tank, Well #5 and Well #5 wellhouse/treatment building. The distance between Well #5 wellhouse building and the storage tank is approximately 1.2 miles. The water storage tank level control system shall consist of storage tank level measurement and a cellular radio SCADA system to read storage tank levels and operate Well #5 submersible pump.

C. Related work:

   1. Division 33 Section 1136 - Submersible Pumps and Well Appurtenances
   2. Division 26 Section 0100 – General Provisions
   3. Division 26 Section 1200 – Wires and Cables
   4. Division 26 Section 1600 – Panel Boards
   5. Division 26 Section 4500 - Grounding

1.3 DEFINITIONS

A. CDMA – Radio cellular for Verizon and partners
B. GSM – Radio cellular AT&T and partners.
C. I/O – Input/Output
D. PLC – Programmable logic controller
E. RTU – Radio transmitting unit
F. SCADA – Supervisory Control and Data Acquisition
G. UPS – Uninterruptible power supply

1.4 SUBMITTALS

A. Product Data: For the following as applicable:

1. Wireless remote control system
2. Pressure transducer.
3. Pressure transmitter.

B. Field Quality-Control Test Reports: From Contractor.

C. As-Built Drawings: Provide Engineer with copies of redlined, as-built plans upon completion of construction.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings and this specification generally indicate the requirements for the storage tank level control system.

B. Testing – Equipment shall be tested both in house before shipping by the manufacturer and in the field by the installation Contractor.

C. Regulatory Requirements - The storage tank level control system shall not require any FCC permitting or licensing.

D. Installation: The installation Subcontractor shall have installed at least 5 similar control systems in the past 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Equipment shall be packaged to prevent damage during delivery, storage and handling.

B. Protect stored equipment from moisture and dirt.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt the existing water storage tank level radio control system until full control of the storage tank level and operation of Well #5 submersible pump. The existing control system consists of a float system within the storage tank, a RTU installed on top of the tank and a RTU located at existing Wells #2 and #4; 5 Abs Road, Chupadero, NM.

B. It shall be the responsibility of the Contractor to take all measures and furnish all material, equipment and labor necessary to provide adequate backfill material as specified herein.

C. Water Service shall remain operational at all times until storage tank level control changeover is completed. Changeover shall occur within 8 hours and the water storage tank shall be fully filled at the start of the changeover process. Coordinate with Owner.

1.8 PROJECT RECORD DOCUMENTS

A. Maintenance of Documents: Store documents apart from drawings used for construction. File submitted documents in accordance with the specification's section numbers. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes.

B. Recording: Label each document "PROJECT RECORD" in neat, large, printed letters. Record information concurrently with construction progress. Marking of project records shall be legible and with a dark pen or pencil. Ink shall not be water based due to easy smearing. Mark drawings to record actual construction including field dimensions, elevations, details, etc. changes made by a modification.

C. Submission: Accompany submittal with transmittal letter in duplicate containing date, project title and number, Contractor's name, address and telephone number, title and number of each record document, and signature of Contractor or his authorized representative.

1.9 PROTECTION

A. Protect all materials, equipment prior to installation.

B. Utilities: Protect from damage to existing utilities. Repair any damage to utilities at no cost to the Owner.

1.10 COORDINATION

A. Coordinate water storage tank level control changeover with the Owner.

PART 2 - PRODUCTS

2.1 Storage Tank Level Control System

A. Programmable controller shall be a compact Logix family controller (L18 or L33ER) capable of communicating with Allen Bradley Ethernet IP. Programming should be in RS Studio 5000 Version 30 or approved equal. Programming may not be required for some systems.

B. The PLC I/O shall be as follows:
   1. Analog inputs 4-20 mA.
   2. Analog outputs 4-20 mA, reported every 2 minutes or on 5% change.
   3. Digital inputs - 24V DC.
   4. Digital outputs Isolated relay outputs or 24V DC outputs with interposing relays for each output wired in the control panel.
   5. One spare I/O module of each type used or 20% spare I/O shall be included, whichever is greater.

C. Operator interface should be a Panel View Plus 7 with a four inch screen or larger, or approved equal.

D. The panels shall have a UPS (120V AC or 24V DC) that will power the PLC, touch screen, cellular radio, instruments and devices for a minimum of 8 hours during a power outage.

E. System shall support cellular radios for LTE, 4G, 3G and 2G for both GSM (AT&T and partners) and CDMA (Verizon and partners).

F. Exterior control panels shall be NEMA 4X and interior control panels shall be NEMA 1. Both shall be UL 508 listed, and shall have fusing for I/O as follows or required:
   1. Each analog signal shall be individually powered with an isolated fuse.
   2. Digital inputs shall have supply power from a single fuse for a piece of equipment I/O (i.e. a motor shall have the Auto, Run, fail digital input signals fused from a single source)

G. Control panels/RTUs shall be installed, as required, at both the water storage tank site and inside Well #5 wellhouse/treatment building.

H. A standard omnidirectional antenna with universal mounting bracket shall be installed at the water storage tank site.

I. A YAGI antenna shall be installed on the Well #5 Wellhouse/Treatment Building. It shall be located on the south side of the building two ft. above the roof parapet. A waterproof roof jack shall be installed on the roof for wiring penetration into the building.

J. System shall include secure web portal, or comparable, for accessing data, alarms and reports. Technical support shall be provided 24-7-365.

K. Control communications are intended to be ethernet at a later date. The provided water storage tank level control system shall consider this future modification.

L. A pressure transducer shall be placed within the water storage tank to monitor tank levels and be used to turn on Well #5 submersible pump when the tank low level setting has been reached and turn off Well #5 submersible pump when the storage tank high level setting has been obtained. The pressure transducer shall have the following features:

1. ±0.25% accuracy.
2. NSF 61/NSF 372 approved construction for use in drinking water applications.
3. 4-20 mA with lightning protection.
4. 16 bit internal digital error correction.
5. 316L stainless steel construction.
6. User rangeable analog output.
7. RS485 modified MODBUS compatible interface
8. Standard dual (analog & RS485) outputs.
9. 2 year warranty.

M. An indicating pressure transmitter shall be installed on the well supply piping located within the Well #5 Wellhouse/Treatment Building and shall be connected to the RTU unit/control panel located within the building. The indicating pressure transmitter shall have the following features:

1. ±0.25% accuracy.
2. ±1% FS temperature stability.
3. Pressure range 300 psig.
4. Display with 3 readings per second
5. Controls – non interactive zero and span with ±10% range, test calibration level of 0 – 100% range and retransmission zero and span.
6. Loop supply voltage operating at 8 – 32 VDC with 4-20 mA current loop/output.
7. Low loop supply voltage indicator.
8. Analog output with 50 millisecond response time.
9. Front panel test button.
10. Epoxy coated extruded aluminum case.
11. All wetted parts shall be 316 stainless steel and be NSF 61 approved.

N. Manufacturers

1. PLC, RTUs and Antennas – Mission Communications, LLC, Norcross, GA – Model No. M851 (interior installation), Model No. M852 (exterior installation) with SW587nTank and Well Control Package, or approved equal.
2. Pressure Transducer – Keller Acculevel, or approved equal.

3. Pressure Transmitter – Cecomp Electronics DPG1000L300PSIG, or approved equal.

PART 3 - EXECUTION

3.1 Installation – Install all equipment in accordance with manufacturer's standards, guidelines and recommendations.

3.2 FIELD QUALITY CONTROL

A. Operational Tests: Conduct field testing of individual components prior to full implementation. Ensure proper operation of entire control system.

B. Notify Engineer and Owner's Representative at least 48 hours in advance of system field testing.

to provide Owner 24 hours' notice prior to said operation.

3.3 CLEANUP AND RESTORATION

Restore all disturbed structures, utilities, etc. to condition equal to or better than before work began, and to satisfaction of Engineer and Owner.

END OF SECTION

SECTION 46 0703 - PACKAGED WATER TREATMENT SYSTEM AND APPURTENANCES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Contractor shall furnish and install a complete packaged and portable alpha particle potable water treatment system for this project. The system shall include a central raw water collection unit with a cartridge pre-filter, flow meter, valves, pressure reducing valve, three (3) sample ports, collection and distribution headers and related items necessary for a complete and operational system.

B. As water passes through the treatment system the level of alpha particles in the water is reduced by its contact with the treatment media. The media shall perform the alpha particle removal by means of ion exchange using an adsorptive media with no backwash. Once the media in the system starts to remove the source of alpha particles from the water, it is considered spent media. When the spent media becomes fully loaded with uranium or other radioactive material, it shall be removed and replaced with fresh media. At no time shall the system store more than fifteen (15) pounds of alpha particle-containing or alpha particle-generating material on site.

C. Manufacturer shall have expertise in the operation of the treatment system, the installation of new treatment media and the removal and replacement of spent media.

1.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. Raw Water Quality. Provide a treatment system capable of treating potable groundwater, to the levels specified in paragraph B of this section, with the following characteristics and performance requirements:

1.	Continuous service flow rate	18 gallons per minute (GPM)
2.	Average annual flow	3.15 million gallons per year (8 hr flow/day)
3.	Average influent uranium concentration	17 micrograms per liter (µg/L) (JSAI Report)
4.	Gross Alpha activity	25.2 +/- 6.2 pCi/L
5.	Pressure drop through system	30 psi maximum

B. Treated Water Requirements. The treatment system shall be designed to produce treated water within the following maximum discharge limits:

1. Gross Alpha activity – 15 pCi/L (NM MCL) Discharge Limit, 10 pCi/L 30-day average limit

C. The system shall be designed with multiple trains and vessels in each train arranged in a series configuration, to ensure that the requirements of paragraph 1.02 B are met at all times. The hydraulic loading rate (HLR) shall be 6 to 10 GPM/ft² and the empty bed contact time (EBCT) shall be a minimum of 7 minutes. A common cartridge filter shall be installed on the inlet piping to the system to prohibit suspended solids from entering the vessels. Smooth nose sample ports shall be provided at three (3) locations with the packaged system. One (1) located at the pre-media vessels to measure pretreatment concentration of alpha particle activity, one (1) located prior to the final downstream vessel(s) to measure alpha particle activity breakthrough in upstream vessels, and one (1) located post vessels to ensure adequate treatment.

D. The system shall be designed such that no liquid waste streams are generated during routine operation of the system. Systems which require chemical regeneration of the treatment media or periodic backwashing are not acceptable.

1.3 SUBMITTALS

A. Submit the product data and quality control submittals specified below, prior to deliver and startup of the treatment system.

1. System acceptance test report, signed by the manufacturer or manufacturer's representative, certifying the system meets the contract requirements and is operating properly.
2. Submit 2 copies of operation and maintenance data for each product included in the installed system.
3. Submit 2 copies of operation and maintenance manual for the installed system, which describes routine operational procedures, if required, to be performed by Owner's personnel.
4. Submit shop drawings showing equipment size, layout, piping, valve and appendages, including required radiation placards.

1.4 QUALITY ASSURANCE

A. Acceptable Manufactures:

1. Water Remediation Technology, LLC, Westminster, CO
2. AdEdge Water Technologies, Atlanta, GA.
3. Or approved equal.

B. Treatment equipment shall be the product of one company who has been regularly engaged in providing similar equipment for a minimum period of 5 consecutive years.

C. Provide the services of the treatment system manufacturer representative for a minimum of 8 working hours for system startup and training to include the following:

1. Render advice regarding installation and final adjustment of the system.
2. Witness final system test and then certify with an affidavit that the system is installed in accordance with the contract documents and is operating properly.
3. Train facility personnel on the operation and maintenance of the system.
4. Explain service programs to facility supervisory personnel.

D. All materials in contact with water shall be NSF 61 approved.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The manufacturer is responsible for the safe delivery of the equipment and appurtenances to the site. The Manufacturer/Contractor is responsible for disinfecting the system after installation at the site in accordance with the contract documents and the disinfection requirements as described in Division 33 Sections "Water Utility Piping and Appurtenances" and "Submersible Pumps and Controls". The manufacturer is responsible for providing trained personnel for system checkout after installation as well as training of Owner's representatives and operators.

B. The Contractor is responsible for installing the treatment system, and providing and installing all necessary piping, wiring, and conduit to and from the treatment system.

C. The Contractor is responsible for off-loading of equipment and the safe on-site storage of the system prior to the installation.

D. Handling of the equipment and appurtenances shall be done in a manner to prevent any damage to the equipment or any of the associated parts. Damaged equipment is the responsibility of the Contractor and shall be repaired or replaced in kind.

PART 2 - PRODUCTS

2.1 TREATMENT MEDIA

A. Submittal shall include a minimum of one (1) facility with references and contact information, where the media has been successfully bench tested or utilized for treatment of the Alpha activity.

Bench scale testing with source raw water shall demonstrate removal 95% of Gross Alpha Activity and meet treatment requirements for removal of Gross Alpha activity.

2.2 VALVES

A. Butterfly Valves: All butterfly valves shall be manually operated, one-piece lug or water style with cast iron or ductile iron bodies and lined discs that meet ANSI 300 pressure ratings for hydrostatic shell test requirements. No metal-to-metal seating surfaces shall be permitted. The seat shall be tongue and groove design with primary hub seal and a molded O-ring. Valves smaller than 6” in diameter shall be lever actuated and valves 6” in diameter and larger shall be gear-operator actuated. All butterfly valves shall be series 30/31 as manufactured by Bray or approved equal.

B. Ball Valves: All ball valves larger than 1” shall be manually operated PVC true union design with socket or thread ends and be compatible with associated piping. Valves shall be suitable for 170 psi working pressure. All PVC ball valves shall be as manufactured by Hayward Industrial Products or approved equal. All ball valves 1” and smaller shall be stainless steel N.P.T. threaded ends, as manufactured by Warren or approved equal.

C. Check Valves: All check valves shall be PVC or steel construction and wafer type operation with stainless steel spring to close and EPDM O-ring/seat. Valves shall be suitable for 170 psi working pressure and be bubble tight when closed. All PVC check valves shall be as manufactured by Hayward Industrial Products or approved equal. All steel check valves shall be as manufactured by Prince or approved equal.

D. Air Relief/Vacuum Relief Valves: All air/vacuum relief valves shall be reinforced nylon construction D-020 or D-040 series as manufactured by A.R.I. USA, Inc. or approved equal.

E. Pressure Reducing Valve: The Pressure Reducing Valve automatically reduces a higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate and/or varying inlet pressure. This valve is an accurate, pilot-operated regulator capable of holding downstream pressure to a pre-determined limit. When downstream pressure exceeds the pressure setting of the control pilot, the main valve and pilot valve close drip-tight.

2.3 PIPING, TUBING & FITTINGS

A. All alpha particle removal system face process piping and fittings shall be steel piping and able to withstand the 175 psi working pressure. Instrument tubing shall be ¼" polyethylene. Sample port tubing shall be 1/8" 304 stainless steel. Sample ports shall be smooth nosed.

2.4 SKID STRUCTURAL FRAMING

A. The central collection and distribution unit shall be a painted structural steel skid frame. The skid frame shall be designed and fabricated to adequately support the operating weight of the appurtenances. In addition, the frame shall have adequate lifting lugs or forklift spacing to safely load and unload the complete packaged treatment system with vessels loaded with media without member buckling or yielding. Foot plates shall be installed to anchor the system adequately to the floor. Steel pipe supports shall be added to adequately support and secure the inlet and outlet header piping to and from each treatment train. The frame shall be sandblasted and coated per the following:

- Cleaning: SSPC-SP6/NACE 3 Commercial Blast Cleaning
- Pre-Treatment/Washing Iron Phosphate Wash Treatment
- Primer: Cardinal E305-GR533 Semi-Gloss Primer or approved equal. 2-3.5 mils DFT.
- Color: Gray
- Topcoat: Polyester GIC Powder Coating. Cardinal T009 – BL01. 3-6 mils DFT
- Color: Blue, Full Gloss

2.5 WATER DISTRIBUTION AND UNDERDRAINAGE SYSTEM

A. The internal collection and distribution system in each vessel shall be designed to collect and distribute uniformly over the bed cross-section.

B. Inlet piping/hoses into the treatment bed shall be designed with connectors or clamps so that the spent media vessels can be changed out and fresh media vessel installed in place, in a timely manner.

2.6 TREATMENT VESSELS

A. The pressure vessels shall be constructed of steel material and be NSF approved.

B. Working Pressure: 175 psi

C. Test Pressure: 263 psi

2.7 PRE AND POST SYSTEM FILTERS

A. Provide a minimum of one (1) system inlet cartridge filter housing with cartridges and minimum of 2" flanged ANSI class 300 connections. The cartridge filter and housing shall be adequately sized to handle the continuous service flow rate of the system and shall have a 175 psig rating. AN ASME U or UM vessel stamp is not necessary. However, the hosing shall be designed per ASME section VIII for pressure vessels. The cartridge filter housing shall be securely mounted to the central skid frame. Cartridge filters shall have a 5 µm nominal size rating.

2.8 TREATMENT INSTRUMENTATION

A. Provide a suitably sized battery powered flow meter on the inlet piping to the treatment system. Meter shall display instantaneous flow in gallons per minute and include a totalizer.

B. Provide inlet, outlet, and intermediate vessel water pressure gauge cluster assemblies with smooth nose sample valves (ports) and differential pressure gauges to display cartridge filter differential pressure and vessel differential pressure, and system inlet and outlet pressures.

C. Provide an air release and vacuum relief valve on the system inlet piping.

D. Provide a pressure reducing valve on the system inlet piping to ensure that the maximum system working pressure of 175 psig is not exceeded.

E. Provide a pressure safety/relief valve to protect the system from overpressure occurrences. Relief valve shall be adjustable to 263 psig.

F. Provide a suitably sized battery powered flow meter on the outlet and bypass piping to the distribution system. Meter shall display instantaneous flow in gallons per minute and include a totalizer.

END OF SECTION 46 0703

GEO-TEST

GEOTECHNICAL ENGINEERING SERVICES JOB NO. 1-00211 NEW WELL HOUSE AND TREATMENT SYSTEM FACILITY CHUPADERO, NEW MEXICO

PREPARED FOR

SANTA FE COUNTY FINANCE DIVISION

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GEO-TEST

March 10, 2020
Job No. 1-00211

Santa Fe County Finance Division
142 W. Palace Avenue #300
Santa Fe, New Mexico 87501

ATTN: Erik Aaboe, Compliance Coordinator

RE: Geotechnical Engineering Services
New Well House & Treatment System Facility
Chupadero, New Mexico

Dear Mr. Aaboe:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation, laboratory testing, and recommendations for foundation design, slab support, as well as criteria for excavation, backfill and general site grading.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

Respectfully submitted:

GEO-TEST, INC.

Timothy Matson, Staff Engineer

Reviewed by:

Robert D Booth, P

ROBERT D. BOOTH
NEW MEXICO
5711
LICENSED PROFESSIONAL ENGINEER

cc: Addressee

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TABLE OF CONTENTS

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INTRODUCTION

This report presents the results of a geotechnical engineering services investigation performed by this firm for the proposed new well house and associated waterline located in Chupadero, Santa Fe County, New Mexico.

The objectives of this investigation were to:

1) Evaluate the nature and engineering properties of the subsurface soils underlying the new well house and proposed waterline.

2) Provide recommendations for foundation design, slab support, as well as criteria for site grading.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

PROPOSED CONSTRUCTION

It is understood that the project consists of the construction of a new well house and approximately +/- 800 feet of new waterline. The new well house will be single story, about 320 square feet with no basements utilizing slab on-grade construction. Structural loads are unknown at this time but are anticipated to be relatively light, not exceeding about 35 kips on columns and 2 kips per lineal foot on walls.

Should structural or other project details vary significantly from those outlined above, this firm should be notified for review and possible revision of the recommendations contained herein.

FIELD EXPLORATION

Three exploratory borings were drilled at the site, one to a depth of about 15½ feet below existing site grades for the new well house and two to depths of about 5 feet below existing site grades for the new waterline. The locations of the borings are shown on the Boring Location Map, Figure 1. The soils encountered in the borings were continuously examined, visually classified and logged during the drilling operation. The boring logs are presented in a following section of this report. Drilling was accomplished using a truck mounted drill rig equipped with 5.5-inch diameter continuous

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flight hollow stem auger. Subsurface materials in the deeper boring were sampled at five-foot intervals or less utilizing an open tube split barrel sampler driven by a standard penetration test hammer. In addition, bulk samples of the auger cuttings were also obtained during the drilling.

LABORATORY TESTING

Selected soil samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents were determined to evaluate the various soil deposits with depth. The results of these tests are shown on the boring logs.

Sieve analysis and Atterberg limits tests were performed to aid in soil classification. Results of these tests are presented in the Summary of Laboratory Results and on the individual test reports presented in a following section of this report.

SITE CONDITIONS

A brief site reconnaissance was performed during our site exploration. The site for the proposed well house is located at the new well site. The area appears to have been graded prior to drilling of the new well, to create a somewhat flat pad. The pad then slopes to the southwest, south and southeast. The general slope of the area trends in a southwest direction. The new waterline is proposed to be located on the existing graded dirt road Don Filomeno Road, and it is understood that an existing waterline underlies a portion of the existing roadway.

SUBSURFACE SOIL CONDITIONS

As indicated by the exploratory borings, the soils underlying the well house site consist of clayey sands to full depth explored. These soils were moderately firm to soft and range from low to medium in plasticity. The soils encountered in boring no. 2 consist of silty sand with gravel and in boring no. 3, clayey sands were encountered. Detailed lithologic descriptions are shown on the attached boring logs.

No groundwater was encountered in the borings and soil moisture contents were generally low throughout the extent of the borings, being well below the plastic limit.

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CONCLUSIONS AND RECOMMENDATIONS

Well House

As indicated by the standard penetration test data, some of the near surface soils as well as some of the deeper soils are low in density and have the potential to create excessive settlements of footings and floor slabs, particularly upon significant moisture increases. Accordingly, the existing, near surface soils are not considered suitable in their present condition to provide reliable support of shallow footings and slabs on-grade.

However, with special site preparation and in order to create a uniform bearing condition, the proposed structure can be supported on shallow spread type footings bearing directly on properly compacted structural fill. The special site preparation would involve overexcavation of the existing soils throughout the building area. These soils should be overexcavated to such an extent as to provide for at least 1.0 feet of properly compacted structural fill below all foundations and floor slabs, or to such an extent as to remove all existing man-made fill soils that may have been placed during drilling and construction of the new well, whichever is the greater depth of overexcavation. The limits of the overexcavation should also extend laterally from the footing perimeters a distance equal to the depth of fill beneath their bases. The exposed native soils at the base of the excavation should be densified prior to placement of structural fill. Detailed recommendations concerning the required site preparation and for foundation design are presented in the following sections of this report.

Waterline

The results of this investigation indicate that the surficial soils encountered in the borings can be readily excavated using normal earth moving and excavation equipment. However, excavations into some of the man-made fill soils on the east end of the site may be a little more difficult. In addition, most of the excavated soils will be suitable for use as backfill above the pipe embedment.

Excavated slopes for utility construction should be designed and constructed in accordance with 29 CFR 1926, Subpart P, and any applicable state or local regulations. Temporary cut slopes should not exceed 1.5 horizontal to 1 vertical. Spoil piles and heavy equipment should not be allowed within 5 feet of the top of the slopes. Shoring, bracing or benching should be performed by the contractor for in accordance with the strictest governing safety standards.

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Bedding and pipe embedment materials to be used around the proposed waterline should consist of well graded sand or gravel conforming to the pipe manufacturer's recommendations and be placed and compacted in accordance with project specifications, local requirements or governing jurisdiction. General fill to be used above pipe embedment materials should be placed and compacted in accordance with the plans and specifications. On-site soils may be used as general fill above pipe embedment materials. Water jetting of trench backfill should not be allowed.

FOUNDATIONS

Shallow spread-type footings bearing directly on a minimum thickness of 1.0 feet properly compacted structural fill are recommended for the support of the proposed structure. An allowable bearing pressure of 1,500 pounds per square foot is recommended for footing design. This bearing pressure applies to full dead load plus realistic live loads and can be safely increased by one-third for totals loads including wind and seismic forces.

Exterior footings should be established a minimum of 2.0 feet below lowest adjacent finished grade, while interior footings should be at least 12 inches below finished floor grade. The minimum recommended width of square and continuous footings is 2.0 feet and 1.33 feet, respectively.

All bearing surfaces should be cleaned of all loose, disturbed materials prior to placement of structural fill or concrete. All foundation systems should be adequately reinforced to aid in redistributing loads and to minimize the effects of differential settlement.

Maximum settlements of foundations designed and constructed as recommended herein are estimated not to exceed ¾ inch for the soil moisture contents encountered during this investigation or moisture contents introduced during construction. Differential movements should be less than 75 percent of total movements. Significant moisture increases in the supporting soils after construction could cause additional movements.

LATERAL LOADS

Resistance to lateral forces will be provided by friction between the base of floor slabs and footings and the soil and by passive earth resistance against the sides of footings and stem walls. A coefficient of friction of 0.40 should be used for computing the lateral resistance between bases of footings and slabs and the soil. With backfill placed as recommended in the site grading section of this report, a passive soil resistance equivalent to a fluid weighing

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325 pounds per cubic foot should be used for analysis.

SLABS ON GRADE

Adequate support for lightly loaded slab-on-grade floors will be provided by the structural fill when placed as recommended in a following section of this report. Thus, the use of granular base for structural support of lightly loaded slabs is not considered necessary. However, should it be desired as a working surface, a course of granular base can be placed beneath concrete floor slabs.

Heavily loaded floor slabs bearing directly on the structural fill can be designed using a modulus of subgrade reaction (k) value of 200 pci. This value can be increased to 300 pci provided a 6-inch thickness of granular base is placed and compacted beneath the slabs.

Where granular base is used beneath the slabs, it should have a plasticity index of no greater than 3 and meet the following grading requirements:

Sieve Size (Square Openings)	Percent Passing by Dry Weight
1 Inch	100
¾ Inch	85-100
No. 4	45-95
No. 200	0-10

The granular base should be compacted to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D1557.

The granular base will act as a capillary barrier but will not totally eliminate the rise of moisture to the slabs. If floor coverings are proposed which are highly sensitive to moisture, it is recommended the slab be placed in accordance with the procedures recommended by the American Concrete Institute (ACI 302.1R-04).

SITE-GRADING

The following guidelines should be included in the project construction specifications to provide a basis for quality control during site grading. It is recommended that all structural fill and backfill be placed and compacted under engineering observation and in accordance with the following:

1) The existing soils throughout the building area should be

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overexcavated to such an extent as to provide for a minimum thickness of 1.0 feet of structural fill beneath all footings and floor slabs, or to such a depth as to remove all man-made fill soils in their entirety, whichever is the greater depth of overexcavation. The overexcavation limits should extend beyond the perimeter of the footings equal to the depth of fill beneath their bases. The exposed native soils should then be densified.

2) Densification of the exposed native soils should consist of scarifying, moisture conditioning to the optimum moisture content or above, and compacting the area to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557. The moisture content of the native soils during compaction should be at or 2 percent above the optimum moisture content.

3) The results of this investigation indicate that most the overexcavated soils will be suitable for use as structural fill, however, some blending, and may be required to meet the specification below. If this cannot be achieved, the overexcavated soils can be blended with a more granular material to meet the specification below. Any imported material must also meet the criteria for structural fill. All structural fill or backfill material should be free of vegetation and debris and contain no rocks larger than 3 inches. Gradation of the backfill material, as determined in accordance with ASTM D-422, should be as follows:

Size	Percent Passing
3-inch	100
No. 4	60 - 100
No. 200	15 - 40

4) The plasticity index should be no greater than 17 when tested in accordance with ASTM D-4318.

5) Fill or backfill, should be placed in 8-inch loose lifts and compacted with approved compaction equipment. Lifts should be reduced to 4-inches if hand-held compaction equipment is used. Each lift should be firm and non-yielding.

6) All compaction of fill or backfill should be accomplished to a minimum of 95 percent of the maximum dry density, and within 2 percent of the

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optimum moisture content, as determined in accordance with ASTM D-1557.

7) Tests for degree of compaction should be determined by the ASTM D-1556 method or ASTM D-6938. Observation and field tests should be carried on during fill and backfill placement by the geotechnical engineer to assist the contractor in obtaining the required degree of compaction. If less than 95 percent is indicated, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

MOISTURE PROTECTION

As stated above, precautions should be taken during and after construction to minimize moisture increases of foundation soils. Positive drainage should be established away from the exterior walls of the structure. If necessary, to provide positive drainage, the building area should be raised above adjacent site grades with structural fill. Backfill should be well compacted and should meet the specifications outlined in the site grading section of this report. Irrigation within 10 feet of foundations should be carefully controlled. All utility trenches leading into the structure should be backfilled with compacted fill. Special care should be taken during installation of the subfloor sewers and water lines to reduce the possibility of post-construction soil moisture increases beneath the structure.

Proper landscaping and drainage maintenance are required to preclude the accumulation of excessive moisture in the soils beneath the structure. Accumulations of excessive moisture could be harmful to some types of interior flooring, to HVAC ductwork beneath the slabs, and can weaken or cause other changes in the soils supporting the foundations. This can cause additional differential movement of foundations and can result in cosmetic or structural damage to structure.

If any water line leaks or if irrigation system leaks are detected, they should be promptly repaired. In addition, if any depressions develop from the settlement of soils in utility trenches or other areas, they should be promptly backfilled to maintain the grade so that surface water drains rapidly away from the structure.

The foregoing recommendations should only be considered minimum requirements for overall site development. It is recommended that a civil/drainage engineer be consulted more detailed grading and drainage recommendations.

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FOUNDATION REVIEW AND INSPECTION

This report has been prepared to aid in the evaluation of this site and to assist in the design of this project. It is recommended that the geotechnical engineer be provided the opportunity to review the design drawings and specifications in order to determine whether the recommendations in this report are applicable to the design. Review of the design drawings and specifications should be noted in writing by the geotechnical engineer.

In order to permit correlation between the conditions encountered during construction and to confirm recommendations presented herein, it is recommended that the geotechnical engineer be retained to perform continuous observations and testing during the earthwork portion of this project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted, and foundation elements penetrate the recommended soils.

CLOSURE

Our conclusions, recommendations and opinions presented herein are:

1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation will be provided during construction.

5) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

This report has been prepared for the sole use of Santa Fe County Finance Division, specifically to aid in the design of the proposed new well house and treatment system facility, to be located in Chupadero, New Mexico and is not for the use by any third parties.

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We make no other warranty, either express or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.

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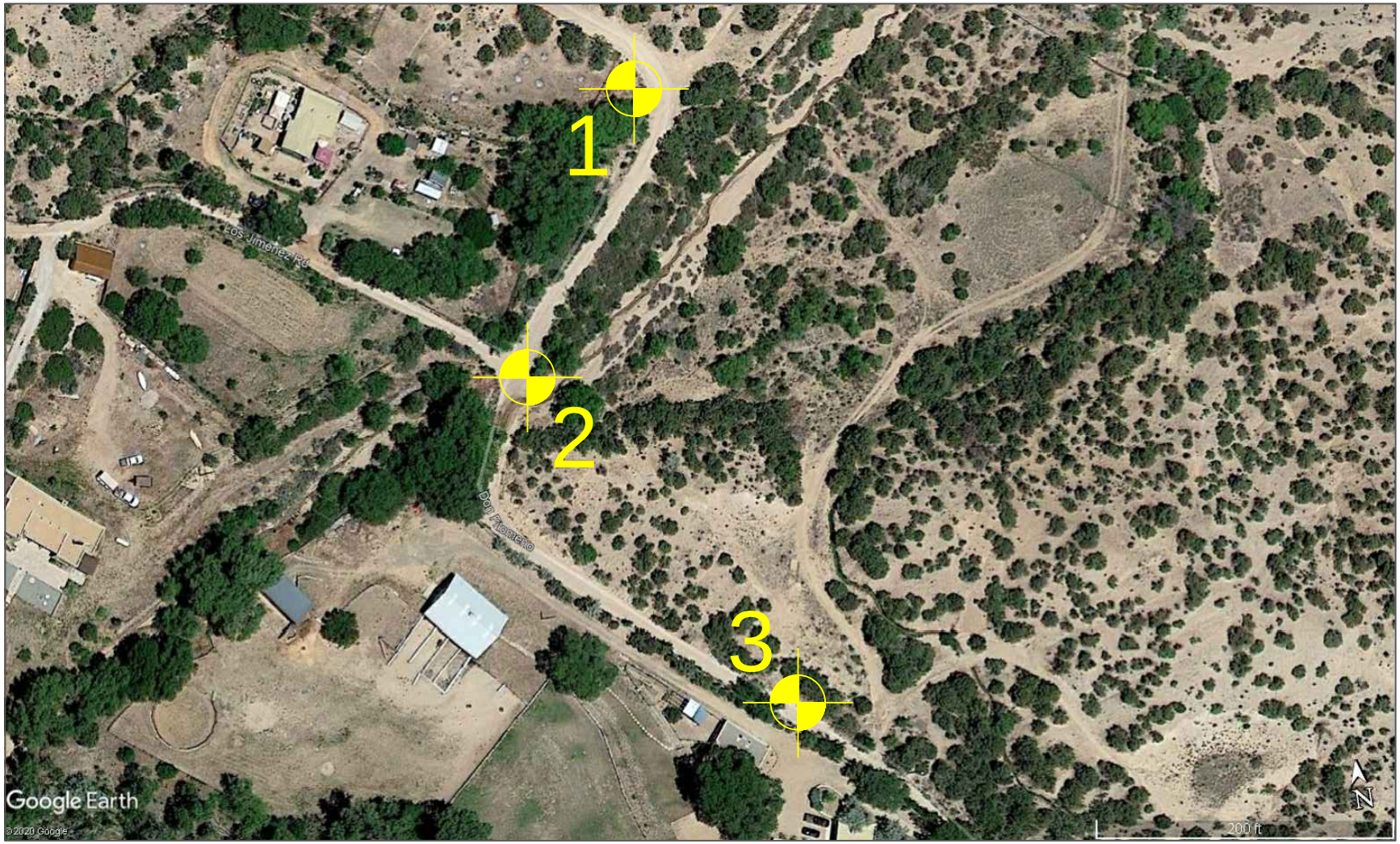
BORING LOCATION MAP



New Well House and Treatment System Facility
Chupadero, Satna Fe County, New Mexico
Job No. 1-00211

Figure 1

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GEOTECHNICAL ENGINEERING
AND MATERIAL TESTING

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Project: New Well House & Treatment System Facility
Date: 03/05/2020 Project No: 1-00211
Elevation: Type: 5.5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 1

During Drilling: none After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
			AC		10			
			SS	8-8-6 14	8			
5			SS	5-5-6 11	7		SC	CLAYEY SAND, fine to medium grained, some gravel, low to medium plasticity, moderately firm, slightly moist to dry, dark to light brown
10			SS	4-3-4 7	9			*soft at 10'
15			SS	5-6-8 14	6			*moderately firm at 15'
								STOPPED AUGER AT 14' STOPPED SAMPLER AT 15.5'
20								

N blows/ft
20 40 60 80

14
11
7
14

LOG OF TEST BORING 1-00211 NEW WELL HOUSE & TREATMENT SYSTEM FACILITY, CHUPADERO.GPJ GEO TEST.GDT 3/6/20

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

GEO-TEST

Project: New Well House & Treatment System Facility
Date: 03/05/2020 Project No: 1-00211
Elevation: Type: 5.5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 2

During Drilling: none After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft 20 40 60 80
			AC		6		SM	SILTY SAND with GRAVEL, fine to coarse grained, non-plastic, slightly moist, brown	
5								STOPPED AUGER AT 5'	
10									
15									
20									

LOG OF TEST BORING 1-00211 NEW WELL HOUSE & TREATMENT SYSTEM FACILITY, CHUPADERO.GPJ GEO TEST.GDT 3/6/20

LEGEND

SS - Split Spoon
AC - Auger Cuttings
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GEO-TEST

Project: New Well House & Treatment System Facility
Date: 03/05/2020 Project No: 1-00211
Elevation: Type: 5.5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 3

During Drilling: none After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft 20 40 60 80
			AC		5		SC	CLAYEY SAND, fine to medium grained, some gravel, low plasticity, slightly moist, brown	
5								STOPPED AUGER AT 5'	
10									
15									
20									

LOG OF TEST BORING 1-00211 NEW WELL HOUSE & TREATMENT SYSTEM FACILITY, CHUPADERO.GPJ GEO TEST.GDT 3/6/20

LEGEND

SS - Split Spoon
AC - Auger Cuttings
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SUMMARY OF LABORATORY RESULTS

						SIEVE ANALYSIS PERCENT PASSING											
TEST HOLE	DEPTH (FEET)	UNIFIED CLASS	(%) MOIST	LL	PI	NO 200	NO 100	NO 40	NO 10	NO 4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	4"
1	0.0 - 2.5	SC	10.3	38	18	36	48	60	76	86	92	93	95	100			
1	3.0	SC	8.2	34	16	35	48	60	80	92	98	98	100				
1	5.0	SC	6.9	31	12	37	55	69	93	99	100						
1	10.0		9.0														
1	15.0		6.2														
2	0.0 - 5.0	SM	6.1	NP	NP	13	18	27	51	68	79	84	87	93	100		
3	0.0 - 5.0	SC	4.9	26	9	17	22	32	67	87	95	96	100				

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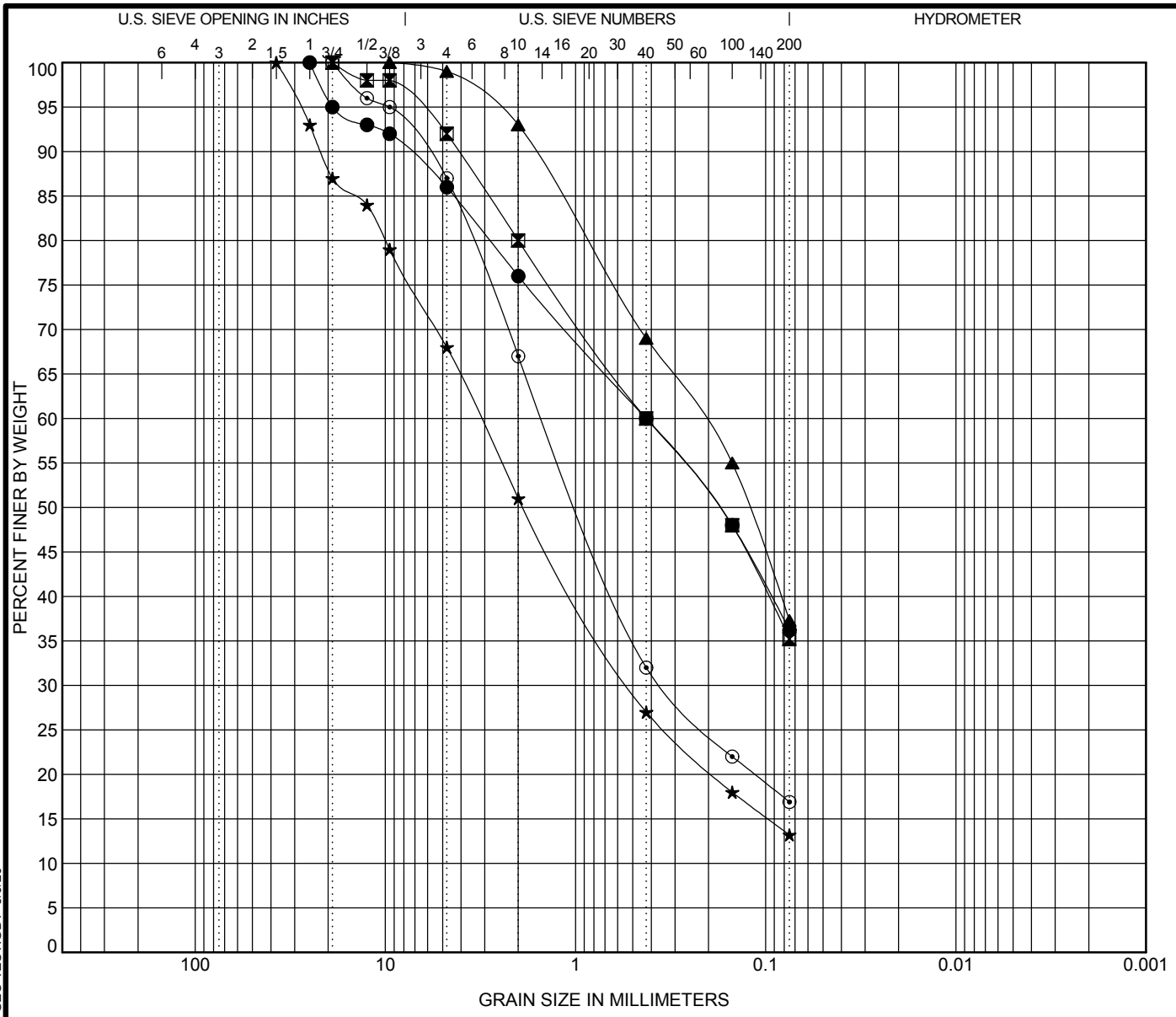
LL = LIQUID LIMIT
PI = PLASTICITY INDEX
NP = NON PLASTIC or NO VALUE

Project: New Well House & Treatment System Facility

Location: Chupadero, New Mexico

Number: 1-00211

SUMMARY OF LABORATORY RESULTS 1-00211 NEW WELL HOUSE & TREATMENT SYSTEM FACILITY, CHUPADERO.GPJ GEO TEST.GDT 3/6/20



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	1	0.0 - 2.5	**CLAYEY SAND(SC)**	**38**	**20**	**18**		
⊠	1	3.0	**CLAYEY SAND(SC)**	**34**	**18**	**16**		
▲	1	5.0	**CLAYEY SAND(SC)**	**31**	**19**	**12**		
★	2	0.0 - 5.0	**SILTY SAND with GRAVEL(SM)**	**NP**	**NP**	**NP**		
⊙	3	0.0 - 5.0	**CLAYEY SAND(SC)**	**26**	**17**	**9**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	0.0 - 2.5	**25**	**0.425**			**14.0**	**49.8**	**36.2**	
⊠	1	3.0	**19**	**0.425**			**8.0**	**56.8**	**35.2**	
▲	1	5.0	**9.5**	**0.218**			**1.0**	**61.7**	**37.3**	
★	2	0.0 - 5.0	**37.5**	**3.162**	**0.516**		**32.0**	**54.8**	**13.2**	
⊙	3	0.0 - 5.0	**19**	**1.467**	**0.345**		**13.0**	**70.1**	**16.9**	

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GRAIN SIZE DISTRIBUTION

Project: New Well House & Treatment System Facility

Location: Chupadero, New Mexico

Number: 1-00211

US GRAIN SIZE 1-00211 NEW WELL HOUSE & TREATMENT SYSTEM FACILITY, CHUPADERO.GPJ GEO TEST.GDT 3/6/20