Navajo Nation
Westwater Water System
Design Project

PROJECT MANUAL

CONTRACT: Westwater Water System Design Project

VOLUME 1 OF 1

DIVISION 0-17 – TECHNICAL SPECIFICATIONS

Contract Issue

Navajo Tribal
Utility Authority

November 2023

Brown and Caldwell
6975 Union Park Center, Suite 490
Midvale, UT 84047

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PROJECT MANUAL

FOR CONSTRUCTION OF

Navajo Nation
WESTWATER WATER SYSTEM DESIGN

CONTRACT: WESTWATER WATER SYSTEM DESIGN

Division 0 – Introductory Information
Divisions 1 thru 17 – Technical Specifications

Navajo Tribal Utility Authority

Prepared by:

Brown and Caldwell
6975 Union Park Center, Suite 490
Midvale, UT 84047

Project No. 158815

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SECTION 00016

SEALS PAGE

WESTWATER WATER SYSTEM DESIGN

CONTRACT: WESTWATER WATER SYSTEM DESIGN

ITEMS IN THIS PROJECT MANUAL	PREPARED BY
Contract, Bidding and General Requirements Divisions 0 – 2, 15	
	Corwin Willmore, P.E. Brown and Caldwell 6975 Union Park Center, Suite 490 Midvale, UT 84047

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CONTRACT: WESTWATER WATER SYSTEM DESIGN

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Navajo Nation
Westwater Water System Design
BC PROJECT NO.: 158815

WESTWATER WATER SYSTEM DESIGN

DIVISION 1

GENERAL REQUIREMENTS

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SECTION 01010

SUMMARY OF WORK

1.0 GENERAL

The work covered under this contract will be performed at the Westwater Development located just West of Blanding City Utah.

2.0 DESCRIPTION OF OWNER'S PROJECT

The overall project will provide water to the existing Westwater Development. This project will connect to the existing Blanding City water system with an 8-inch pipeline

3.0 WORK OF THIS CONTRACT

The work to be performed under this contract includes:

- Construction of approximately 6,660 linear feet of 8-inch diameter PVC pipeline.
- Construction of approximately 1,100 linear feet of 8-inch diameter HDPE pipeline crossing the Westwater Creek. This will be installed by doing a horizontal directional bore.
- Construction of approximately 460 linear feet of 8-inch HDPE pipeline using horizontal directional bore under an existing archeological site to minimize surface disturbance.
- Construction of 12 water laterals to be plugged and stubbed for future connection.
- Construction of 17 water laterals to existing homes.

4.0 WORK OF OTHER CONTRACTS – NOT NEEDED

5.0 CLARIFICATIONS REGARDING THE WORK

- The Contractor is advised that the Work includes everything in the Project Manual and on the Drawings.

END OF SECTION

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SECTION 01014

WORK SEQUENCE

PART 1--GENERAL

1.01 CONTINUITY OF SYSTEM OPERATIONS

A. GENERAL:

The existing homes inside of the Westwater Development that have indoor plumbing are currently connected to existing cisterns with pumps inside of them. The Contractor shall coordinate the work to minimize the downtime of any existing indoor plumbing.

1.02 SEQUENCE AND SCHEDULE OF CONSTRUCTION

A. General:

1. To permit continuous use of indoor plumbing at existing homes, the construction schedule shall provide for the following specific conditions:

a. All constructed pipelines shall be installed, pressure tested, and disinfected according to these specifications prior to any new lateral being connected to any existing indoor plumbing.

1.03 SUBMITTALS

The following submittals shall be provided in accordance with Section 01300:

A. OUTAGE PLAN:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested

deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Submit a detailed outage plan and time schedule for operations which will make it necessary to remove any facility, piping, well, electrical or control circuit, or equipment from service. The schedule shall be coordinated with the construction schedule specified in the General Conditions of the Contract Documents and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the means and methods to maintain potable water system operational and disinfected, the length of time required to complete said operation, and the necessary personnel and equipment which the Contractor shall provide to prevent extended duration loss of available potable water.

PART 2—PRODUCTS – NOT USED

PART 3—EXECUTION – NOT USED

END OF SECTION

SECTION 01071

STANDARD REFERENCES

Wherever used in the project manual, the following abbreviations will have the meanings listed:

AA	Aluminum Association Incorporated P.O. Box 753 Waldorf, MD 20604
AABC	Associated Air Balance Council 1518 K Street N.W. Washington, DC 20005
AAMA	American Architectural Manufacturers Association 1540 East Dundee Road, Suite 310 Palatine, IL 60067
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, DC 20001
ABMA	American Bearing Manufacturers Association 1200 19th Street N.W., Suite 300 Washington, DC 20036
ACI	American Concrete Institute 22400 West Seven Mile Road P.O. Box 19150, Redford Station Detroit, MI 48219
AEIC	Association of Edison Illuminating Companies 600 North 18th Street P.O. Box 2641 Birmingham, AL 35291
AGA	American Gas Association ATTN: Records 1515 Wilson Boulevard Arlington, VA 22209
AGMA	American Gear Manufacturer's Association, Inc. 1500 King Street, Suite 201 Alexandria, VA 22314
AHA	American Hardboard Association 1210 West Northwest Highway Palatine, IL 60067
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601

AISI	American Iron and Steel Institute 1101 Seventeenth Street, NW, Suite 1300 Washington, DC 20036
AITC	American Institute of Timber Construction 7012 South Revere Parkway, Suite 140 Englewood, CO 80112
ALSC	American Lumber Standard Committee P.O. Box 210 Germantown, MD 20875
AMCA	Air Movement and Control Association, Inc. 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 11 West 42nd Street, 13th Floor New York, NY 10036
APA	American Plywood Association 7011 South 19th Street Tacoma, WA 98466
API	American Petroleum Institute 1220 "L" Street N.W. Washington, DC 20005
ARI	Air-Conditioning and Refrigeration Institute 4301 North Fairfax Drive, Suite 425 Arlington, VA 22203
ASCE	American Society of Civil Engineers United Engineering Center 345 East 47th Street New York, NY 10017
ASCII	American Standard Code for Information Interchange United States of America Standards Institute 10 East 40th Street New York, NY 10016
ASE Code	American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials

100 Barr Harbor Drive
West Conshohocken, PA 19428

AWPA American Wood-Preservers' Association
9549 Old Fredrick Road
Ellicott City, MD 21042
or
P.O. Box 286
Woodstock, MD 21163-0286

AWS American Welding Society
550 NW LeJeune Road
P.O. Box 351040
Miami, FL 33135

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

BOCA Building Officials and Code Administrators, International, Inc.
4051 West Flossmoor Road
Country Club Hills, IL 60478

CALTEST Materials Manual, State of California, Business and Transportation Agency
Department of Public Works
State of California, Department of Transportation
6002 Folsom Boulevard
Sacramento, CA 95819

CALTRANS Standard Specifications, State of California, Department of Transportation
State of California, Business and Transportation Agency
P.O. Box 1499
Sacramento, CA 95807

CBM Certified Ballast Manufacturers
2120 Keith Building
Cleveland, OH 44115

CMAA Crane Manufacturers Association of America, Inc.
(Formerly called: Overhead Electrical Crane Institute) (OECI)
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

CRSI Concrete Reinforcing Steel Institute
933 N Plum Grove Road
Schaumburg, IL 60173

CSA Canadian Standards Association
178 Rexdale Boulevard
Rexdale, Ontario, M9W IR3, Canada

DEMA Diesel Engine Manufacturer's Association
30200 Detroit Road
Cleveland, OH 44145

DHI Door and Hardware Institute
14170 Newbrook Drive

Chantilly, VA 22021

DIS Division of Industrial Safety
California Department of Industrial Relations
2422 Arden Way
Sacramento, CA 95825

EEI Edison Electric Institute
90 Park Avenue
New York, NY 10016

EIA Electronic Industries Association
Order from:
Global Engineering Documents
18201 McDurmott West
Irvine, CA 92714

EJMA Expansion Joint Manufacturers Association
25 North Broadway
Tarrytown, NY 10591

ESO Electrical Safety Orders
California Administrative Code, Title 8, Chap. 4, Subarticle 5
Office of Procurement, Publications Section
P.O. Box 20191
8141 Elder Creek Road
Sacramento, CA 95820

FEDSPEC Federal Specifications
General Services Administration
Specification and Consumer Information
Distribution Branch
Washington Navy Yard, Bldg. 197
Washington, DC 20407

FEDSTDS Federal Standards
(see FEDSPECS)

FM Factory Mutual Engineering and Research Corporation
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

HEI Heat Exchange Institute
1300 Sumner Avenue
Cleveland, OH 44115

HI Hydraulic Institute
9 Sylvan Way, Suite 180
Parsippany, NJ 07054

HPVA Hardwood Plywood & Veneer Association
1825 Michael Faraday Drive
P.O. Box 2789

Reston, VA 22090-2789

IAPMO International Association of Plumbing and Mechanical Officials
20001 Walnut Drive S
Walnut, CA 91789

ICBO International Conference of Building Officials
5360 Workman Mill Road
Whittier, CA 90601

ICEA Insulated Cable Engineers Association
P.O. Box 440
South Yarmouth, MA 02664

IEEE Institute of Electrical and Electronics Engineers
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855

IES Illuminating Engineering Society of North America
120 Wall Street
New York, NY 10017

ISA Instrument Society of America
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, NC 27709

JIC Joint Industrial Council
7901 West Park Drive
McLean, VA 22101

MFMA Metal Framing Manufacturers Association
401 N. Michigan Avenue
Chicago, IL 60611

MILSPEC Military Specifications
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

MSS Manufacturers Standardization Society of the Valve & Fittings Industry, Inc.
127 Park Street, N.E.
Vienna, VA 22180

NAAMM National Association of Architectural Metal Manufacturers
11 South La Salle Street, Suite 1400
Chicago, IL 60603

NACE National Association of Corrosion Engineers
1440 South Creek Drive
Houston, TX 77084

NBC National Building Code
Published by BOCA

NEC National Electric Code
National Fire Protection Association
One Batterymarch Park
P.O. Box 9101

Quincy, MA 02269

NELMA Northeastern Lumber Manufacturers Association, Inc.
P.O. Box 87A
Cumberland Center, ME 04021

NEMA National Electrical Manufacturer's Association
2101 L Street, NW, Suite 300
Washington, DC 20037

NESC National Electric Safety Code
American National Standards Institute
1430 Broadway
New York, NY 10018

NFOR National Forest Products Association
(Formerly National Lumber Manufacturer's Association)
1111 19 Street NW, Suite 700
Washington, DC 20036

NFPA National Fire Protection Association
One Batterymarch Park
P.O. Box 9101
Quincy, MA 02269

NHLA National Hardwood Lumber Association
6830 Raleigh LaGrange
P.O. Box 34518
Memphis, TN 38184-0518

NSF National Sanitation Foundation
3475 Plymouth Road
P.O. Box 130140
Ann Arbor, MI 48113

OSHA Occupational Safety and Health Act
U.S. Department of Labor
Occupational and Health Administration
San Francisco Regional Office
450 Golden Gate Avenue, Box 36017
San Francisco, CA 94102

PCI Precast/Prestressed Concrete Institute
175 West Jackson Blvd., Suite 1859
Chicago, IL 60604

PPIC The Plumbing & Piping Industry Council, Inc.
510 Shatto Place, Suite 402
Los Angeles, CA 90020

RIS Redwood Inspection Service
California Redwood Association
405 Enfrente Dr., Suite 200
Novato, CA 94949

RMA Rubber Manufacturers Association

	1400 K Street NW, Suite 900 Washington, DC 20005
SAE	Society of Automotive Engineers, Inc. 400 Commonwealth Drive Warrendale, PA 15096
SAMA	Scientific Apparatus Makers Association One Thomas Circle Washington, DC 20005
SBC	Standard Building Code Published by SBCCI
SBCCI	Southern Building Code Congress International Inc. 900 Montclair Road Birmingham, AL 35213
SCMA	Southern Cypress Manufacturers Association 400 Penn Center Boulevard, Suite 530 Pittsburg, PA 15235
SDI	Steel Door Institute 30200 Detroit Road Cleveland, OH 44145
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. P.O. Box 221230 Chantilly, VA 22021
SPI	Society of the Plastics Industry, Inc. 1275 K Street NW, Suite 400 Washington, DC 20005
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway Pensacola, FL 32504
SSPC	Society for Protective Coatings 40 24th Street, 6th Floor Pittsburgh, PA 15222
SSPWC	Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034
TEMA	Tubular Exchanger Manufacturer's Association 25 North Broadway Tarrytown, NY 10591
TPI	Truss Plate Institute 583 D'Onofrio Drive, Suite 200 Madison, WI 53719
UBC	Uniform Building Code Published by ICBO
UL	Underwriters Laboratories Inc.

333 Pfingsten Road
Northbrook, IL 60062

UMC Uniform Mechanical Code
Published by ICBO

UPC Uniform Plumbing Code
Published by IAPMO

USBR Bureau of Reclamation
U.S. Department of Interior
Engineering and Research Center
Denver Federal Center, Building 67
Denver, CO 80225

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns St.
P.O. Box 23145
Portland, OR 97223

WWPA Western Wood Products Association
(Formerly called: West Coast Lumbermen's Association (WCLA))
Yeon Building
522 SW 5th Avenue
Portland, OR 97204

END OF SECTION

SECTION 01200

PROJECT MEETINGS

1.0 PRECONSTRUCTION CONFERENCE

The Construction Manager will schedule and conduct one preconstruction conference prior to the commencement of any work at the site, to which all interested agencies and utility companies will be invited to discuss their interests and requirements relating to the project. Contractor and all subcontractor representatives shall attend.

2.0 CONSTRUCTION PERIOD MEETINGS

Construction period meetings will be conducted at weekly intervals or at some other frequency if approved by the Contractor and Construction Manager. These meetings shall be attended by the Construction Manager and the Contractor's Project Manager and any others that are invited by these people.

The agenda of these project meetings will include reports on construction progress, the status of submittal reviews, the status of information requests, and any general business. The meetings will be conducted by the Construction Manager. Construction Manager shall keep minutes of the proceedings. The minutes shall be typed and distributed to all attendees within 48 hours of each meeting.

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SECTION 01300

SUBMITTALS

1.0 GENERAL

Submittals covered by these requirements include manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, and piping and conduit details. The Contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, and manufacturer's installation and other instructions as specifically required in the contract documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents.

2.0 CONTRACTOR'S RESPONSIBILITIES

A. GENERAL

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment, or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Construction Manager in each case where their submittal may affect the work of another contractor or the Owner. The Contractor shall coordinate submittals among his subcontractors and suppliers.

The Contractor shall coordinate submittals with the work so that work will not be delayed. He shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment shall be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."

The Contractor shall certify on each submittal document that they have reviewed the submittal, verified field conditions, and complied with the contract documents.

The Contractor may authorize in writing a material or equipment supplier to deal directly with the Construction Manager or with the Owner with regard to a submittal. These dealings shall be limited to contract interpretations to clarify and expedite the work.

3.0 CATEGORIES OF SUBMITTALS

A. GENERAL:

Submittals fall into two general categories; submittals for review and comment, and submittals which are primarily for information only. Submittals which are for information only are generally specified as PRODUCT DATA in Part 2 of applicable specification sections.

At the beginning of work, the Construction Manager will furnish the Contractor lists of those submittals specified in the project manual. Two separate lists will be provided: submittals for review and comment and product data (submittals) for information only.

B. SUBMITTALS FOR REVIEW AND COMMENT:

All submittals except where specified to be submitted as product data for information only shall be submitted by the Contractor to the Construction Manager for review and comment.

C. SUBMITTALS (PRODUCT DATA) FOR INFORMATION ONLY:

Where specified, the Contractor shall furnish submittals (product data) to the Construction Manager for Information only. Submittal requirements for operation and maintenance manuals, which are included in this category, are specified in Section 01730.

4.0 TRANSMITTAL PROCEDURE

A. GENERAL:

Unless otherwise specified, submittals regarding material and equipment shall be accompanied by Transmittal Form 01300-A specified in Section 01999. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.

A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.

B. DEVIATION FROM CONTRACT:

If the Contractor proposes to provide material, equipment, or method of work which deviates from the project manual, they shall indicate so under "deviations" on the transmittal form accompanying the submittal copies.

C. SUBMITTAL COMPLETENESS:

Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

5.0 REVIEW PROCEDURE

A. GENERAL:

Submittals are specified for those features and characteristics of materials, equipment, and methods of operation which can be selected based on the Contractor's judgment of their conformance to the specified requirements. Other features and characteristics are specified in a manner which enables the Contractor to determine acceptable options without submittals. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform as specified. Review shall not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the project manual) or to safety precautions or programs incident thereto. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.

When the contract documents require a submittal, the Contractor shall submit the specified information as follows:

1. Unless otherwise specified, one (1) electronic copy in Adobe ".pdf" format of all submitted information. Consolidate electronic format submittals with multiple pages into a single file. Include an electronic submittal transmittal form 01300-A as the first page in the electronic file.

2. Unless otherwise specified, one (1) electronic copy in Adobe ".pdf" format of all submitted information shall be transmitted for submittals (Product Data) for information only.

3. Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section.

4. For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is used.

5. Where required, three (3) samples of submitted information shall be provided to the Construction Manager. Samples will not be returned. Provide samples from manufacturer's standard colors, materials, products, or equipment lines. Clearly label samples to indicate any that represent non standard colors, materials, products, or equipment lines and that if selected, will require an increase in Contract Time or Contract Price.

6. If requested by Engineer, Contractor shall provide hardcopies of any submittals or shop drawings.

B. SUBMITTALS FOR REVIEW AND COMMENT:

Unless otherwise specified, within 10 working days after receipt of a submittal for review and comment, the Construction Manager shall review the submittal and return 1 electronic copy of the marked-up reproducible original noted in 1 above. The reproducible original will be retained by the Construction Manager. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment or work method complies with the project manual, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

4. If the review indicates that the material, equipment, or work method does not comply with the project manual, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations which have not been identified clearly may be rejected. Except at his own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

C. SUBMITTALS (PRODUCT DATA) FOR INFORMATION ONLY:

Such information is not subject to submittal review procedures and shall be provided as part of the work under this contract and its acceptability determined under normal inspection procedures.

6.0 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Construction Manager or the Owner, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

END OF SECTION

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SECTION 01310

CONSTRUCTION SCHEDULE

1.0 SCOPE

This section specifies reports and schedules for planning and monitoring the progress of the work.

2.0 DESCRIPTION

The Contractor shall provide a graphic construction schedule indicating the various subdivisions of the work and the dates of commencing and finishing each. The schedule shall show the time allowed for testing and for other procedures which must be completed prior to the work being put into operation. The schedule will take into account the time of completion.

3.0 SUBMITTAL PROCEDURES

Within 20 days after the date of the Notice to Proceed, the Contractor shall submit in accordance with Section 01300, a construction schedule conforming to paragraph 01310-2.0. The submittal shall consist of a reproducible original and two copies.

Within 7 calendar days after receipt of the submittal, the Construction Manager shall review the submitted schedule and return one copy of the marked up original to the Contractor. If the Construction Manager finds that the submitted schedule does not comply with specified requirements, the corrective revisions will be noted on the submittal copy returned to the Contractor.

4.0 SCHEDULE REVISIONS

Revisions to the accepted construction schedule may be made only with the written approval of the Contractor and Owner. A change affecting the contract value of any activity, the completion time, and specific dates and sequencing may be made only in accordance with OWNER approval.

5.0 PROJECT STATUS UPDATE

Project status review and update shall be provided each month.

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SECTION 01400

QUALITY ASSURANCE, INSPECTION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

This section specifies administrative and procedural requirements for quality assurance and control services, special inspections, and field testing required for this project. This Section is supplementary to the applicable testing and inspection program in the Contract, and describes the responsibilities of all parties pertaining to testing and inspections.

This section covers requirements for quality assurance and inspection required in accordance with the latest version of the International Building Code and is in addition to and supplements the quality assurance requirements contained on the Contract Drawings.

The Contractor is responsible for providing quality workmanship and materials for the construction of this project in accordance with the Contract Documents.

1.02 DEFINITIONS

A. Approved Agency: An agency approved by the Building Official to engage in furnishing testing or inspection services.

B. Certificate of Compliance: A certificate stating that materials and products meet specified standards or that work was performed in compliance with approved construction documents.

C. Registered Design Professional in Responsible Charge: An architect or engineer, licensed to practice in the State of Utah, acting as the Owner's agent.

D. Resident Project Representative: The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative. The term "Construction Manager," as used in this and other technical specifications, refers to the Resident Project Representative.

E. Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed and at the completion of the work.

H. Special Inspector: A qualified person who has demonstrated competence, to the satisfaction of the Building Official, to perform inspection of the construction or operation requiring special inspection.

I. Statement of Special Inspections: The quality assurance plan contained on the contract drawings establishing the systems and components subject to special inspection and testing, as well as the frequency of testing and extent and duration of the special inspection.

J. Structural Observation: The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents at significant construction stages and at completion of the structural system.

1.03 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

References to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization, or if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ASTM E329	Practice for Use in Evaluation of Inspection and Testing Agencies as Used in Construction
IBC	International Building Code with local amendments
ICC-ES	International Code Council – Evaluation Service Reports and Legacy Reports

1.04 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. Fabricator Approval: Certification showing that fabricator is registered and approved to perform shop fabrication without special inspection.

2. Certificates of Compliance: Certificates of compliance shall be submitted stating that materials and products meet specified standards.

3. Contractor Statement: Prior to start of construction, Contractor shall submit statement of responsibility containing the following:

    a. Acknowledgement of awareness of special inspection requirements.
    b. Acknowledgement that control will be exercised to obtain conformance with documents approved by the Building Official.
    c. Procedures for exercising control within the Contractor's organization.
    d. Identification and qualifications of persons exercising control.

4. Testing Laboratory Qualifications: Prior to start of construction, submit latest inspection report of testing laboratory facilities indicating current accreditation by the accreditation authority.

1.06 INSPECTION AND TESTING

The Construction Manager/Resident Project Representative may throughout the duration of construction, inspect construction and require the Contractor to test materials to assure Contractor conformance with these specifications. Special inspections and associated testing, as shown on the drawings, will also be performed by approved Special Inspectors for compliance with the IBC. This testing will be in addition to that otherwise required of the Contractor in this and other specification sections.

1.07 COSTS

A. Paid by the Contractor:

1. Testing to demonstrate and document conformance with the Contract Documents and applicable permits and codes.

2. Retesting and re-inspections required due to defective work.

3. Testing performed for the convenience of the Contractor.

1.08 CONTRACTOR'S RESPONSIBILITIES

Contractor shall cooperate with testing personnel. Contractor shall provide access to the work and supplier's operations.

Contractor shall deliver adequate samples of materials proposed to be used and which require testing to the Testing Laboratory or as otherwise directed by the Construction Manager/Resident Project Representative.

Contractor shall furnish casual labor and facilities, including but not limited to obtaining and handling samples, repairing of test areas to match original conditions, storage and curing of samples, etc.

Contractor shall provide all testing required to demonstrate compliance with the Contract Documents as well as all special inspections. Additional testing requirements are specified in the technical specification sections.

For all Contractor-required testing, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329.

1.09 SPECIAL INSPECTOR'S RESPONSIBILITIES

Special Inspector shall keep records of inspections.

Special Inspector shall provide inspection reports to the Construction Manager.

Special Inspector shall provide a final report documenting special inspections and correction of any discrepancies noted in the inspections to the Construction Manager and Building Official.

Special Inspector shall attend pre-construction conferences and construction progress meetings if requested by the Construction Manager.

1.10 APPROVED AGENCY'S RESPONSIBILITIES

The Approved Agency shall employ personnel experienced and trained to perform the types of tests or inspections required for this project.

The Approved Agency personnel performing testing of welds shall be certified in accordance with AWS QC 1.

1.11 SPECIAL INSPECTION AND TESTING REPORTS

A. REPORT CONTENTS:

At a minimum, Special Inspection and Testing Reports shall include the following:

1. Project name and date of report.

2. Testing laboratory name, address, telephone number, name of laboratory field sampling personnel, and name of lab testing personnel, as applicable.

3. Date, time, and location of sampling, testing, and inspecting.

4. Ambient temperature and weather conditions at the site or shop and curing conditions of samples.

5. Product identification and referenced specification section number.

6. Type of sample, test, and inspection and industry standard for sampling and testing.

7. Results of sample, test, and inspection.

8. Evaluation of compliance with requirements in Contract Documents.

B. DISTRIBUTION OF REPORTS:

Test and Inspection reports shall be submitted to the Construction Manager and distributed by the Testing Laboratory as directed by the Construction Manager. Draft field test and inspection reports shall be submitted to the Construction Manager prior to the Special Inspector departing the project site. Final test and inspection reports shall be submitted not more than three days after completion of required tests and inspections. Inspection reports shall be submitted immediately to the Construction Manager if deficiencies or significant irregularities are noted. Provide two legible reproducible copies of all draft field reports and one copy of all final reports.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

3.01 GENERAL:

The Contractor shall furnish access to the Work as required for special inspections, testing and structural observations.

The Contractor shall notify the Construction Manager in advance of required special inspections and structural observation no later than 3 days prior to the date of the inspection.

Contractor shall correct defective work at no additional cost to the Owner.

3.02 TESTING

Component and attachment testing shall be required of component manufacturers for mechanical and electrical components subject to special inspections for seismic resistance. The Contractor shall submit a certificate of compliance prepared by the component manufacturer.

Certificates of Compliance shall include the manufacturer's name and address; applicable Drawing and Detail number, products, units and assemblies, and system equipment identification.

END OF SECTION

SECTION 01410

TESTING LABORATORY AND SPECIAL INSPECTION SERVICES

PART 1--GENERAL

1.01 DESCRIPTION

A. This Section specifies Quality Control testing and reporting performed by the Testing Laboratory and Special Inspector. The CONTRACTOR shall select a qualified Testing Laboratory and contract for the services specified herein. Such an arrangement does not relieve the Contractor from their responsibility to provide the completed project as specified, and to perform Quality Assurance according to the QCS as reviewed and accepted.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	**Title**
ASTM A880	Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C802	Conducting an Inter-laboratory Test Program to Determine the Precision of Test Methods for Construction Materials
ASTM C1021	Laboratories Engaged in the Testing of Building Sealants
ASTM C1077	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C1093	Accreditation of Testing Agencies for Unit Masonry

Reference	Title
ASTM D3666	Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3740	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4561	Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
ASTM E4	Force Verification of Testing Machines
ASTM E329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E543	Agencies Performing Nondestructive Testing
ASTM E994	Calibration and Testing Laboratory Accreditation Systems General Requirements for Operation and Recognition.
IBC	International Building Code with local amendments

1.03 LABORATORY FOR TESTING QUALIFICATIONS

A. Testing Laboratory shall satisfy the following qualifications:

1. Recommended Requirements for Independent Laboratory Qualification, published by American Council of Independent Laboratories.

2. Conform to the requirements of ASTM E329 in particular, and other reference standards as generally pertain to this project.

3. Authorized to operate in the State of Utah, with personnel and equipment based sufficiently close to the project to allow short-notice site access for sampling and testing.

4. Acceptable to OWNER, Construction Manager, and local building authorities.

1.04 TESTING LABORATORY RESPONSIBILITIES

A. Testing Laboratory shall provide qualified personnel at the site and cooperate with Construction Manager and Contractor in performance of the following services:

1. Perform specified independent inspection, sampling, and testing of products in accordance with specified standards, to determine compliance with requirements of Contract Documents.

2. Provide sampling equipment and personnel, deliver samples to the testing laboratory, record field measurements, and cure samples as required by Contract Documents.

3. Timely prepare and deliver reports summarizing results of tests and inspections.

4. Attend pre-construction conferences and, if requested, a limited number of progress meetings where Quality Control, testing, and inspection issues require discussion.

5. When directed by the Construction Manager or requested by the Contractor, provide special and additional tests and inspections to verify material compliance with requirements of Contract Documents.

   a. Contractor shall pay for additional tests and inspections where work fails to comply with Contract Document requirements (re-inspection) and for costs associated with cancelled or short-notice re-scheduling of requested sampling, testing, and inspection. Testing Laboratory work requested by Contractor to fulfill submittal requirements shall also be considered additional tests.

1.05 CONTRACTOR RESPONSIBLITIES

A. Contractor shall deliver adequate samples of materials proposed to be used and which require testing by the Testing Laboratory. Contractor shall coordinate and cooperate with the Testing Laboratory personnel and provide access to the work and to manufacturer's facilities. Contractor shall provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

B. Contractor shall notify Construction Manager 24 hours prior to expected time for operations requiring inspection, sampling and testing services unless otherwise noted.

1.06 TEST AND INSPECTION REPORTS

A. REPORT CONTENTS

At a minimum, Test and Inspection Reports shall include the following:

1. Project name and date of report.

2. Testing Laboratory name, address, telephone number, name of laboratory field sampling personnel, and name lab testing personnel, as applicable.

3. Date, time, and location of sampling, testing, and inspecting.

4. Ambient temperature and weather conditions at the site or shop and curing conditions of samples.

5. Product identification and referenced specification Section number.

6. Type of sample, test, and inspection and industry standard for sampling and testing.

7. Results of sample, test, and inspection.

8. Evaluation of compliance with requirements in Contract Documents.

9. Certified Inspection Reports shall specifically indicate the qualification of the inspector to render judgment and certify said inspection.

10. When requested by Construction Manager, interpretation of test results.

B. DISTRIBUTION OF TEST AND INSPECTION REPORTS

1. Test and Inspection reports shall be submitted to the Construction Manager for distribution as Product Data described in Section 01300. Test reports shall be submitted not more than two days after completion of required tests. Inspection reports shall be submitted immediately if deficiencies or significant irregularities are noted, and in no case less than two working days after said inspection. Provide electronic copies of all reports.

1.07 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any

requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Documentation of conformance with Testing Laboratory Qualifications as specified in paragraph 1.03 herein.

3. Form A described in paragraph 3.03 herein, by both Testing Laboratory and Contractor.

1.08 LIMITS ON TESTING LABORATORY AUTHORITY

A. Testing Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents. Testing Laboratory may not approve or accept any portion of the work, nor assume any duties of Contractor. Testing Laboratory has no authority to stop the work.

PART 2--PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. GENERAL

1. Source quality control is defined in Section 01400. This Section provides general guidelines as to the sampling, tests, and inspections required of products and manufactures prior to delivery to the project site, and should be considered a minimum. Additional information and requirements are provided in each technical specification Section and those requirements shall control over this Section when in conflict. Absence of a test, inspection or requirement listed herein from a subsequent specification Section does not relieve the Testing Laboratory or the Contractor from their respective responsibilities specified in this Section.

B. REFERENCE STANDARDS IN OTHER SECTIONS

1. Codes, standards, and other references called out below, but which are not listed in paragraph 1.02 are described in other specification Sections and not repeated herein.

C. FILL MATERIALS

1. IMPORTED FILL MATERIALS: Testing Laboratory may conduct additional testing on behalf of Contractor to prepare required submittals specified in Section 02200.

2. TYPE K FILL MATERIAL: Testing Laboratory shall conduct required testing to verify on-site materials proposed for fill conforms to

specification Section 02200. Contractor shall pay Testing Laboratory for such sampling and testing. Sampling and testing shall determine Liquid Limit, Plasticity Index, optimum moisture content and density relationship, and other data as required for proper use of this material.

D. PAVING MATERIALS: NOT USED

E. CONCRETE REINFORCING: NOT USED

F. CAST-IN-PLACE CONCRETE: NOT USED

G. PRECAST CONCRETE: NOT USED

H. MASONRY: NOT USED

I. STRUCTURAL STEEL: NOT USED

J. STEEL DECK: NOT USED

K. COLD FORMED STEEL FRAMING AND TRUSSES: NOT USED

L. ROUGH CARPENTRY: NOT USED

M. MISCELLANEOUS METALWORK, GRATING, GUARDRAILING: NOT USED

N. PLASTIC LINING FOR STRUCTURES -NOT USED

O. COATING SYSTEMS: NOT USED

P. ENGINEERED METAL BUIDINGS – NOT USED

PART 3--EXECUTION

3.03 FIELD QUALITY CONTROL

A. GENERAL

1. Field quality control is defined in Section 01400. This Section provides general guidelines as to the sampling, tests, and inspections required of work in progress or completed in the field, and should be considered a minimum. Additional information and requirements are provided in each technical specification Section and those requirements shall control over this Section when in conflict. Absence of a test, inspection or requirement listed herein from a subsequent specification Section does not relieve the Testing Laboratory or the Contractor from their respective responsibilities specified in this Section.

B. REFERENCE STANDARDS IN OTHER SECTIONS

1. Codes, standards, and other references called out below, but which are not listed in paragraph 1.02 are described in other specification Sections and not repeated herein.

C. FILL

1. SUBGRADE PREPARATION AND COMPACTION: NOT USED

2. STRUCTURE FILL: NOT USED

3. STRUCTURE BACKFILL: NOT USED

4. PIPE TRENCH BACKFILL: Verify material provided, lift thickness, and compaction density. Frequency of sampling and testing for Bedding, pipe zone, and trench back fill shall be at performed intervals no greater than 500 feet. Testing at minimum shall be performed at the spring line on both sides of the pipe and at 12-inches above the crown of the pipe.

5. OTHER FILL MATERIALS: NOT USED

D. PAVING: NOT USED

E. CONCRETE REINFORCING: NOT USED

F. CAST-IN-PLACE CONCRETE: NOT USED

G. PRECAST CONCRETE: NOT USED

H. ANCHOR BOLTS AND ANCHORS: NOT USED

I. GROUT: NOT USED

J. MASONRY: NOT USED

K. STRUCTURAL STEEL: NOT USED

L. STEEL ROOF DECK: NOT USED

M. ROUGH CARPENTRY: NOT USED

N. MISCELLANEOUS METALWORK, GRATING, GUARDRAILING: NOT USED

O. PLASTIC LINING FOR STRUCTURES: NOT USED

P. COATING SYSTEMS: NOT USED

Q. ENGINEERED METAL BUIDINGS: NOT USED

3.02 EVALUATION AND CORRECTION

A. EVALUATION

1. Satisfactory completion of work will be judged on results of laboratory, shop, and site tests and inspections.

B. CORRECTIONS

1. If results of tests and inspections indicate work is below requirements of Contract Documents, that portion of work is defective and shall be repaired or replaced by the Contractor at no additional expense to the OWNER by methods specified in each material or system's Section. Corrective action shall continue until such work meets the requirements of the Contract Documents.

3.03 SCHEDULE OF INSPECTIONS AND TESTS

A. Form A below shall be used to coordinate sampling and testing provided by Testing Laboratory, Special Inspector, Construction Manager, Contractor, and other parties, if any. Testing Laboratory shall fill out Form A with anticipated inspections, sampling, and testing, submit for review by Construction Manager and for information to Contractor, and revise as directed. After receipt of Testing Laboratory's/Special Inspector Form 01410-A submittal, Contractor shall submit Form 01410-A to identify sampling and testing requested for submittal preparation, and with an allowance for additional inspections. Such allowance shall not be less than five percent (5%) of the anticipated Field Quality Control budget for the Testing Laboratory and Special Inspector, but shall not contractually commit Contractor to such expenditure, unless additional inspections requested and then only to their extent.

FORM 01410-A

ANTICIPATED SAMPLING, TESTING, AND INSPECTIONS BY TESTING LABORATORY AND CONTRACTOR

Prepared by: Testing Laboratory, Special Inspector, Contractor (check one).
Electronic version available upon request. Expand each cell as necessary to provide a complete scope description.

Specification Section	**Source Quality Control**	**Field Quality Control**
02200 Earthwork		
03200 Concrete Reinforcement		
03300 Cast-In-Place Concrete		
03600 Grout		
04200 Masonry		
05100 Structural Metals		
05311 Steel Roof Deck		
05501 Anchors		
05505 Miscellaneous Metalwork		
06100 Rough Carpentry		
06160 Sheathing		
09900 Finishes		

END OF SECTION

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SECTION 01500

CONTRACTOR'S UTILITIES

1.0 OFFICE

The Contractor shall maintain a suitable office at the site of the work.

2.0 POWER

The Contractor shall provide power for construction at the construction sites. He shall make arrangements with the electrical utility and with the Owner for power takeoff points, voltage and phasing requirements, transformers and metering and shall pay the costs and fees arising therefrom. The Contractor shall provide the special connections required for his work.

3.0 SANITARY FACILITIES

The Contractor shall provide toilet and washup facilities for his work force at the site of work. The facilities shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

END OF SECTION

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SECTION 01560

ENVIRONMENTAL CONTROLS

1.0 SITE MAINTENANCE

The Contractor shall keep the work site clean and free from rubbish and debris. Materials and equipment shall be removed from the site when they are no longer necessary. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

2.0 TEMPORARY DAMS

Except in time of emergency, earth dams are not acceptable at catch basin openings, local depressions, or elsewhere. Temporary dams of sand bags, asphaltic concrete, or other acceptable material will be permitted when necessary to protect the work, provided their use does not create a hazard or nuisance to the public. Such dams shall be removed from the site as soon as they are no longer necessary.

Measures to protect and maintain water quality shall be in accordance with Section 01561 STORM WATER POLLUTION PREVENTION PLAN (SWPPP).

3.0 AIR POLLUTION CONTROL

The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. They shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water, or other means as necessary. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

4.0 NOISE CONTROL

Between 7:30 p.m. and 7:00 a.m., noise from Contractor's operations shall not exceed limits established by applicable laws or regulations and in no event shall exceed 86 dBA at a distance of 50 feet from the noise source.

END OF SECTION

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SECTION 01561

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1--GENERAL

1.01 DEFINITIONS

A. The Storm Water Pollution Prevention Plan (SWPPP) is defined as the improving of water quality by reducing pollutants in storm water discharges from the construction site.

B. The Storm Water Pollution Prevention Plan was developed in accordance with the EPA guidebook, "Storm Water Management for Construction Activities, Developing Pollution Plans and Best Management Practices" (EPA publication number 823-R-92-005). The guidebook is a reference for information relating to the different methods of storm water pollution prevention presented in this SWPPP.

C. Waste disposal from the construction site for construction wastes, sanitary wastes, chemicals, and dust abatement shall be conducted per the requirements of the following SWPPP sections.

1.02 SUBMITTALS

A. If deemed necessary, the CONTRACTOR shall submit an approved SWPPP to the CONSTRUCTION MANAGER.

1.03 CONTRACTOR'S RESPONSIBILITIES

B. The CONTRACTOR's storage yard and construction trailer shall be located within the confines of the construction staging areas as defined in the Contract Documents. The areas designated for the CONTRACTOR's use shall contain construction materials, chemicals used during construction and their containment, and other waste materials.

C. Construction Wastes: The CONTRACTOR is responsible for proper disposal of all construction wastes. All construction wastes shall be disposed of in a proper manner via use of an on-site dumpster supplied by the CONTRACTOR. The CONTRACTOR shall provide removal services by a licensed solid waste management firm. The dumpster shall be emptied a minimum of once per week or more often if necessary. Burial of construction wastes on-site is not permitted. The CONTRACTOR shall ensure that the CONTRACTOR on-site work crews and subcontractors are trained in the proper manner of disposal for construction wastes. Disposal of solid waste from the construction site shall meet all applicable Federal, State, and local codes.

D. Sanitary Wastes: The CONTRACTOR shall hire a properly licensed sanitary waste management firm for the disposal of the sanitary waste from the construction site, including from the CONTRACTOR's trailers. Disposal of sanitary waste from the construction site shall meet all applicable Federal, State, and local codes.

E. Hazardous Wastes: All hazardous materials used for the construction shall be stored, handled, and applied per the manufacturer's printed instructions and per all applicable Federal, State, and local codes. The CONTRACTOR shall ensure that the on-site work crews and subcontractors are trained in the proper manner of disposal for hazardous wastes. The disposal of hazardous wastes from the construction site shall be the responsibility of the CONTRACTOR and shall be performed by a licensed hazardous wastes management firm.

F. The construction access to the CONTRACTOR's storage yard shall be stabilized to prevent the removal of sediment from the construction site onto the adjacent property or paved road. The stabilized access roadway shall be wide enough to handle the anticipated truck traffic to and from the construction site.

1.04 MAINTENANCE AND INSPECTION

A. Any erosion control structures and stabilization practices will be inspected by the CONSTRUCTION MANAGER on a weekly basis at a minimum and after any storm event of ½-inch or greater, unless otherwise specified. A copy of the inspection report will be provided to the CONTRACTOR.

B. All erosion control structures and stabilization practices shall be maintained in good working condition throughout the duration of the construction project.

C. Repair of the damage to any erosion control structure shall commence within 24 hours of discovery of the damage.

D. In locations where silt fences are used around catch basins, sediment trapped by the silt fence shall be removed by the CONTRACTOR when one-third of the height of the silt fence is covered by sediment.

E. All areas which undergo temporary and final stabilization with seeding or sodding shall be inspected for lack of growth and bare spots to ensure healthy growth.

1.05 NON-STORM WATER DISCHARGES

A. Flushing of Pipelines: Pipelines shall be flushed after installation. The CONTRACTOR shall direct flushing water to a nearby storm drain system. The CONTRACTOR shall maintain siltation protection during flushing of the pipelines. If the flushing water is contaminated or if the water is suspected of having been contaminated by a regulated compound, testing may be ordered by the CONSTRUCTION MANAGER to determine contamination. Contamination

is defined as having either a pH less than 5.0 or greater than 10.0, evidence of hydrocarbon contamination, or presence of free chlorine residual.

If testing is ordered, the OWNER shall pay for the testing. If the testing indicates the water is contaminated and this occurred due to construction activities under the control of the CONTRACTOR, the CONTRACTOR shall reimburse the OWNER for all costs associated with the testing. The OWNER will be the sole judge of whether the flushing water is contaminated. Depending on the type of contamination, the flow shall be directed to the sanitary sewer system or otherwise disposed of as approved by the CONSTRUCTION MANGER.

B. Dewatering of Uncontaminated Groundwater: Water from dewatering activities during the construction of this project shall be directed to the storm drain system. The CONTRACTOR shall maintain siltation protection during disposal of water from dewatering activities. The CONTRACTOR shall be responsible for obtaining all necessary permits required for the dewatering activities.

C. Irrigation Water: Irrigation water shall be used for boundary landscaping and temporary stabilization seeding. The grading of the area shall be such that the irrigation water is directed to a retention pond or other storm drain system component. Irrigation of landscaped areas and berms shall be such that the irrigation water runoff does not permit washout of the topsoil.

D. Miscellaneous Washdown Water for Pavement: Washdown of structures and pavement shall occur in areas having no sign of contamination of hazardous substances, such as vehicle oil or fuel. Washdown water shall be directed to the storm drain system via proper grading of the site, particularly in the area of the washdown.

1.06 SPILL PREVENTION

A. Only materials used for this construction project shall be stored on-site. These materials shall be stored in quantities reasonable for use on this project.

B. Materials shall be stored in a neat and orderly fashion in their original containers. The materials shall be protected from the elements.

C. The handling and storage of all materials shall follow the Manufacturer's written instructions, the project Specifications, or applicable governmental codes; whichever is most stringent.

D. Construction material storage containers shall be disposed in a proper manner and, if possible, only after all the contents have been used.

E. The CONTRACTOR shall keep on-site all manufacturers' printed recommendations for the storage, handling, use, and disposal of construction materials.

F. The CONTRACTOR shall inspect the materials storage area on a daily basis to ensure that proper precautions are utilized for material storage.

G. The CONTRACTOR shall maintain an inventory of construction materials stored on-site. The inventory shall be kept on the site and be available for inspection by the CONSTRUCTION MANGER.

H. When transferring or unloading materials, the CONTRACTOR shall ensure that the area is protected from storm water and that the materials transfer operation shall not cause contamination to storm water due to runoff from the materials transfer location.

I. During adverse weather, as described in the General Conditions of the Contract Documents, and against the possibility thereof, the CONTRACTOR shall take all necessary precautions to ensure the protection of the construction materials storage area.

J. Hazardous Materials: The following additional precautions shall be followed for hazardous construction materials:

1. Hazardous materials shall be stored separately from non-hazardous material on-site.

2. Products shall remain in their original containers with the original legible product label attached to the container.

3. All products shall be used before disposal of the container.

4. Hazardous materials, including diesel fuel, must be stored in contained areas which are able to contain 150 percent of the volume of the largest container's contents. If the area is not exposed to storm water, the volume of the containment area shall be 110 percent of the volume of the largest container's contents. Each hazardous material shall be stored in its own containment area. Under no circumstances shall hazardous materials be used or stored within 100-feet of any water supply well, unless specifically permitted by the CONSTRUCTION MANGER and governing Federal, State, or local agency.

   At a minimum, the containment area shall be constructed with dikes and lined with a material resistant to the properties of the hazardous material being contained. Before removal of any storm water from the containment area, a representative sample of water shall be tested for contamination by the hazardous material stored in that containment area. For example, if the hazardous material is an acid, the pH of the rainwater shall be measured prior to disposal. Disposal of non-contaminated storm water shall be directed to the nearest storm drain system component. If the storm water is

found to be contaminated, the CONTRACTOR shall follow the spill control measures for this hazardous material.

5. The CONTRACTOR shall keep the Material Safety Data Sheets of all hazardous materials at the Site.

1.07 PRODUCT SPECIFIC PRACTICES

A. Petroleum-Based Products: All on-site vehicles shall be properly maintained and checked for any leaks of fluid or petroleum-based products. If a leak is found, the vehicle shall be repaired immediately or removed from the Site. Diesel fuel shall be considered a hazardous material and shall be stored in a containment area as indicated above.

B. Acid and Base Chemicals: All acid and base chemicals are considered hazardous materials and shall be stored in containment areas as described above. Disposal of acid or base chemicals shall, under no circumstances, occur via the storm drain system, but instead through proper hazardous materials disposal procedures.

C. Paints, Thinners and Solvents: Paints, thinners, and solvents shall be stored in their original containers. Unused paints, thinners, and solvents shall not be dumped on-site or disposed through the sanitary or storm sewer system. Disposal of unused paints, thinners, and solvents shall be through proper hazardous materials disposal procedures.

D. Fertilizers and Pesticides: Fertilizers and pesticides shall be applied at the minimum rate recommended by the manufacturer. Before spraying any pesticide, a certified pesticide applicator shall receive a permit for spraying of the pesticide in a well field. Storage of fertilizers shall be transferred to sealable containers to prevent spillage and exposure to storm water. Fertilizer shall be worked into the soil upon application in a landscaped area.

E. Concrete Trucks: The washdown of concrete trucks or the disposal of unused or unacceptable concrete from a concrete truck will be permitted on-site only if the CONTRACTOR has set aside a specific area, with dikes to prevent contact between excess concrete and washdown water or storm water. After the solids in the area have hardened, the CONTRACTOR shall dispose of the solids in a proper manner as approved by the CONSTRUCTION MANGER.

1.08 SPILL CONTROL PRACTICES

A. In addition to the precautionary practices described above, the following practices shall be followed for spill prevention, control, cleanup, and notification:

1. Any spills shall be cleaned up immediately.

2. The CONTRACTOR shall notify the CONSTRUCTION MANGER, OWNER, and all applicable governmental agencies if a spill occurs.

3. Manufacturer's printed instructions for the cleanup of a spill shall be kept on-site by the CONTRACTOR at all times. The CONTRACTOR's work crews and subcontractors shall be required to be familiar with the requirements and procedures for spill cleanup. Equipment necessary for spill cleanup, such as gloves, metal containers, mops, etc., shall be maintained on-site by the CONTRACTOR. The cleanup equipment shall be kept on-site by the CONTRACTOR during construction activities.

4. Workers involved in the cleanup of a spill shall be properly protected by protective suits, ventilation masks, goggles, and other necessary equipment, prior to contact with the spilled material.

5. The CONTRACTOR shall name an employee who will be on-site full-time throughout the duration of the project as the spill cleanup coordinator. The spill cleanup coordinator will be responsible for notifying the proper personnel and agencies of a spill and obtaining the proper equipment and personnel to clean up the spill. The name and phone number where the spill cleanup coordinator can be reached at all times shall be posted on the Site. The spill cleanup coordinator shall be properly trained in spill cleanup procedures.

6. The CONTRACTOR shall maintain Material Data Safety Sheets (MSDS) on-site for all hazardous materials. The spill cleanup coordinator shall have access to the MSDSs at all times during construction. The CONTRACTOR shall provide the CONSTRUCTION MANAGER with a copy of all MSDSs.

7. After a spill is contained and cleaned up, a spill occurrence report shall be completed by the on-site inspector.

PART 2--PRODUCTS

A. NOT USED

PART 3--EXECUTION

A. NOT USED

END OF SECTION

SECTION 01605

SHIPMENT, PROTECTION AND STORAGE

1.0 GENERAL

Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Construction Manager.

2.0 PIPE

Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

3.0 EQUIPMENT

A. PACKAGE AND MARKING:

All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.

Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.

B. IDENTIFICATION:

Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

C. SHIPPING:

Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.

Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.

D. FACTORY APPLIED COATINGS: NOT USED

E. STORAGE:

During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.

Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

F. PROTECTION OF EQUIPMENT AFTER INSTALLATION: NOT USED

END OF SECTION

SECTION 01710

FINAL CLEANUP

1.0 GENERAL

At the completion of work and immediately prior to final inspection, cleaning of the entire project shall be accomplished according to the following provisions:

1. The Contractor shall thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract. The cleaning shall leave the site in a complete and finished condition to the satisfaction of the Construction Manager.

2. All subcontractors shall similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their Contracts.

3. The Contractor shall remove all temporary structures and all debris, including all dirt, sand, gravel, rubbish and waste material.

4. Should the Contractor not remove rubbish or debris or not clean the site as specified, the Owner reserves the right to have the cleaning done at the expense of the Contractor.

2.0 SITE CLEANUP

For all roadway work, the Contractor shall conform the work to acceptable line and grade, as determined by the Construction Manager. Other surfaces of the grounds shall be rake cleaned. The Owner will not authorize final payment until the Contractor has removed all rubble and debris from the street and adjoining work areas, including all temporary storage and parking areas used by the Contractor.

All barricades, tools, rubbish collection receptacles and other such items shall be removed by the Contractor.

All remaining earthen stockpiles of excess excavated material shall be graded to provide gentle slopes to prevent erosion as directed by the Construction Manager.

END OF SECTION

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SECTION 01720

RECORD DRAWINGS

Record drawings refer to those documents maintained and annotated by the Contractor during construction and are defined as (1) a neatly and legibly marked set of contract drawings showing the final location of piping, equipment, electrical conduits, outlet boxes and cables; including X, Y, and Z coordinates for all fittings and valves after installation and before burial; (2) additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the specifications; and (3) Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Construction Manager during normal working hours at the Contractor's field office. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Construction Manager.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

Additions - Red
Deletions - Green
Comments - Blue
Dimensions - Graphite*

*Legibly mark to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

END OF SECTION

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SECTION 01730

OPERATING AND MAINTENANCE INFORMATION

1.0 SCOPE

Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.

2.0 TYPES OF INFORMATION REQUIRED

A. GENERAL:

O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.

B. OPERATING INSTRUCTIONS: NOT USED

C. PREVENTIVE MAINTENANCE:

The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

1. LUBRICATION DATA: Provide lubrication data, other than instructions for lubrication in accordance with paragraph 2.0-B6.

   a. A table showing recommended lubricants for specific temperature ranges and applications;

   b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

   c. A lubrication schedule showing service interval frequency.

2. PREVENTIVE MAINTENANCE PLAN AND SCHEDULE: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

D. CORRECTIVE MAINTENANCE:

Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.

1. TROUBLESHOOTING GUIDES AND DIAGNOSTIC TECHNIQUES: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

2. WIRING DIAGRAMS AND CONTROL DIAGRAMS: NOT USED

3. MAINTENANCE AND REPAIR PROCEDURES: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.

4. REMOVAL AND REPLACEMENT INSTRUCTIONS: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test and illustrations.

5. SPARE PARTS AND SUPPLY LISTS: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

6. CORRECTIVE MAINTENANCE MANHOURS: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

E. APPENDICES:

The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

1. PARTS IDENTIFICATION: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as use high-strength bolts and nuts. Identify parts by make, model, serial

number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

2. WARRANTY INFORMATION: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

3. PERSONNEL TRAINING REQUIREMENTS: NOT USED

4. TESTING EQUIPMENT AND SPECIAL TOOL INFORMATION: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

3.0 TRANSMITTAL PROCEDURE

Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01300 accompanied by Transmittal Form 01730-A and Equipment Record Forms 01730-B and/or 01730-C, as appropriate, all as specified in Section 01999. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.

Five (5) hard copies and five (5) electronic pdf (CD) copies of the specified O&M information shall be provided. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information. Binders shall be 3-ring, of uniform color (preferably white) with plastic view covers for cover page and spine inserts. The binders shall be sized adequately to accommodate the appropriate manual. The outside cover page insert and spine insert shall include the equipment location, project number, all applicable equipment ID numbers, description, supplier name and purchase agreement number. The inside cover page shall include all applicable equipment ID numbers, description, location, “Purchased From” (supplier name), “purchased by” (purchaser name), suppliers contact information, and purchase agreement number. All manuals shall also have a uniform tabbed Table of Contents.

If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

4.0 PAYMENT

Acceptable O&M information for the project must be delivered to the Construction Manager prior to the project being 65 percent complete. Progress payments for work in excess of 65 percent completion will not be made until the specified acceptable O&M information has been delivered to the Construction Manager.

5.0 FIELD CHANGES

Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the Contractor to reflect any field changes or information requiring field data.

END OF SECTION

SECTION 01800

ENVIRONMENTAL CONDITIONS

This section describes the environmental conditions which have been observed at the site of the work and which may reasonably be anticipated throughout the life of the project.

The Westwater Water Construction site is at elevation range of **6010 to 6170** feet above mean sea level. Climate conditions are described as follows:

Description	Range of Conditions
Winter	**3 to 61 (°F)**
Summer	**38 to 110 (°F)**
Relative humidity, percent	
Indoors	**40-60%**
Average outdoors	**40-60%**
Air temperature, degrees F	
Outdoors	**53.6 °F Annual Avg**
Indoors	**70 °F (Varies)**
Barometric pressure, inches, mercury	**29.99 Annual Avg**

Additional conditions which may be applicable are specified in other sections.

END OF SECTION

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SECTION 01999

REFERENCE FORMS

The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01300-A	Submittal Transmittal Form
01730-A	Operation and Maintenance Transmittal Form
01730-B	Equipment Record Form
01730-C	Equipment Record Form

SUBMITTAL TRANSMITTAL

Submittal Description: _____ Submittal No:[1] _____

Spec Section: _____

	Routing	Sent	Received
OWNER: Navajo Tribal Utility Authority (NTUA)	Contractor/CM		
PROJECT: Dilkon Pass Booster Pump Station and Pipeline	CM/Engineer		
	Engineer/CM		
CONTRACTOR:	CM/Contractor		

We are sending you ☐ Attached ☐ Under separate cover via _____

☐ Submittals for review and comment ☐ Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action[a]	Reviewer initials	Review comments attached

[a]**Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected** Attach additional sheets if necessary.

Contractor

Certify either A or B:

☐ A. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).

☐ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature

[1]See paragraph 01300-4.0 A, Transmittal Procedure.

01730-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date: _____ Submittal No:[2] _____

To: _____ Contract No: Contract 3

_____ Spec. Section: _____

_____ Submittal Description: _____

_____ From: _____

Attention: _____ _____

Checklist	Contractor		Construction manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks: _____

Contractor's Signature _____

[2]See paragraph 01300-4.0 A, Transmittal Procedure.

01730-B. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours
LUBRICANTS: RECOMMENDED:							
ALTERNATIVE:							
MISC. NOTES:							

RECOMMENDED SPARE PARTS			
PART NO	QUAN	PART NAME	COST

ELECTRICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	V	AMP	HZ
PH	RPM	SF	DUTY
CODE	INSL. CL	DES	TYPE
NEMA DES	C AMB	TEMP RISE	RATING
MISC.			
MECHANICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	RPM	CAP	SIZE
TDH	IMP SZ	BELT NO.	CFM
PSI	ASSY NO.	CASE NO.	
MISC			

01730-C. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours

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Navajo Nation
Westwater Water System Design
BC PROJECT NO.: 158815

WESTWATER WATER SYSTEM DESIGN

DIVISION 2

SITE CONSTRUCTION

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SECTION 02100

SITE PREPARATION

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies site preparation which consists of clearing, grubbing, demolition and salvage.

B. EXISTING CONDITIONS:

The CONTRACTOR shall determine the actual condition of the site as it affects this portion of work.

C. PROTECTION:

Site preparation shall not damage existing utilities to remain in service, structures, landscaping or vegetation adjacent to the site. The CONTRACTOR shall repair or replace any damaged property.

Demolition activities shall not damage utilities to remain in service, structures, landscaping or vegetation adjacent to the site. The Contractor shall repair or replace any property damaged by demolition activities.

D. DEFINITIONS

1. REMOVAL: Facilities to be removed shall be completely removed from the site as shown and specified in the Contract Documents. Disposal shall conform to applicable codes and procedures when hazardous or contaminated materials are removed and disposed of.

2. ABANDON: Facilities to be abandoned shall remain in place and be abandoned in accordance with procedures as shown and specified in the Contract Documents.

3. SALVAGE: Equipment and appurtenances to be salvaged shall be removed without damage and delivered to Owner as shown and specified in the Contract Documents.

PART 2--PRODUCTS

No products are included in this section.

PART 3--EXECUTION

3.01 CLEARING AND GRUBBING

Unless otherwise specified, the CONTRACTOR shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger than 6 inches in any dimension, broken or old concrete and pavement, debris, and structures where the completion of the work require their removal.

Material that is removed and is not to be incorporated in the work shall be properly disposed of off the site in accordance with local, state, and federal regulations.

3.02 DEMOLITION AND REMOVAL

A. STRUCTURES: NOT USED

B. PAVEMENT: NOT USED

C. SALVAGE:

The Owner has the right to salvage any items scheduled for removal. The CONTRACTOR shall notify the CONSTRUCTION MANAGER 15 days prior to any salvage or demolition work to determine the disposition of items to be removed. The CONSTRUCTION MANAGER will mark items to be salvaged. Such items shall be properly disconnected, removed from their foundations, cleaned, and stored at a location on site as directed by the CONSTRUCTION MANAGER.

3.03 UTILITY INTERFERENCE

Where existing utilities interfere with the prosecution of the work, the CONTRACTOR shall protect or relocate them.

END OF SECTION

SECTION 02160

HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 DESCRIPTION

A. SCOPE:

This Section specifies installation of product pipe by horizontal directional drilling (HDD) or directional boring.

The Contractor shall provide all services, equipment, material, and labor necessary for the complete and proper installation and testing of the product pipeline by directional drilling methods.

The Contractor shall be responsible for investigating existing soils and subsurface conditions to select appropriate equipment and methods. The Contractor shall include in the bid price the cost of any geotechnical borings along the pipe alignment which may be necessary to design and install the directionally drilled crossing. Geotechnical investigations have not been performed in the HDD alignment shown at the Center Street Westwater Creek crossing.

Work shall be completed in accordance with industry standards and in accordance with all local, state, and federal regulations. All applicable permits and applications must be in place prior to start of work.

B. REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. References shall be made to the latest edition of said standards unless otherwise called for.

Reference	Title
ASTM F1962	Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles
IHS	Standard Drawing No W-33

1.02 QUALITY ASSURANCE

A. QUALIFICATIONS

All directional drilling operations shall be performed by qualified directional drilling contractor who has at least five (5) years experience involving work of a similar nature. The contractor must have installed a minimum of 10,000 linear feet of pipe (6-inch diameter or greater) using directional drilling operations in the last five (5) years. The directional drilling contractor shall supply a list of project references, prior to job commencement.

The HDD field supervisor and HDD equipment operator shall have a minimum of 2 years experience in the operation of the equipment being used. The field supervisor shall be on-site at all times during the preparation and execution of the horizontal directional drilling operation.

B. CONTROL OF LINE AND GRADE

The Contractor shall use electronic guidance instrumentation to monitor and adjust the drill head. The guidance system shall provide data establishing the horizontal and vertical location of the drill head throughout the bore and provide readings at sufficient intervals to allow for slope and steering adjustment to maintain line and grade.

The Contractor shall maintain a daily drilling operation log and guidance system log. An as-built sketch of the finished pilot hole shall be furnished as part of the record drawings.

C. HORIZONTAL CONTROL

Survey work including location of existing utilities and geotechnical investigations, and control points for bore path determination, product pipe locating and tracking shall be provided by a surveyor licensed in the State of Utah.

1.03 SUBMITTALS

Submit the following prior to commencement of the Work:

A. Contractor’s Experience Record: Furnish document(s) supporting the directional drilling Contractor's qualifications and experience. Information provided shall be sufficient to demonstrate compliance with Section 1.02. A and include all personnel including backup personnel in the event that an individual is unavailable.

B. Material: Submit product data for HDD pipe, fittings, appurtenances, and other materials provided under this section.

C. Work Plan: Submit a work plan detailing the procedure and schedule for mobilization and setup, drilling, back reaming and pipe installation, demobilization and restoration. The plan shall include a description of all equipment and tools to be used, a list of all personnel, list of subcontractors, safety plan (including MSDS of

any potentially hazardous substances to be used), an environmental protection plan, and contingency plan.

The Work plan should be comprehensive demonstrating the thoughtful planning required to successfully complete the project and based on actual site and working conditions for the project.

D. Bore Plan: Submit a pilot bore plan showing grades, entry and exit angles, deflection and radiuses of the pilot bore, existing utilities with minimum vertical and horizontal clearances and cover over the installed pipe. Provide the location of the drill rig setups, the bore lengths, soil conditions along the path.

E. Design Calculations: Submit calculations demonstrating the provided pipe is adequate for the service and installation conditions. Maximum allowable safe loads on the pipe and the anticipated loads during installation along the proposed bore path shall be provided.

F. Drilling Equipment: Submit product data for directional drilling equipment to be used demonstrating the equipment is adequate to complete the project based on existing site conditions. Equipment list is to include but not be limited to: drilling rig, down-hole tools, guidance system, and rig safety systems. Include calibration records for guidance equipment.

G. Drilling Fluid (Mud) System: Submit product data for drilling fluid system materials and equipment to be used demonstrating adequacy for the existing site conditions. Submittal shall include but not be limited to: mud system, mud motors, drilling fluid properties including any product data and MSDS sheets for bentonite and additives. Submittal shall also identify disposal sites for drilling fluid, cuttings disposal and provide procedures for handling and disposal of cuttings and drilling fluid.

Submit the following Record information:

H. Submit geotechnical borings and soil analysis performed.

I. Submit Logs of HDD operations including daily logs, thrust, torque, pull back load or push back load, and slurry flow rate recorded at a minimum of every 20 feet of pipe length installed.

1.04 DESIGN REQUIREMENTS

Contract Drawings includes an approximate drill path with entry and exit locations. The Contractor shall review and modify the drill path shown based on the selected means and methods for HDD installation and results of any site investigations performed by the Contractor.

The Contractor's bore path plan shall be in accordance with accepted industry standards for performance of the Work and meet the minimum requirements as specified including minimum

cover and bending radius of the pipe. Contractor shall determine actual bore lengths and length of pipe needed for installation including any allowance for the pipe to recover and relax from installation loads and other conditions.

The Contractor shall determine the handling and installation loads for all phases of the work. Contractor shall include forces resulting from frictional resistance between the pipe and the borehole, frictional resistance from the pipe and the ground, forces from bends, hydrokinetic drag, resistance due to pipe stiffness, as well as other installation and handling loads as applicable. Contractor shall determine allowable loads for the pipe including the appropriate factor of safety for successful installation, however, the factor of safety shall not be less than 2.0 for the yield stress of the pipe material nor shall it exceed the recommended limits identified by the pipe manufacturer, whichever is more stringent.

Determine appropriate size of reamed borehole and drilling fluid required for the existing soils, ground water and site specific requirements, to reduce forces applied to the pipe during pull back and to prevent hydrofracturing of soil and loss of drilling fluid.

PART 2 – PRODUCTS

2.01.1 EQUIPMENT

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system.

All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2.02 PIPE

Product pipe shall be provided as shown on the contract drawings and suitable for installation by HDD.

A. High Density Polyethylene Pipe: HDPE Pipe shall be in accordance with Section 15065 with an outside diameter conforming to ductile iron pipe sizes (DIPS). Minimum thickness shall be as determined by the Contractor's calculations but not less than DR 11.
B. Steel Casing Pipe: NOT NEEDED.

2.03 DRILLING FLUID

Drilling fluid shall be a mixture of bentonite and water. Water shall be from a clean source with a pH of 8.5 to 10 and/or per the mixing requirements of the manufacturer.

Admixtures to improve the physical qualities of the mixture may be provided subject to acceptance by the Engineer. Admixtures shall be inert and non-toxic.

Drilling fluid viscosities shall be sufficient to suspend cuttings and maintain the integrity of bore wall based on the project soil and groundwater conditions.

2.04 GUIDANCE SYSTEM

The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced in its proper use. The system shall provide a continuous and accurate determination of the location of the drill head during the drilling operation and capable of tracking at the maximum depth required in the existing soil conditions. It shall enable the driller to guide the drill head by providing immediate information to the tool face, azimuth (horizontal direction), and inclination (vertical direction).

If a magnetic system is provided, the Contractor shall be responsible to identify any conditions creating magnetic anomalies such as but not limited to over-head power lines. The Contractor shall consider such influences in the selection and operation of the guidance system and shall use alternate methods to maintain the required slope and alignment as required.

2.05 PIPE ROLLERS

Pipe rollers shall be provided to fully support the weight of the pipe during hydrotesting and pull-back operations.

PART 3 – EXECUTION

3.01.1 GENERAL

The Contractor shall notify the Engineer 48 hours prior to commencing work.

Prior to the start of drilling, existing utilities in proximity to the bore path shall be identified and located horizontally and vertically. A minimum of 18-inches shall be maintained between outer edges of the water main and any other utility.

Excavation, backfill, and compaction of entry, exit, recovery pits, slurry sump pits or other excavations shall be in accordance with Section 02200, Earthwork.

3.02 PILOT HOLE

Pilot holes shall be drilled on the accepted bore path with no deviations greater than 2.5% of line or grade over a length of 100 feet. Minimum cover shall not be less than specified and line shall maintain a separation of 18-inch minimum from exiting utilities and ROW boundaries. If deviation outside the stated tolerance occurs, Contractors shall notify the Engineer and shall be required to pull-back and re-drill to correct the deviation at no additional cost to the Owner if so determined by the Engineer.

3.03 PREREAM AND PULLBACK

A swivel shall be installed between the molehead/reamer and pipe connection to minimize torsional stress imposed on the pipe and allow the reamer to turn without rotating the pipe.

Water shall be provided to ballast the pipe as it is pulled below grade. Water shall be metered into the front end of the pipe string and anchored in place as pipe is pulled.

The pullback shall be conducted in one continuous operation to limit the potential for binding of the pipe in the hole unless layout room is not sufficient for pipe stringing. All pipe pulled through the pilot holes shall have two (2) continuous tracer wires securely fixed to the pipe. Wire shall be #12 copper.

The leading edge of the pipe shall be examined for significant external damage after pull-back. If the pipe is deemed by the Engineer to have suffered significant damage, the damaged pipe shall be cut off and additional pipe pulled through the hole prior to the relaxation period.

Due to the elastic properties of the pipe, the pipe shall be relaxed for one overnight period to return to its original pre-pull length. The pipe shall be installed past the tie-in point, according to manufacturers' recommendations, to accommodate thermal as well as tensile forces in the pipe.

3.04 HANDLING OF DRILLING FLUIDS AND CUTTINGS

Provide adequate measures for handling and disposal of drilling fluid and cuttings. Piping, pumps, storage containers shall be water-tight and the Contractor shall take measures to guard against leakage of drilling fluid including use of drilling tools and procedures which will minimize the unintentional discharge of any drill fluids. Drilling fluid and cuttings shall not be discharged into any waterway, storm drain, sanitary sewer or other such conveyance, nor shall it be disposed of at the work site.

Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape. The Contractor shall stockpile haybales at the drilling site to contain an inadvertent bentonite slurry return. Any haybales used for containment of slurry shall be removed from the site and properly disposed of at the completion of the work.

Regulate the pressure of drilling fluid and conduct drilling operations in such a manner that minimizes potential for drilling fluid to migrate to the surface or collapse the provided pipe.

3.05 PIPE TESTING

All water pipe shall meet the testing requirements as described in Section 15065.

3.06 SITE RESTORATION

Following successful testing of the pipe, Contractor shall demobilize equipment and restore the site to original condition. All excavations shall be backfilled and compacted to a minimum of 90% density.

END OF SECTION

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SECTION 02200

EARTHWORK

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies earthwork which consists of excavation, filling, grading, and disposal of excess material.

B. DEFINITIONS:

1. COMPACTION: The degree of compaction is specified as percent compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content.

2. EXCAVATION SLOPE: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.

3. EMBANKMENT SLOPE: Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.

4. EMBEDMENT ZONE: Embedment zone shall be defined as the area from the trench bottom to a level at least 12-inches over the top of the pipe including bedding, haunching and initial backfill.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents

shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in. (457-mm) Drop
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. TESTS:

The CONTRACTOR will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The CONTRACTOR shall remove surface material at locations designated by the CONSTRUCTION MANAGER and provide such assistance as necessary for sampling and testing. The CONSTRUCTION MANAGER may direct the CONTRACTOR to construct inspection trenches in compacted or consolidated backfill to determine that the CONTRACTOR has complied with these specifications.

Tests will be made by the CONTRACTOR in accordance with the following:

Test	Standard Procedure
Moisture content	ASTM D6938
Gradation	ASTM C136
Density in-place	ASTM D1556 or D6938
Moisture-density relationships	ASTM D1557

The CONTRACTOR shall provide safe access to the trench or excavation for the inspection and compaction testing. This shall include providing all safety equipment and temporary shoring to enable inspection of the trench foundation and compaction testing at multiple levels in the trench.

1.03 SUBMITTALS

Samples of fill materials to be used shall be submitted 2 weeks in advance of use. Samples shall consist of 0.5 cubic feet of each type of material.

PART 2--MATERIALS

2.01 FILL MATERIALS

A. TYPE A:

Type A material (3/4-inch Minus) shall be a clean gravel-sand mixture free from organic matter and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
3/8 inch	70-100
No. 4	40-99
No. 10	35-95
No. 20	20-80
No. 40	0-55
No. 100	0-2

B. TYPE B:

Type B material (3-inch Minus) shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3 inch	100
3/4 inch	70-100
No. 4	40-100
No. 200	15-50

The coefficient of uniformity shall be 3 or greater.

The plasticity index of the material, as determined in accordance with ASTM D4318, shall not exceed 10.

The material may be an imported quarry waste, clean natural sand or gravel, select trench excavation or a mixture thereof.

C. TYPE C:

Type C material shall be unclassified silty sand material which is free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 3 inches. The material shall have a maximum of 65% passing #4 sieve and maximum of 20% passing #200 sieve. If the native material excavated from the site meets these requirements, it may be segregated from non-conforming material and classified as Type C.

D. TYPE D:

Type D material shall be granular base material and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1 inch	100
3/4 inch	85-100
No. 4	45-95
No. 200	0-8

The granular base shall have a plasticity index of no greater than 3 when tested in accordance with ASTM D4318.

The coarse aggregate shall have a percent of wear, when subjected to the Los Angeles abrasion test (ASTM C131) of no greater than 50.

E. TYPE E:

Type E material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	100
3/4 inch	30-75

U.S. standard sieve size	Percent by weight passing
1/2 inch	15-55
1/4 inch	0-5

Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65

F. TYPE F:

Type F material shall be crushed rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	87-100
3/4 inch	45-90
No. 4	20-50
No. 30	6-29
No. 200	0-12

Type F material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

G. TYPE G:

Type G material shall be Class l crushed stone (manufactured angular, crushed stone, crushed rock, or crushed slag), commonly known as chips and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
No. 4	30-50
No. 200	0-5

The material shall have a minimum sand equivalent value of 75.

H. TYPE H:

Type H material shall be 6-inch crushed/angular riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
10 pounds	100
5 pounds	80-100
2 pounds	45-80
1 pound	15-45
1/2 pound	5-15
Below 1/2 pound	0-5

Specific gravity shall be between 2.5 and 2.82.

I. TYPE I:

Type I material shall be 12-inch riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
160 pounds	100
100 pounds	80-100
50 pounds	45-80
20 pounds	15-45
5 pounds	5-15
1 pound	0-5

Specific gravity shall be between 2.5 and 2.82.

J. TYPE J:

Type J material shall be unclassified material and may be obtained from excavation on site. The material may contain extraneous material such as demolition waste, unsuitable material excavated from beneath structures, and clearing and grubbing debris up to 50 percent by volume. Extraneous material shall be thoroughly mixed, and the maximum size of organic particles shall be 6 inches.

K. TYPE K

Native material, segregated from non-conforming material, may be used for bedding and backfill outside roadway and public right of ways or easements. The material shall be granular, free from peat, wood, roots, bark, clay lumps, debris, garbage, rubbish or other material as defined by the Construction Manager. All materials used as final backfill shall pass a 3-inch sieve. Materials used for select backfill or bedding shall meet the following gradation requirements:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
No. 4	40-90
No. 200	30 or less

The plasticity index of the material, as determined in accordance with ASTM D4318, shall not exceed 10. Native soils including high plasticity clay soils, sandy clay and clayey sand soils shall not be used as bedding or backfill.

The Contractor shall furnish sieve analyses per ASTM C 136, plasticity indexes PI - per ASTM D 4318 and baseline maximum density tests, Modified Proctor per ASTM D 1557, for conditioned native material. Acceptance by the Construction Manager of the tests shall be required prior to using these materials. All costs for testing shall be paid for by the Contractor. Native materials shall be tested once per 400 feet of trench or as directed by the Construction Manager. In all cases, soil samples for testing shall be taken in the presence of the Construction Manager.

The Contractor will be solely responsible to demonstrate compliance and where native materials do not meet the requirements, shall provide imported bedding and backfill per the line item unit price in the contract schedule of materials.

PART 3--EXECUTION

3.01 GENERAL

A. CONTROL OF WATER:

The CONTRACTOR shall keep excavations reasonably free from water during construction. The static water level shall be drawn down a minimum of 1 foot below the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance.

The CONTRACTOR shall have on hand pumping equipment and machinery in good working condition for emergencies and shall have workmen available for its operation. Dewatering systems shall operate continuously until backfill has been completed to 1 foot above the normal static groundwater level.

Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions. Dewatering systems shall not remove natural soils. The CONTRACTOR shall control surface runoff to prevent entry or collection of water in excavations.

Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.

The CONTRACTOR shall incorporate the use of temporary detention ponds, rock checks or rock socks to allow settlement or filtering of silt carried by the water before entering storm drains or natural waterways. Straw bales are not acceptable for this purpose.

If a National Pollutant Discharge Elimination System (NPDES) permit is required for disposal of water from construction dewatering activities, it shall be obtained by the CONTRACTOR prior to any dewatering activities.

B. OVEREXCAVATION:

The CONTRACTOR shall take care to avoid excavation below the depths indicated. However, where the undisturbed condition of natural soils is inadequate for support of the planned construction, the CONSTRUCTION MANAGER may direct the CONTRACTOR to overexcavate and install additional bedding material.

The quantity of overexcavation and placement of additional bedding material will be paid for on a unit price basis per cubic yard of overexcavation and additional material installed. The unit price shall include all costs associated with the overexcavation and installation of the additional material including but not limited to: bedding material, geotextile material, installation, and all testing.

C. SURPLUS MATERIAL:

Unless otherwise specified, surplus excavated material shall be disposed of off site in accordance with applicable ordinances and environmental requirements.

If the quantity of surplus material is specified, the quantity specified is approximate. The CONTRACTOR shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the CONTRACTOR, shall be replaced by the CONTRACTOR.

Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure except for those areas designated to be preconsolidated. For these areas, the depth of stockpiled material shall be as specified. The CONTRACTOR shall maintain stability of the soil adjacent to any excavation.

D. BORROW MATERIAL:

If the quantity of acceptable material from excavation is not sufficient to construct the embankments or trench backfill required by the work, the quantity of material needed to

complete the embankments or trench backfill shall consist of imported borrow conforming to specified requirements.

E. HAULING:

When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

F. HAUL ROADS:

The CONTRACTOR shall construct haul roads required to transport materials on site. Alignment of haul roads shall be selected to avoid interference with plant operations. Haul roads must stay within the designated limit of disturbance as shown in the drawings. Haul roads shall be removed after completion of construction.

G. FINISH GRADING:

Finished surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.

Finished grade shall be as specified plus or minus 0.10 foot except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness of topsoil can be applied to attain the finished grade.

When the work is an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.

If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than 2-1/2 inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

H. CONTROL OF EROSION:

The CONTRACTOR shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the CONTRACTOR shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

I. STABILIZATION:

Instead of or in addition to overexcavation and additional material as described in 02200-3.01B, the CONSTRUCTION MANAGER may direct the CONTRACTOR to stabilize the subgrade by pressing large riprap into the soft unstable subgrade to support the compaction of bedding, initial backfill and subsequent backfill. The quantity and placement of

stabilization material will be paid for on a unit price basis per cubic yard of stabilization material installed. The unit price shall include all costs associated with the installation of the stabilization material including but not limited to: stabilization material, installation, and all testing.

3.02 CLASSIFICATION OF FILL

Fill material shall be placed in horizontal layers and compacted with power-operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A. Unless otherwise specified, fill classes shall be used where specified in Table A under general application.

Table A, Fill Classifications

Fill class	Material type	Maximum uncompressed layer depth, inches	Minimum compaction, percent	General application
A1	A	6	95	Subsequent, near-surface pipeline backfill under gravel roadways, roadway shoulders, roadway embankments and public Right-of-Ways or easements; pipeline bedding; initial utility pipeline backfill per trench detail in project drawings
NOT REQD	A	48	95	NOT REQUIRED
B1	B	8	95	Subsequent pipeline backfill; compaction as specified
B2	B	8	90	NOT REQUIRED
C1	C	8	90-95	Subsequent pipeline backfill; compaction as specified
C2	C	8	90	NOT REQUIRED
D1	D	8	95	NOT REQURED
E1[a,b]	E	8	95[b]	Backfill for overexcavated zone; Requires layer of non-woven filter fabric between Type E and any other material containing fines (including native)
F1	F	12	95	Lower 6” of road base for gravel road section.
NOT REQD	G	8	95	NOT REQUIRED
NOT REQD	H	-	-	NOT REQUIRED
H2[d]	H	-	-	Trench or Excavation bottom soil stabilization.
NOT REQD	I	-	-	NOT REQUIRED

Fill class	Material type	Maximum uncompressed layer depth, inches	Minimum compaction, percent	General application
NOT REQUIRED	J	8	90	NOT REQUIRED
K1	K	6	90	Subsequent, near-surface pipeline backfill nonpaved areas outside roadway and public Right-of-Ways or easements; per Typical Trench Detail; compaction as specified
K2	K	6	95	Pipeline bedding; initial utility pipeline backfill; per trench detail in project drawings; compaction as specified

[a]Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the fill. Dry density compaction shown is per ASTM D1557. Use 70% of ASTM D4253 maximum relative density, as applicable, based on the soil used for fill.
[b]NOT USED.
[c]NOT USED.
[d]Riprap to be pressed into unstable trench bottom soil until trench bottom will support placement and compaction requirements for backfill.
[e]Asphalt and concrete slabs from demolition may be placed at the bottom of the fill side by side to form a continuous pad. Clearing and grubbing is not required unless shrubs are taller than 3 feet. Mucking of the subgrade and keying or benching of adjoining embankments is not required.

3.03 EARTHWORK FOR STRUCTURES

A. STRUCTURE EXCAVATION: NOT USED

B. FOUNDATION TREATMENT: NOT USED

C. STRUCTURE BACKFILL: NOT USED

3.04 EARTHWORK FOR PIPELINES AND CONDUITS

A. GENERAL:

Earthwork for pipelines and conduits is specified in paragraph 02200-3.02, Table A; in the standard details; and in the following paragraphs.

B. PIPELINE EXCAVATION:

Unless otherwise specified, shown on the drawings, or approved by the CONSTRUCTION MANAGER, pipelines shall have a minimum 48-inch depth of cover and maximum 72-inch depth of cover. The top 12 inches of soil shall be removed and stored in such a manner that it will not become mixed with unsatisfactory soils. Excavate the trench to line and grade with allowance for pipe thickness, sheeting and shoring, pipe bedding and over-excavation.

The CONTRACTOR shall be responsible to deflect joints and/or provide shop-fabricated fittings as required to achieve the vertical and horizontal alignment. The provided alignment shall not include isolated high or low points requiring an air release valve or flush valve that is not shown on the drawings but required for the proper operation and maintenance of the pressure pipeline as determined by the CONSTRUCTION MANAGER. Where the CONSTRUCTION MANAGER determines the Contractor's alignment has created a high or low point, the Contractor shall provide air release or flush valves in accordance with the Standard Details at no additional cost to the OWNER.

The allowable joint deflection shall not exceed 50% of the manufacturer's written maximum recommendation unless otherwise specified. When gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. CONTRACTOR shall provide a wider trench as required for this purpose at no additional cost to the OWNER. Longitudinal bending of the pipe shall not be allowed.

In the event obstructions are encountered which require exceptions to the allowable depth of cover, the CONSTRUCTION MANAGER shall have the authority to change the plans and order the necessary deviation from the line and grade.

Remove hard spots that would prevent a uniform thickness of bedding or result in concentrated loads on the pipe. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade with specified bedding materials or in accordance with over-excavation requirements where unsuitable material is encountered.

Prior to placement of bedding, the exposed subgrade at the base of the trench excavation shall be examined to detect soft, loose, or unstable areas. Loose materials in the trench bottoms resulting from excavation disturbance should be removed until firm material is encountered. If soft or unstable areas are encountered, these areas should be overexcavated to a minimum depth of 24 inches below the pipe or to firm material and replaced with suitable bedding material.

Where clay soils are encountered at the bottom of cut surfaces, the clay surface shall be scarified and mixed to a minimum depth of 12 inches and watered as necessary to bring the upper foot of soil to between 1 and 3 percent above the optimum moisture content and compacted to between 95 and 98 percent of maximum dry density.

C. PIPELINE EMBEDDMENT ZONE:

Bedding and backfill material in the embedment zone shall be as specified and as shown on the project trench detail.

1. BEDDING: The CONTRACTOR shall not proceed with bedding placement in excavated areas until the subgrade has been inspected by the CONSTRUCTION MANAGER.

All pipe shall have a minimum thickness of 6 inches of bedding material below the barrel of the pipe to provide uniform and adequate longitudinal support under the pipe as specified. Bedding material shall be placed in the bottom of the trench, leveled and compacted.

Bell holes shall be excavated to provide a minimum clearance of 2-inches below the coupling or bell at each pipe joint and to permit proper inspection of the joint. Imported Type A or conditioned Type K bedding material shall be placed at bell holes and beneath the pipe as required to provide uniform and adequate longitudinal support.

2. HAUNCHING: After pipe has been properly bedded and laid to alignment and grade, additional bedding material shall be placed in layers the full width of the trench and compacted. CONTRACTOR shall place and compact haunching, defined as the area between the top of bedding to the springline of the pipe, simultaneously on both sides of the pipe, keeping the level of material the same on each side.

   Haunching shall be carefully placed in 6" lifts and hand compacted around the pipe to ensure that the pipe barrel is completely supported with no voids or uncompacted areas and adequate side support to the pipe is provided without either vertical or lateral displacement of the pipe from proper alignment.

3. INITIAL BACKFILL: After placement of haunching material, CONTRACTOR shall place, and compact initial backfill from the springline to at least 12-inches above the top of the pipe.

   Initial backfill shall be placed and compacted in lifts not to exceed 6-inches in loose measure. Placement and compaction shall be performed in such a manner as to avoid damage or disturbance of the haunching material or pipe.

   Moisture content of trench backfill at the time of compaction shall be within 2 percent of optimum moisture content.

4. FINAL OR SUBSEQUENT BACKFILL:

   Backfill material, placement and compaction above the pipe zone shall be as specified. Backfill above the pipe zone shall not commence until pipe zone backfill has been inspected and accepted by the CONSTRUCTION MANAGER.

   a. IMPROVED AREAS: Unless otherwise specified, select granular backfill (Class A) shall be used under all paved and unpaved roadways and paved and unpaved roadway shoulders, roadway embankments, and in all public right-of-ways and easements. The

trench shall be backfilled to an elevation which will permit the placement of the specified surface and paving as specified. Roadway surface shall be restored, including compaction, to the condition existing prior to construction including restoration of yard areas.

b. UNIMPROVED AREAS: Class C1or Class K backfill shall be used for all trenches in pastureland, cultivated land, undeveloped land, and for other unimproved areas where specified. Class C1 backfill shall not be used in any public right-of- way or under roadways. Excavated trench material that meets the requirements of Type C material may be used. The CONTRACTOR shall maximize the use of fine-grained materials (e.g., sand, silty sand, sandy silt) as Class C1 backfill.

The trench above the pipe zone shall be backfilled to within 12 inches of original ground surface. Moisture content of trench backfill at the time of compaction shall be within 2 percent of optimum moisture content.

After the trench has been backfilled, the stored topsoil shall be replaced at a uniform depth in its original area compacted to its original condition. The CONTRACTOR shall leave the backfilled trench neatly mounded not more than 6 inches above existing grade for the full width of the backfill area.

The CONTRACTOR will be required to perform the work so that trenches will remain open for the minimum time required to accomplish the work. Do not begin trench excavation until appropriate compaction equipment is at the excavation site. During non-working hours, open trenches shall be completely covered or fenced to prevent access.

3.05 EARTHWORK FOR EMBANKMENTS: NOT USED

3.06 SUBGRADE FOR PAVEMENT: NOT USED

3.07 SITE FILL: NOT USED

END OF SECTION

SECTION 02270

EROSION CONTROL (VEGETATIVE)

PART 1- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide erosion protection including fertilizing, seeding, and mulching for all disturbed areas.

B. The CONTRACTOR shall provide biodegradable erosion control blanket on all slopes greater the 4H:1V.

1.02 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01300 - Submittals.

B. Product Data: Manufacturer's catalog sheets and sample of erosion control fabrics.

PART 2- PRODUCTS

2.01 MATERIALS

A. Fertilizer: Fertilizer shall be a commercial, chemical type, uniform in composition, free- flowing, conforming to state and federal laws and suitable for application with equipment designed for that purpose. Fertilizer shall have a guaranteed analysis showing not less than 11 percent nitrogen, 8 percent available phosphoric acid, and 4 percent water soluble potash.

B. Seed: Seed shall be delivered in original unopened packages bearing an analysis of the contents. Seed shall be guaranteed 95 percent pure with a minimum germination rate of 80 percent. Seed mix shall be native vegetation consisting of 3 lb – Crested Wheatgrass, 1 lb – Pubescent Wheatgrass, 2 lb – Indian Ricegrass, 3 lb – Western Wheatgrass, and 2 lb – 4-wing Salt bush.

C. Mulch: Mulch shall be a fibrous, wood cellulose product produced for this purpose. It shall be dyed green and shall contain no growth or germination inhibiting substances and shall be manufactured so that when thoroughly mixed with seed, fertilizer, and water, in the proportions indicated it will form a homogenous slurry which is capable of being sprayed. The mulch shall be Sliva Fiber as manufactured by Weyerhaeuser Company; Conwood Fiber as manufactured by Consolidated Wood Conversion Corp.; or equal.

D. Erosion Control Fabric

1. Materials: North American Green, S75 Temporary Erosion Control Blanket, or equal.

2. Anchorage Devices: Six-inch, 11-gauge staples from the manufacturer or staples of the proper length as recommended by the manufacturer for specific soil condition.

E. Manufacturers, or Equal

1. North American Green

2. Mirafi (Ten Cate)

3. Maccaferri

PART 3- EXECUTION

3.01 GENERAL

A. Weather Conditions: Fertilizing, seeding, or mulching operations will not be permitted when wind velocities exceed 15 miles per hour or when the ground is frozen, unduly wet, or otherwise not in a tillable condition.

B. Soil Preparation: The ground to be seeded shall be graded in conformance with the Drawings and shall be loose and reasonably free of large rocks, roots, and other material which will interfere with the work.

C. Method of Application: Fertilizer, seed, and mulch may be applied separately (Dry Method), or they may be mixed together with water and the homogeneous slurry applied by spraying (Hydraulic Method), except that all slopes steeper than 3H:1V shall be stabilized by the Hydraulic Method.

3.02 DRY METHOD

A. Fertilizing: The fertilizer shall be spread uniformly at the rate of 800 lb per acre (approximately 1 lb per 55 square feet). The fertilizer shall be raked in and thoroughly mixed with the soil to a depth of approximately 2-inches prior to the application of seed or mulch.

B. Seeding: The seed shall be broadcast uniformly at the rate of 16.5 lb per acre. After the seed has been distributed it shall be incorporated into the soil by raking or by other approved methods.

C. Mulch Application: Mulch shall be applied at the rate of 1,500 lb (air dried weight) per acre.

3.03 HYDRAULIC METHOD

A. The hydraulic method consists of the uniform application by spraying of a homogeneous mixture of water, seed, fertilizer, and mulch. The slurry shall be prepared by mixing the ingredients in the same proportions as indicated above. The slurry shall have the proper consistency to adhere to the earth slopes without lumping or running. Mixing time of materials shall not exceed 45 minutes from the time the seeds come into contact with the water in the mixer to the complete discharge of the slurry onto the slopes, otherwise the batch shall be recharged with seed. The mixture shall be applied using equipment containing a tank having a built-in, continuous agitation and recirculation system, and a discharge system which will allow application of the slurry to the slopes at a continuous and uniform rate. The application rates of the ingredients shall be the same as those specified for the Dry Method. The nozzle shall produce a spray that does not concentrate the slurry nor erode the soil.

3.04 EROSION CONTROL BLANKET

A. Placement

1. Biodegradable erosion control blanket shall be used on all slopes 4H:1V and steeper.

2. The erosion control shall be spread only on prepared, fertilized and seeded surfaces.

3. On all slopes, the erosion control blanket shall be laid up-and-down the slope in the direction of water flow.

4. Waste of erosion control material shall be minimized by limiting overlaps as specified and by utilizing the full length of the netting at roll ends.

B. Anchorage

1. Ends and sides of adjoining pieces of material shall be overlapped 6-inches and 4- inches respectively, and stapled. Six anchors shall be installed across ends. A common row of staples shall be used at side joints. Staple through both blankets, placing staples approximately 6-inches apart.

2. The top edge of the erosion control blanket shall be anchored in a 6-inch deep by 6- inch wide trench. Backfill and compact trench after stapling.

3. Anchorage shall be by means of 9-inch long, 2-legged staples driven vertically and full-length into the ground. The legs shall be spread 3-inches to 4-inches apart at the ground to improve resistance to pull-out. In loose soils the use of 18-inch metal washer pins may be required to properly anchor the blankets.

4. All slopes which are 3:1 or greater shall be stapled with 2 staples per square yard in a triangular pattern. Staples shall be installed per the manufacturer's recommended staple pattern guide.

5. The erosion control blanket shall not be stretched but should be laid loosely over the ground to avoid pulling the blanket downslope.

6. The erosion control blanket shall not be rolled out •onto ground containing frost within the 9-inch penetration zone of the anchorage staples. Further, no stapling shall be undertaken while any frost exists within the staple penetration zone.

3.05 WATERING

A. Upon completion of the erosion control seeding, water shall be applied as specified by the seed manufacture to meet germination requirements.

3.06 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. The CONTRACTOR shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary, and sufficient watering to maintain the plant materials in a healthy condition. The ENGINEER may require replanting of any areas in which the establishment of the vegetative ground cover does not appear to be developing satisfactorily.

END OF SECTION

Navajo Nation
Westwater Water System Design
BC PROJECT NO.: 158815

WESTWATER WATER SYSTEM DESIGN

DIVISION 15

MECHANICAL

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SECTION 15050

PIPING SYSTEMS

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies systems of process piping and general requirements for piping systems. Detailed specifications for the components listed on the Piping System Specification Sheets are found in other sections of Division 15. This section shall be used in conjunction with those sections.

B. DEFINITIONS:

Pressure terms used in Section 15050 and elsewhere in Division 15 are defined as follows:

1. Maximum: The greatest continuous pressure at which the piping system operates.

2. Test: The hydrostatic pressure used to determine system acceptance.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AASHTO M36/M36M	Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
ANSI A13.1	Scheme for the Identification of Piping Systems
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.3	Malleable Iron Threaded Fittings Class 150 and 300
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ANSI B16.11	Forged Steel Fittings, Socket Welding and Threaded
ANSI B16.12	Cast Iron Threaded Drainage Fittings
ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ANSI B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
ANSI B31.1	Power Piping
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Qualifications
ASTM A47	Malleable Iron Castings
ASTM A53	Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	Forgings, Carbon Steel, for Piping Components
ASTM A106	Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A197	Cupola Malleable Iron
ASTM A234/A234M	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A312/A312M	Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A403/A403M	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A536	Ductile Iron Castings
ASTM A570/A570M	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
ASTM B88	Seamless Copper Water Tube

Reference	Title
ASTM C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C443-REV A	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3261	Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
AWWA C105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
AWWA C111	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C153	Ductile-Iron Compact Fittings, 3 Inches through 12 Inches, for Water and Other Liquids
AWWA C200	Steel Water Pipe 6 Inches and Larger
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe--4 In. and Larger--Shop Applied
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services--Sizes 4 In. through 144 In.

Reference	Title
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipe
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C651	Disinfecting Water Mains
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water
AWWA C901	Polyetheylene (PE) Pressure Pipe and Tubing, ¾ In. (19 mm) Through 3 In. (76 mm), for Water Services
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks
AWWA M11	Steel Pipe--A Guide for Design and Installation
CISPI 301	Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings
FEDSPEC L-C-530B(1)	Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
MIL-H-13528B	Hydrochloric Acid, Inhibited, Rust Removing
MIL-STD-810C	Environmental Test Methods
SAE J1227	Assessing Cleanliness of Hydraulic Fluid Power Components and Systems
UPC	Uniform Plumbing Code
NTUA	Navajo Area Standards & Construction Requirements

B. FITTINGS AND COUPLING COMPATIBILITY:

To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturers.

1.03 SUBMITTALS

Submittals and product data for all piping materials shall be provided in accordance with Section 01300.

Piping layout drawings for all piping (including encased and above ground piping) shall be transmitted to the CONSTRUCTION MANAGER a minimum of 2 weeks prior to construction. Drawings shall be original layouts by the CONTRACTOR; photocopies of contract drawings are not acceptable.

1.04 TEMPORARY ABOVEGROUND POTABLE WATER PIPE (HIGH LINE)

High line piping shall be provided where water service is to be maintained and as required by the CONSTRUCTION MANAGER. High line piping and appurtenances shall be furnished, installed, disinfected, connected, maintained, and removed by the CONTRACTOR. Bacteriological sampling and testing shall be performed by a certified testing laboratory approved by the Owner. The Contractor shall coordinate highlining activities with the Construction Manager.

PART 2--PRODUCTS

2.01 PIPING MATERIALS

Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the piping system specification sheets. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenance specified in other sections of Division 15.

2.02 PIPING IDENTIFICATION

A. PLASTIC CODING MARKERS:

Plastic markers for coding pipe shall conform to ANSI A13.1 and shall be as manufactured by W. H. Brady Company, Seton Name Plate Corporation, Marking Services Inc., or equal. Markers shall be the mechanically attached type that are easily removable; they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C. Markers shall withstand a continuous operating temperature range of -40 degrees F to 180 degrees F. Plastic coding markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic.

Markers bearing the legends on the background colors specified in the PIPESPEC shall be provided in the following letter heights:

Outside pipe diameter,[a] inches	Letter height, inches
Less than 1-1/2	1/2
1-1/2 through 3	1-1/8
Greater than 3	2-1/4

[a] Outside pipe diameter shall include insulation and jacketing.

In addition, pipe markers shall include uni- and bi-directional arrows in the same sizes as the legend. Legends and arrows shall be white on blue or red backgrounds and black on other specified backgrounds.

B. MAGNETIC TAPE:

Polyethylene magnetic tape shall be as manufactured by Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal. Tape shall be acid and alkali-resistant, 3 inches wide, 0.005 inch thick, and have 1500 psi strength and 140 percent elongation value. The tape shall be colored the same as the background colors as specified in paragraph 15050-3.06 and shall be inscribed with the word "CAUTION--PIPE BURIED BELOW" and the name of the piping system.

2.03 VALVES

Valves of the same size and service shall be provided by a single valve manufacturer. Packing shall be nonasbestos material. Actual length of valves shall be within 1/16 inch (plus or minus) of the manufacturer's specified length. Flanges shall meet the requirement of ANSI B16.5. Push-on and mechanical joints shall meet the requirements of AWWA C111.

PART 3--EXECUTION

3.01 INSTALLATION

A. LOCATION:

Piping shall be provided as specified.

B. PIPING SIZES:

Where the size of piping is not specified, the CONTRACTOR shall provide piping of the sizes required by UPC. Unless specified otherwise, small piping (less than 1 inch in diameter) required for services not described by UPC shall be 1/2 inch.

C. PIPE SUPPORT, ANCHORAGE AND SEISMIC BRACING: NOT USED

D. ANCHORAGE FOR BURIED PIPING:

All plugs, caps, tees and bends in buried pressure piping systems shall be anchored by means of reaction backing or restrained joints as specified.

E. BEDDING AND BACKFILL:

Bedding and backfill for buried piping shall be as specified in Section 02200 (Earthwork).

F. EQUIPMENT CONNECTION FITTINGS

Where shown, equipment connection fittings as specified in Section 15085 shall be provided between field piping systems and equipment inlet and outlet connections.

G. FLEXIBILITY

Pipe couplings or flexible joints shall be provided as specified.

Unless otherwise specified, piping passing from concrete to earth shall be provided with two pipe couplings or flexible joints as specified in Section 15085.

3.02 PIPING IDENTIFICATION

A. PIPE CODING:

After application of the specified coating and insulation systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with plastic markers as specified in paragraph 15050-2.02 A. Legend markers and directional arrows shall be located at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, and at approximately 50-foot centers.

B. MAGNETIC TAPE:

Polyethylene magnetic tape shall be buried 12 to 18 inches below ground and shall be above and parallel to buried nonferrous, plastic and reinforced thermosetting resin pipelines. For pipelines buried 8 feet or greater below final grade, the CONTRACTOR shall provide a second line of tape 2.5 feet above and parallel to the buried pipe.

3.03 VALVE IDENTIFICATION: NOT USED

3.04 TESTING

A. GENERAL:

Upon completion of piping the CONTRACTOR shall test the piping systems. Pressures, media and test durations shall be as specified in AWWA C605 and paragraph 3.06 15050.

Equipment which may be damaged by the specified test conditions shall be as specified Testing shall be performed using calibrated test gages and calibrated volumetric measuring equipment to determine leakage rates. Each test gage shall be selected so that the specified test pressure falls within the upper half of the gage's range. Unless otherwise specified, the CONTRACTOR shall notify the CONSTRUCTION MANAGER 24 hours prior to each test.

Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new pipe systems. Existing pipe shall be tested to the nearest existing valve. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.

B. GAS, AIR, AND VAPOR SYSTEMS: (NOT USED)

C. LIQUID SYSTEMS: (NOT USED)

D. CHLORINE SYSTEMS: (NOT USED)

E. HYDRAULIC AND LUBE OIL SYSTEMS: (NOT USED)

F. DRAINS: (NOT USED)

F. GRAVITY SEWER LINES: NOT USED

3.05 CLEANING AND FLUSHING

A. GENERAL:

Piping systems shall be cleaned following completion of testing. The CONTRACTOR may, at their option, clean and test sections of buried or exposed piping systems. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab.

B. TEMPORARY SCREENS: NOT USED

C. GAS AND AIR SYSTEMS: NOT USED

D. LIQUID SYSTEMS: NOT USED

E. CHLORINE SYSTEMS: NOT USED

F. STEAM SYSTEMS: NOT USED

G. HYDRAULIC AND FLUID POWER OIL SYSTEMS: NOT USED

H. POTABLE WATER SYSTEMS:

Potable water piping systems shall be flushed, tested and disinfected in accordance with AWWA and NTUA requirements. Furnish test equipment, chemicals for chlorination, temporary valves, bulkheads and other water equipment control equipment and materials required.

Indiscriminate onsite disposal or discharge of chlorinated water to sewer systems, storm drains, drainage courses or surface waters is prohibited.

Pipes, fittings, valves and all other components incorporated into tie-ins and connections with the existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the CONSTRUCTION MANAGER. Disinfection by this method is generally limited to assemblies of 20' or less in length. Alternate methods such as "predisinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the CONSTRUCTION MANAGER.

3.06 PIPING SPECIFICATION SHEETS (PIPESPEC)

Piping and valves for groupings of similar plant processes or types of service lines are specified on individual piping specification sheets (PIPESPECS). Piping services are grouped according to the chemical and physical properties of the fluid conveyed and/or by the temperature or pressure requirements. Each grouping of services (PIPESPEC) is identified by a piping system number. Piping services specified in the PIPESPECS are designated by service symbols as shown in Table A. Table A also indicates the system number, fluid category, and pipe marker background color of each service.

Table A, Piping Services

Symbol	Service	System	Fluid category	Pipe marker color[1]
1W	Potable Water (City water)	7	Water	Blue

3.06 PIPING SPECIFICATION SHEET--PIPESPEC

Piping Symbol/Service 1W--Potable Water System--7

Test Requirements:

Medium:	Water; ref. spec paragraph 15050-3.04 A.
Pressure:	200 psig (see Hydrostatic Test Pressure & Disinfection Requirements – Appendix D)
Duration:	120 minutes

Gasket Requirements:

Push-on/Mech Cpl:	EPDM

Exposed Pipe and Valves:
(See IHS/NTUA Standard Drawings for pipe size and valve type.)

(3" and smaller)

Pipe:	Conn; solder type with threaded or flanged adapters for valves. Ftgs; bronze, ANSI B16.22.
	PVC; ASTM D1784, Class 12454 B, NSF certified, ASTM D1785, Sch. 80. Ref. spec Section 15064. Conn; plain end; solvent weld. Ftgs; PVC, Sch. 80, socket type.
	O.D. Pipe, Brass
Valves:	Ball; Jamesbury Fig. 351, Nibco T-580, or equal. Globe; Crane 7TF or 17TF, Lunkenheimer 123 or 214, or equal.
	Ball; PVC, true union, socket type, Chemtrol Tru Block TU Series, Asahi/ America Duo Bloc TU Series, GSR TU Series, or equal, with PTFE seats and Viton O-rings. Diaphragm; PVC body, PTFE diaphragm, Chemtrol Series PD, Posacon 677, Asahi/ America, or equal.
	Gate; F.I.P.T., N.R.S., R.H.T., Brass hand wheel
	Gate; Brass, F.I.P.T.
	Hose Bib, Stainless steel (S.S._)
	Hose Bib, MIPT Brass
	Combination Air Release/Vacuum Valve
	Curb Stop, FIPT, Mueller H-10287, OAE (4" and larger)
Pipe:	Ductile iron; AWWA C151 with NSF Compliant lining and coating. Polyethylene encasement per ANSI/AWWA A21.5/C105. Conn; Flanged or PE pipe. Flanged adapters for valves. Ftgs; ductile iron;flanged, coating, lining, and ends to match pipe.

(3" and larger)

Valves: Gate; F.I.P.T., N.R.S., R.H.T.

Buried Pipe and Valves:

(See drawings for pipe size and valve type.)

(3" and smaller)

Pipe: HDPE; per ASTM D-2239, SIDR 7, 200 PSI

PVC; ASTM D1784, Class 12454 B, certified, ASTM D1785, Sch. 80. Ref. spec Section 15064.
Conn; plain end; solvent weld
Ftgs; PVC, Sch. 80 socket type.

(2-1/2" and smaller)

Valves:

Gate; C.I., FIPT, RW, NRS, RHT, W/2" operating nut, Mueller A-2360-37

(4" to 12")

Pipe: HDPE; per AWWA C901, DR as specified. Ref. spec Section 15065

PVC; per AWWA C900, DR as specified. Ref. spec Section 15064.
Restrained push-on rubber gasket joint. MJ adapters for valves and fittings.
Ftgs; ductile iron; coating, lining and ends to match pipe.

Ductile iron; AWWA C151 with NSF Compliant lining and coating. Polyethylene encasement per ANSI/AWWA A21.5/C105. Ref, spec Section 15062.
Conn; Restrained mechanical joint pipe. MJ adapters for valves.
Ftgs; ductile iron; restrained mechanical joint, coating, lining, and ends to match pipe.

Valves: Gate; Resilient Seated. ref. spec Section 15102, with extension stem and valve box.

Remarks:

1. Combination air valve shall be provided at the high points and drains provided at the low points of each reach of pipeline.

2. Sleeves shall be installed of proper size for all pipes passing through walls as shown on the drawings. Where indicated on the drawings, or required for liquid or gas-tightness, the pipe shall be sealed with mechanical seal by Link Seal as manufactured by Thunderline Corp., Wayne, Michigan, or equal.

3. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment.

4. System 7 piping installed in areas and locations subject to freezing (including ceiling areas which are not heated) shall be insulated.

5. Water lines installed over suspended or other type ceilings shall be insulated for condensation control.

6. Systems shall be disinfected per NTUA Testing and Disinfecting Water Mains – See Appendix D.

7. Tape shall be spirally wrapped with a 55 percent overlap and sufficient tension and pressure to provide continuous adhesion without stretching the tape. Edges of tape must be continuously smoothed and sealed by hand during wrapping. On vertical application, contractor shall begin at bottom and proceed upward creating a weather board overlap.

Smooth contours shall have a minimum thickness of 50 mils while nuts, bolts, and sharp projections shall be 100 mils.

END OF SECTION

SECTION 15062

DUCTILE IRON PIPE

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies ductile iron pipe, ductile fittings, and gaskets.

B. DEFINITION:

Where cast iron pipe is specified, the term and symbol shall mean ductile iron pipe.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI A21.14	Ductile-Iron Fittings 3 In. Through 24 In., for Gas
ANSI A21.52	Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand Lined Molds for Gas
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings
ASTM A716	Ductile-Iron Culvert Pipe
ASTM C150	Portland Cement

Reference	Title
AWWA C104 (ANSI A21.4)	Cement-Mortar Lining for Ductile- Iron and Gray-Iron Pipe and Fittings for Water
AWWA C110 (ANSI A21.10)	Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111 (ANSI A21.11)	Rubber-Gasket Joints for Ductile- Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115 (ANSI A21.15)	Flanged Ductile-Iron and Gray-Iron Pipe With Threaded Flanges
AWWA C150 (ANSI A21.50)	Thickness Design of Ductile-Iron Pipe
AWWA C151 (ANSI A21.51)	Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C153 (ANSI A21.53)	Ductile-Iron Compact Fittings, 3 In. Through 12 In. for Water and Other Liquids
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Type Joints
NTUA	Navajo Area Standards & Construction Requirements

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The CONSTRUCTION MANAGER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration .*

2. Shop fabrication drawings showing details of materials, piping, fittings, couplings, dielectric connections, joint locations and details, types and locations of supports.

3. CONTRACTOR's layout drawings as specified in paragraph 15050-1.03.

4. Certifications specified in the following documents:

   ANSI A21.14, paragraph 14-4.2
   ANSI A21.52, paragraph 52-4.2
   ASTM A716, paragraph 4.2
   AWWA C110, paragraph 10-5.3
   AWWA C111, paragraph 11-7.1
   AWWA C115, paragraph 15-4.2
   AWWA C151, paragraph 51-5.2
   AWWA C153, paragraph 53-6.3
   AWWA C606, paragraph 4.1.1.1

5. Other data necessary to show conformance of the complete piping system to these specifications.

PART 2--PRODUCTS

2.01 GENERAL

Pipe design, materials and manufacture shall comply with the following documents:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	
Water or other liquid	AWWA C151
Gas	ANSI A21.52
Gravity service pipe	ASTM A716
Joints	
Rubber gasket	AWWA C111
Threaded flange	AWWA C115
Fittings	
Water or other liquid	AWWA C110/AWWA C153
Gas	ANSI A21.14
Cement mortar lining	AWWA C104

2.02 PIPE – NOT USED

2.03 GASKETS

Use the manufacturer's standard gasket for use in potable water systems. Gaskets shall comply with AWWA C111 for push-on and mechanical joints and with AWWA C606 for grooved end joints.

2.04 FITTINGS

Unless otherwise specified, fittings shall conform to AWWA C110. Ends shall be flanged, restrained mechanical joint, restrained push-on, or grooved to suit the conditions specified. The AWWA C153 compact ductile iron fittings in sizes 3 through 12 inches are an acceptable substitute for standard fittings unless otherwise specified. Long-radius elbows shall be provided where specified. Grooved end fittings shall comply with paragraph 15050-1.02 B.

2.05 JOINTS

A. UNRESTRAINED JOINTS:

1. PUSH-ON JOINTS: Unrestrained joints, where specified, shall be the rubber ring compression, push-on type joint suitable for buried service. Unrestrained joints shall be the Fastite Joint as manufactured by American Cast Iron Pipe Company, the Tyton Joint as manufactured by U.S. Pipe, or equal. This joint is not permitted on fittings or specials, unless otherwise specified. Unless otherwise specified, joints shall have an allowable deflection up to 5 degrees at specified pressures. Joint assembly and field cut joints shall be made in strict conformance with AWWA C600 and manufacturer's recommendations.

2. MECHANICAL JOINTS: Where specified, mechanical joints for above or below ground service shall meet the requirements of ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111. Gaskets and bolts and nuts shall comply with paragraphs 15062-2.03 and 2.05 D, respectively.

B. RESTRAINED JOINTS:

1. GENERAL: Unless otherwise specified, restrained joints are required for all exposed and buried piping. Unless otherwise specified, restrained joints shall be flanged or grooved end for exposed service and restrained push-on for buried service.

2. PUSH-ON JOINTS: Restrained push-on joints shall be as specified in paragraph 15062-2.05 A.1., modified for restraint. Joints shall be the Flex-Ring or Lok-Ring Joint as manufactured by American Cast Iron Pipe Company, TR Flex Joint as manufactured by US Pipe, or equal. Restrained joints shall be capable of being deflected after full assembly. Joint assembly shall be in strict conformance with AWWA C600 and manufacturer's recommendations. No field cuts of restrained pipe are permitted without prior approval of the CONSTRUCTION MANAGER.

3. FLANGE ASSEMBLIES: Unless otherwise specified, flanges shall be ductile iron and shall be threaded-on flanges conforming to ANSI/AWWA A21.15/C115 or cast-on flanges conforming to ANSI/AWWA A21.10/C110. Flanges shall be adequate for 250 psi working pressure. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges. Where specified, flanges shall be threaded-on or cast-on flanges conforming to ANSI B16.1, Class 250.

Unless otherwise specified, bolts and nuts for flange assemblies shall conform with paragraph 15085-2.01 C. Gaskets shall be as specified in paragraph 15085-2.01 B.

4. MECHANICAL JOINTS: Where specified, restrained mechanical joints shall be the positive restraint type. Mechanical joints with retainer glands are not acceptable.

Locked mechanical hydrant tees, bends and adapters are an acceptable substitute for anchoring fire hydrants and valves to the pipe main.

C. BALL AND SOCKET FLEXIBLE JOINT PIPE:

Ball and socket flexible joint pipe shall be the boltless type and shall allow a maximum joint deflection of 15 degrees. Each joint shall be provided with a retainer lock to prevent rotation after assembly. Joints shall be the Flex-Lok Joint as manufactured by American Cast Iron Pipe Company, USIflex as manufactured by U.S. Pipe, or equal.

D. BOLTS AND NUTS:

Corrosion-resistant bolts and nuts for use with ductile iron joints shall be high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11.

2.06 PIPE COATING

Unless otherwise specified, pipe and fittings shall be coated with asphaltic material as specified in AWWA C151.

2.07 PIPE LINING

A. ASPHALTIC LINING:

Unless otherwise specified, pipe and fittings shall be lined with asphaltic material as specified in AWWA C151.

B. CEMENT MORTAR LINING:

Where specified, interior surfaces of pipe and fittings shall be cement mortar lined in accordance with AWWA C104. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkalies.

C. GLASS LINING: (NOT USED)

PART 3--EXECUTION

3.01 INSTALLATION

A. GENERAL:

Piping runs specified on the drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01300.

Pipe shall be installed in accordance with AWWA C600.

Connections to existing structures and manholes shall be made so that the finished work will conform as nearly as practicable to the requirements specified for the new manholes, including necessary concrete work, cutting and shaping. Concrete mortar shaping within any structure and manhole shall be as specified.

B. INSULATING SECTIONS:

Where a metallic nonferrous pipe or appurtenance is connected to ferrous pipe or appurtenance, an insulating section shall be provided as specified in paragraph 15085-3.05.

C. ANCHORAGE:

Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted in accordance with Section 01300.

3.02 ACCEPTANCE TESTING

Hydrostatic pressure tests shall be conducted in accordance with AWWA C600, Paragraph 3.09 of the Navajo Area Standards & Construction Requirements (See Appendix D), and at test pressures listed in Section 15050.

The CONTRACTOR shall conduct the tests in the presence of the CONSTRUCTION MANAGER.

END OF SECTION

SECTION 15064

PLASTIC PIPE

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies polyvinylchloride, chlorinated polyvinylchloride, polyethylene, and polypropylene pipe and fittings. High density polyethylene (HDPE) piping for trenchless installation shall be per specification Section 15065.

The Contractor shall provide all necessary labor, materials, appurtenances, equipment, and services for a complete, in-place pipeline.

B. PIPE DESIGNATIONS:

For use in the Piping System Specification Sheets (PIPESPEC) in Section 15050 and in this section, the following plastic pipe designations are defined:

Designation	Definition
PVC	Polyvinylchloride
PE	Polyethylene

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2464	Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM D2657	Heat-Joining Polyolefin Pipe and Fittings
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F402	Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
ASTM F437	Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
AWWA C110	Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber-Gasket Joints for Ductile-Iron
AWWA C115	Flanged Ductile-Iron Pipe With Ductile-Iron

Reference	Title
AWWA C116	Protective Fusion-Bonded Epoxy Coatings
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast
AWWA C153	Mechanical Joint Ductile Iron Fittings
AWWA C210	Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings
AWWA M23	PVC Pipe Design and Installation
NTUA	Navajo Area Standards & Construction Requirements

B. MANUFACTURER INSPECTION AND TESTS:

1. Unless otherwise specified, all pipe manufacturing materials, pipe and fittings provided shall be tested in accordance with the applicable referenced standards.

   a. Perform material tests at no additional cost to the Owner.

   b. In addition to those tests specifically required, Construction Manager may request additional samples of any material for testing by Construction Manager. Additional samples and testing shall be furnished at no additional cost to Owner.

2. Like pipe and fittings provided shall be furnished by a single manufacturer.

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The CONSTRUCTION MANAGER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the

paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration*.

2. Shop fabrication drawings showing details of materials, piping, fittings, couplings, mechanical restraint devices, dielectric connections, joint locations and details, types and locations of supports.

3. CONTRACTOR's layout drawings as specified in paragraph 15050-1.03. Contractor shall provide restraint calculations including required length for mechanical restraint, placement and/or sizing of thrust blocks, based on provided layout and Section 3.03. Calculations shall be stamped by a Registered Professional Engineer in the State of Utah.

4. Manufacturer's certificates of compliance with the specified standards.

5. Procedures for safe handling, transport and storage of HDPE piping, including maximum pipe stacking height to maintain the round pipe shape.

6. Other data necessary to show conformance of the complete piping system to these specifications.

PART 2--PRODUCTS

2.01 PVC PIPE

A. PRESSURE PIPE:

PVC material for pipe and fittings shall conform to ASTM D1784, Class 12454-B with an established hydrostatic design basis (HDB) equal to or greater than 4000 psi at 73.4 degrees F.

Pressure pipe for water lines 4 through 60-inches shall be manufactured in accordance with AWWA C900. Minimum Dimension ratio shall be as specified on the plans. Where not specified on plans, use DR18.

Where specified, pipe and fittings shall be in accordance with ASTM D1785 or shall conform to ASTM D2241 for standard dimension ratios: 160 psi pipe--SDR 26; 200 psi pipe--SDR 21; 250 psi--SDR 17. Pressure rating for pipe shall be in excess of test pressure specified in Section 15050. Neoprene gaskets with push-on joints shall conform to ASTM F477.

Where specified, Schedule 80 PVC socket type fittings shall conform to ASTM D2467. Schedule 40 PVC fittings shall conform to ASTM D2466. PVC solvent weld cement for socket

connections shall meet the requirements of ASTM D2564. Schedule 80 PVC threaded fittings shall conform to ASTM D2464. Fittings for gasketed pipe shall be ductile iron or steel push-on IPS-sized pressure fittings rated for use with the specified class of PVC pipe.

B. NONPRESSURE PIPE:

1. GRAVITY SEWER PIPE: NOT USED

2. DRAIN, WASTE AND VENT PIPE: NOT USED

C. FITTINGS FOR PVC PRESSURE PIPE

Fittings for PVC water lines shall be ductile-iron conforming to AWWA C110 or AWWA C153 with a minimum rated working pressure greater or equal to the provided pressure pipe. The fittings shall have restrained mechanical or push on joints manufactured specifically for the PVC pipe to be used with the fitting. Fittings with repaired defects are not acceptable and will be rejected.

Bolts and nuts for mechanical joints, or flanged ends will be of high strength corrosion resistant low-alloy steel and shall conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Restrained joint bolts and nuts for below ground installation shall be 316 stainless steel. All fittings shall be fusion bonded epoxy lined and coated and lined unless stainless steel is used.

Couplings shall meet the requirements of AWWA C900 as applicable, and be suitable for the working pressure. Deflection shall not exceed 50% of the manufacturer's written maximum recommendation unless otherwise specified.

2.02 CPVC PIPE

CPVC material for pipe and fittings shall conform to ASTM D1784, Class 23447-B. Pipe and fittings shall be in accordance with ASTM F441. Neoprene gaskets with push-on joints shall conform to ASTM F477.

Schedule 80 CPVC socket type fittings shall conform to ASTM F439. Schedule 40 CPVC socket type fittings shall conform to ASTM F438. CPVC solvent weld cement for socket connections shall meet the requirements of ASTM F493. Schedule 80 CPVC threaded type fittings shall conform to ASTM F437.

2.03 PE PIPE

PE pipe shall meet the requirements of ASTM D1248, Type III, Grade P 34, Class C, 100 psi or as specified in Section 15050, whichever is higher. Fittings shall be of the same material, molded socket fusion for sizes 4 inch diameter and smaller and molded or fabricated butt fusion for

sizes 6 inch and larger. Fittings shall be 125 psi or as specified in Section 15050, whichever is higher. Heat fusion welding shall be in conformance with ASTM D2657.

2.04 PP PIPE

A. PRESSURE PIPE:

PP pipe and fittings shall be formulated of polypropylene conforming to ASTM D4101, SDR 11, butt fusion type. Pipe shall be 150 psi rated in all sizes. Heat fusion welding shall be in conformance with manufacturer's recommendation.

B. DRAIN, WASTE AND VENT PIPE: NOT USED

PART 3--EXECUTION

3.01 STORAGE AND HANDLING

Pipe shall be stored and handled in accordance with AWWA M23 and the manufacturer's recommendations. PVC pipe that has been gouged, scratched, or otherwise damaged shall be subject to rejection at the discretion of the Construction Manager. Rejected pipe shall be removed from the site and replaced at no additional cost to the Owner.

Cover stored PVC pipe with an opaque material to protect it from the sun's ultraviolet radiation. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the Construction Manager.

PVC pipe that has been contaminated in any way with petroleum products (on the inside or outside of the pipe) shall not be used.

3.02 INSTALLATION

PVC pipe 3 inches in diameter and smaller shall be joined by means of socket fittings and solvent welding in conformance with ASTM F402. Solvent-cemented joints shall be made in strict compliance with the manufacturer's/supplier's instructions and recommended procedures. Unless otherwise specified, PVC pipe 4 inches in diameter and greater shall be joined by means of gasketed push-on joints and steel or ductile iron push-on or mechanical joint fittings. Fittings that are not plastic or stainless steel shall be lined and coated. Linings shall meet or exceed AWWA C-116 or AWWA C-210 and fully compliant with NSF requirements for potable water service, Ceramapure PL90 ceramic epoxy, or equal. Coatings shall be asphaltic material as specified in AWWA C151. Unless otherwise specified, PVC and CPVC piping exposed to sunlight shall be painted with an approved Latex coatings Tnemec Series 1028 or 1029, Sherwin Williams, Sher Cryl HPA, or equal.

Connections to different types of pipe shall be by means of flanges, specified adapters or transition fittings. Where sleeve type couplings are used, both shall be uniformly torqued in

accordance with pipe manufacturer's recommendation. Foreign material shall be removed from the pipe interior prior to assembly.

Unless otherwise specified, PE pipe and fittings 4 inch diameter and smaller shall be joined by means of thermal socket fusion and pipe 6 inch and larger by thermal butt fusion. Butt-fusion joining of the pipes and fittings shall be performed with special joining equipment in accordance with procedures recommended by pipe manufacturer. Tensile strength at yield of butt-fusion joints shall not be less than pipe. Flanged adapters shall be provided for connection to valves and where specified.

3.03 SUPPORTS, THRUST AND ANCHOR BOLTS

All plugs, caps, tees and horizontal and vertical alignment changes greater than or equal to 11 ¼ degrees and as specified in buried pressure piping systems shall be anchored by means of reaction backing thrust blocks or mechanically restrained joints. Concrete support blocks shall be provided for all ductile-iron fittings and valves to prevent the fitting or valve weight from being carried by the PVC pipe.

3.04 TESTING

Testing of plastic piping shall be in accordance with AWWA C605 and at test pressures listed in Section 15050.

END OF SECTION

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SECTION 15065

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 -- GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies high density polyethylene (HDPE) pipe, fittings, and appurtenances for piping 2 inches to 10 inches in nominal diameter.

B. CHARACTERISTICS:

Provided HDPE pipe shall conform to the following minimum requirements:

Dimension Ratio (DR)	11
Material Designation	PE-4710
Pipe Sizing System per AWWA C906 & ASTM F714	DPS
Pressure Class in accordance with AWWA C906	200 psig

C. REFERENCES:

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. References shall be made to the latest edition of said standards unless otherwise called for.

References	Title
ANSI/AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks
ASTM D2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2657	Heat Joining Polyolefin Pipe and Fittings
ASTM D3350	Polyethylene Plastics Pipe and Fittings Material
PPI TR 31	Underground Installation of Polyolefin Piping

1.02 QUALITY ASSURANCE

A. INSPECTION AND TESTING:

All HDPE materials, pipe and fittings shall be inspected and tested in accordance with the requirements of AWWA C906.

B. AFFIDAVIT OF COMPLIANCE:

The manufacturer shall furnish an affidavit of compliance conforming to the requirements of AWWA C906, Section 1.5, affirming that the piping components comply with the requirements of AWWA C906 and this section.

1.03 SUBMITTALS

Submittals shall be in accordance with Section 01300.

Submit the following prior to commencement of the Work:

A. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Detail drawings which show the type and location of all fittings, joints, and connections to other pipe materials.

C. Design calculations demonstrating that the pipe is capable of sustaining service conditions and the maximum loads to be imposed during installation.

D. Affidavit of Compliance specified in paragraph 15065 1.02 B.

E. A report containing a copy of all manufacturer's test results for all tests conducted in accordance with paragraph 15065-1.02 B.

1.04 DESIGN REQUIREMENTS

The design and layout of pipe shall meet the service and installation conditions and the criteria specified in this Section and as shown on the Plans are the responsibility of the Contractor. This design shall be performed by or under the supervision of a Professional Engineer licensed by the State of Utah. The Contractor shall submit design calculations for pipe with wall thickness and pressure class demonstrating that the pipe is capable of sustaining the maximum stresses to be imposed during installation and service.

The calculations shall take into account ground loads, live loads such as traffic and railroad, and any other installation loads which may be reasonably anticipated.

PART 2 -- PRODUCTS

2.01 GENERAL

HDPE materials, pipe and fittings shall be manufactured, marked, inspected, sampled and tested in accordance with the requirements of AWWA C906 and this section.

The color of the pipe shall be black with a blue stripe designating potable water.

2.02 MATERIALS

HDPE piping components shall as a minimum be manufactured from materials that meet or exceed the requirements of the Plastic Piping Institute designation PE 4710 and that conform to the requirements of ASTM D3350 for a cell classification of PE 445474C.

2.03 PIPE

Pipe shall have the nominal pipe diameter shown, with the inside diameter based on the DR and pipe sizing system shown. Dimensions and tolerances shall be as specified in AWWA C906.

2.04 FITTINGS

Fittings shall meet the pressure requirements of the specified pipe. Fittings shall conform to the applicable requirements of AWWA C906 for the joining methods specified in paragraph 15065-3.02 B.

Increase wall thickness to next nominal pressure rating/next lower DR for mitered bends. Mitered bends shall be segmented according to the following table:

Degree of bend	Minimum number of miter segments
45 or less	2
Greater than 45	4

PART 3 -- EXECUTION

3.01 PIPE HANDLING AND STORAGE

The Contractor shall use care in handling and storage of the pipe. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

Sections of pipe with cuts, gouges, or scratches on the outside diameter (OD) surface that exceed 10-percent of the wall thickness of the pipe shall be removed completely and the ends of the pipeline rejoined. The inside diameter (ID) surface shall be free of cuts, gouges, and/or scratches.

3.02 INSTALLATION

A. GENERAL:

Unless otherwise specified, the piping system shall be installed in accordance with ASTM D2321, ASTM F1962, AWWA C906 and the manufacturer's recommendations.

B. JOINING:

Pipe and fittings shall be joined into continuous lengths on the job site above ground. Unless otherwise specified, joining shall by the butt-fusion method performed in accordance with the pipe manufacturer's recommendations and ASTM D2657. Socket fusion, extrusion welding and hot gas welding shall not be used.

The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of HDPE pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they are adequately trained and qualified in the techniques involved. Butt fusion joining shall yield a joint strength equal to or greater than the tensile strength of the pipe.

Romac alpha, restrained joint couplings with standard gaskets will be used to make connections to PVC pipe where specified.

C. TRENCH EXCAVATION:

Trenches shall be excavated to ensure that sides will be stable under all working conditions. Trench walls or supports shall comply with all local and national standards for safety.

D. LOCATION AND ALIGNMENT:

Pipe and fittings shall be placed in the trench with the invert conforming to the elevations, slopes, and alignments shown.

E. BEDDING AND BACKFILL:

Materials used for bedding and backfill shall be as specified in Section 02200 and as shown.

Place materials by methods that will not disturb or damage the pipe. All HDPE pipe shall be at the temperature of the surrounding soil at the time it is backfilled and compacted. Work in and tamp the bedding material in the area under the pipe and up to the spring line before placing and compacting the remainder of the embedment. Blocking under the pipe shall not be permitted.

Use compaction equipment and techniques that are compatible with materials specified and location in the trench. Before using heavy compaction or construction equipment directly over the pipe, place sufficient backfill to prevent damage, excessive deflections, or other disturbances of the pipe.

3.03 TESTING

A. HYDROSTATIC PRESSURE TESTING:

HDPE piping systems shall be fully pressure tested prior to placing the line into service. Water shall be the test medium for hydrostatically testing the pipe. Test procedures shall be conducted in accordance with Paragraph 3.09 of the Navajo Area Standards & Construction Requirements (See Appendix D), and at pressures listed in Section 15050. In case of conflict, the following procedures shall apply.

Cover the pipe at intervals and/or at curves if necessary to hold the pipe in place during testing. Connections shall be left exposed for visual leak inspection.

After all free air is removed from the test section, the pressure in the pipe shall be raised at a steady rate to the required pressure. The pressure in the section shall be measured at the lowest point of the test section. Test pressure shall be as specified in Section 15050. The initial pressure shall be applied and allowed to stand without makeup pressure for 2-3 hours to allow for diametric expansion or pipe stretching to stabilize. After the equilibrium period, the test section shall be returned to the required test pressure and held for 3 hours. Amounts of makeup water allowable for expansion during the pressure test shall be as listed in the Plastic Pipe

Institute Technical Report TR 31-88. No visual leaks or pressure drops shall be observed during the final test period.

B. DEFLECTION TESTING:

1. GENERAL: Deflection testing shall be performed on the entire length of installed pipe no sooner than 30 days after completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe and fittings in the installed pipeline under external loads shall not exceed the maximum deflection specified in paragraph 15065-1.01 B. Either of the following devices and procedures may be used to measure deflection.

2. PULL-THROUGH DEFLECTION TESTING: The Contractor shall determine whether the allowable deflection has been exceeded by use of a pull-through device.

a. PULL-THROUGH DEVICE: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device. Ball, cylinder, or circular sections shall conform to the following:

(1) A diameter, or minor diameter as applicable, equal to the average inside diameter of the pipe minus the dimension equivalent of the maximum installed deflection specified in paragraph 15065-1.01 B. A tolerance of plus 0.5 percent in the diameter of the test device will be permitted.

(2) A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.

(3) Center bored and through bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.

(4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. PULL-THROUGH DEVICE PROCEDURE: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

3. DEFLECTION DEVICE: The Contractor shall determine whether the allowable deflection has been exceeded by use of a deflection measuring device.

a. DEFLECTION MEASURING DEVICE: This device shall be sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension. The deflection measuring device shall be approved by the Construction Manager prior to use.

b. DEFLECTION MEASURING DEVICE PROCEDURE: Measure deflections through each run of installed pipe. If deflection readings in excess of the maximum allowable specified in paragraph 15065-1.01 B are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of the allowable, remove pipe which has excessive deflection, replace with new pipe, and completely retest in the same manner and under the same conditions.

3.05 DISINFECTION

A. Disinfection of HDPE piping shall be in accordance with AWWA C651, and as specified in Section 15050.

** END OF SECTION **

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SECTION 15075

JOINT GASKETS

PART 1--GENERAL

1.01 DESCRIPTION

This section specifies rubber gaskets for push-on compression type joints used with fabricated steel pipe, steel pipe, reinforced concrete pipe, concrete cylinder pipe, and cement mortar lined and coated steel pipe.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D395	Rubber Property--Compression Set, Test for
ASTM D412	Rubber Properties in Tension, Test for
ASTM D471	Rubber Property--Effect of Liquids, Test for
ASTM D573	Rubber--Deterioration in an Air Oven, Test for
ASTM D1149	Rubber Deterioration--Surface Ozone Cracking in a Chamber (Flat Specimens), Test for
ASTM D2240	Rubber Property--Durometer Hardness, Test for

B. TESTING:

Certified copies of test reports indicating that the gasket material has been tested and that the results of the tests comply with the requirements specified in paragraph 15075-2.02 shall be provided as product data.

1.03 SUBMITTALS

Manufacturer's product data shall be provided in accordance with Section 01300.

In accordance with Section 01300, the CONTRACTOR shall provide certified copies of test reports specified in paragraph 15075-1.02 B.

PART 2--PRODUCTS

2.01 MATERIALS

Gasket stock shall be a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain no less than 50 percent by volume neoprene and shall be free from factice, reclaimed rubber and other deleterious substances.

2.02 PHYSICAL REQUIREMENTS

The compound shall meet the following physical requirements when tested in accordance with the specified ASTM standards.

A. TENSILE (ASTM D412):

The tensile strength shall be 1500 psi minimum and the ultimate elongation shall be 350 percent minimum.

B. HARDNESS (ASTM D2240, TYPE A DUROMETER):

The compound shall have a hardness in the range of 35 to 50 for concrete spigots and 50 to 65 for steel spigots.

C. COMPRESSION SET (ASTM D395):

The compression set shall not exceed 20 percent when compressed for 22 hours at 70 degrees C.

The test specimens shall be circular discs cut from the gaskets. Test specimens shall be 0.500 ($\pm$ 0.005 - 0.025) inches in height. The diameter of the test specimen shall be that of the gasket but not to exceed 1.129 $\pm$ 0.010 inches in diameter.

D. AGING (ASTM D573):

The test specimen deterioration shall be less than 20 percent reduction in tensile strength, 40 percent reduction in ultimate elongation, and 15 points increase in hardness.

E. EFFECT OF LIQUIDS (ASTM D471):

The maximum volume change in oil and in water shall be as follows:

1. Oil: 100 percent in ASTM oil No. 3.

2. Water: 15 percent.

The test specimens shall have a thickness of 0.080 $\pm$0.005 inches and shall be circular discs cut from the gasket.

F. OZONE CRACKING (ASTM D1149):

The test specimen shall be a gasket loop mounted to give at least 20 percent elongation. There shall be no cracking visible at two times magnification of the gasket after 100 hours exposure to 1 mg/l ozone at 40 degrees C.

PART 3--EXECUTION

The gaskets shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

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SECTION 15085

PIPING CONNECTIONS

PART 1--GENERAL

1.01 DESCRIPTION

This section specifies the following methods of connecting metallic piping: flanges, threading, mechanical couplings, equipment connection fittings, dielectric unions, and welding.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI Bl.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI Bl.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI B31.1	Power Piping
ANSI B31.3	Chemical Plant and Petroleum Refinery Piping
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators Qualifications
ASTM B98	Copper-Silicon Alloy Rod, Bar and Shapes

Reference	Title
ASTM F37	Standard Test Methods for Sealability of Gasket Materials
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F152	Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service-Size 4 in. through 144 in.
AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
AWWA C550	Protective Epoxy Coatings for Valves and Hydrants
AWWA C606	Grooved and Shouldered Joints
AWWA M11	Steel Pipe-A Guide for Design and Installation
NSF 61	Drinking Water System Components - Health Effects

1.03 SUBMITTALS

In addition to the material listed in the detailed specification, the following submittals shall be provided in accordance with Section 01300:

1. For Equipment Connection Fittings used in pumping applications submit thrust rod stretch calculations in accordance with paragraph 2.01D. and dimensional layout data.

PART 2--PRODUCTS

2.01 FLANGE ASSEMBLIES

A. FLANGES:

1. GENERAL: Flanges shall either be flat flanges or convoluted ring flanges as specified in the following paragraphs.

2. FLAT FLANGES: Cast iron flanges shall be faced in accordance with ANSI B16.1. Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face. Class 150 and Class 300 forged steel flanges shall be raised face conforming to ANSI B16.5. Lightweight slip-on flanges shall be plain face conforming to AWWA C207, Class B and ANSI B16.5. Unless otherwise specified, steel flanges shall be ANSI B16.5, Class 150 or AWWA C207, Class D. Class E AWWA flanges shall be provided where test pressure exceeds 175 psi. Plain faced flanges shall not be bolted to raised face flanges.

3. CONVOLUTED RING FLANGES: Convoluted ring flanges shall be ductile iron, forged steel or cast stainless steel, designed to bear on hubs welded to the pipe and shall be as manufactured by Improved Piping Products. The Construction Manager knows of no equal. The flange joints shall be rated for not less than 150 percent of the test pressures listed in Section 15050 and shall conform to the requirements of ANSI B 16.5 and AWWA C207. The flange manufacturer shall be prepared to demonstrate, by certified pressure test that the flanges will meet these requirements.

B. GASKETS:

Gasket material shall be as specified in paragraph 15085-2.03.

Gaskets for plain faced flanges shall be the full face type. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter. Unless otherwise specified, gaskets for raised face flanges shall match the raised face and shall be 1/16 inch thick for pipe 3-1/2 inches and less in diameter and 1/8 inch thick for pipe 4 inches and larger.

C. BOLTS:

Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI Bl.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5.

Unless otherwise specified, bolts shall be carbon steel machined bolts with hot pressed hexagon nuts. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

2.02 MECHANICAL COUPLINGS

A. SLEEVE-TYPE COUPLINGS:

Unless otherwise specified, sleeve-type mechanical pipe couplings shall be Romac Style 501, Dresser Style 38, or equal, with the stop removed from the middle ring.

Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, markingF593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04, or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

Gaskets shall be as specified in paragraph 15085-2.03 and AWWA C111.

B. EQUIPMENT CONNECTION FITTINGS

Equipment connection fittings shall provide both lateral and angular misalignment adjustment between equipment connection flanges and the connection to field piping systems by providing individually adjustable flexible joints at each connection. In addition, equipment connection fittings shall provide full pressure thrust restraint between the field piping connection and equipment connection flanges.

Equipment connection fittings shall consist of two flanged coupling adapters, a plain end section of pipe and thrust restraint rods and associated fittings designed to transmit thrust without transmitting shear to the thrust restraint rods and without compromising provisions for accommodating angular and parallel misalignment. Materials and features shall conform to the requirements established in this paragraph. Standard "dismantling joints" incorporate only one flanged coupling adapter and are not acceptable substitutes. Equipment connection fittings shall be Romac ECF Series, or Baker Coupling Company, Los Angeles or equal, modified as specified to provide the required features.

Equipment connection fittings shall each consist of a single sleeve of plain end piping conforming to the requirements of the specified piping system of sufficient length to span the gap between the connection at the equipment and the connection at the field piping with gasketed flange adapters at each end. Thrust restraint shall be provided by means of all threaded rod spanning between flanges and male rod nuts and female washers that are rounded to provide a ball-joint type self aligning feature. All threaded restraint rod shall project through flange and mating flange coupling adapter bolt holes or through holes in restraint lug plates that extend above the flanges and are secured to the flanges with a minimum of two flange bolts. Where the all threaded rods project through flange bolt holes, ball joint type nut and washer combinations and lock washers shall be provided at each face, each end. Where restraint lug plates are employed, ball joint type nuts and washers shall be provided only on the outside faces of the plates and the nuts shall have a self locking feature that prevents nut movement due to vibration or other operational or environmental causes. Double nutting with non-locking nuts shall not be an acceptable method of providing the self locking feature. Thrust rod diameter and material shall be selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings to accommodate piping misalignment without transmitting any shear to the thrust rods and also to permit full development of thrust restraint at all thrust rod tension take-ups. Design of equipment connection fittings shall conform to AWWA C219.

Thrust rods, restraint lug plates, nuts, washers and lock washers shall be Type 316 stainless steel, all selected to develop full rated piping system pressure thrust forces. Equipment connection fittings for pump applications shall have thrust rod number and diameter selected such that thrust rod stretch under piping system operating pressure does not exceed 2 mils. Calculations shall be submitted. Dry film molybdenum di-sulfide anti-galling compound shall be factory applied to ends of thrust rods, covering all threads subject to nut travel and tightening.

Gaskets shall be as specified in paragraph 15085-2.03. Flange gaskets shall be full face type. Follower gaskets shall be compression wedge type.

Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All metal portions of equipment connection fittings, with the exception of 316 stainless steel components, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61.

C. FLEXIJOINT

Where specified Flexijoint couplings shall be Flanged Romac Flexijoint couplings. The Flexijoint is a flexible, ductile iron joint that can accommodate expansion, contraction, rotation and bending and is rated at 350 psi working pressure. The joint can accommodate 15 to 20 degree deflection depending on size. Body shall be ductile iron, lock rings Type 410 stainless steel, and ring gasket, casing, ball and cover shall be EPDM molded watertight construction. All metal portions of Flexijoint coupling including the stainless steel lock rings shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61. For buried installations, install with polyethylene baggy cover in accordance with the manufacturer's instructions.

2.03 GASKETS

Gaskets designated in Section 15050 shall be as follows:

1. EPDM: ethylene-propylene-diene-terpolymer.

2. Neoprene: neoprene.

3. Nitrile: nitrile (Buna N).

4. Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder; ASTM F104 (F712400), 2500 psi (ASTM F152), 0.2 ML/HR LEAKAGE FUEL A (ASTM F37).

5. Compressed gasketing consisting of organic fibers (Kevlar) and SBR binder; ASTM F104 (F712400), 2500 PSI (ASTM F152), 0.1 ml/hr leakage Fuel A (ASTM F37).

6. Gylon gasketing, Garlock Style 3500, 2000 psi (ASTM F152), 0.22 ml/hr Fuel A (ASTM F37).

7. Gylon gasketing, Garlock Style 3510, 2000 psi (ASTM F152), 0.04 ml/hr Fuel A (ASTM F37).

8. Gylon gasketing, Garlock Style 3504, 2000 psi (ASTM F152), 0.12 ml/hr Fuel A (ASTM F37).

9. TFE: noncreeping tetrafluoroethylene (TFE) with insert filler.

10. PTFE bonded EPDM: PTFE bonded to EPDM in full-face gasket having concentric-convex molded rings; Garlock Stress Saver 370 or equal.

2.04 THREAD

Pipe thread dimensions and size limits shall conform to ANSI Bl.20.1.

2.05 DIELECTRIC INSULATING JOINT

Dielectric insulating joints and flange spacers shall be Spears or approved equal with bolt insulators.

2.06 COATINGS

Unless otherwise specified, flange assemblies and mechanical type couplings for buried installation shall be field coated with System M-1 as specified in Section 09900.

PART 3--EXECUTION

3.01 PIPE CUTTING, THREADING AND JOINTING

Pipe cutting, threading and jointing shall conform to the requirements of ANSI B31.1.

3.02 PIPE WELDING – NOT USED

3.03 TAKEDOWN COUPLINGS

Takedown couplings shall be screw unions, flanged or grooved end mechanical coupling type joints and shall be provided as specified. Flanged or grooved end joints shall be employed on pipelines 2-1/2 inches in diameter and larger. Where piping passes through walls, takedown couplings shall be provided within 3 feet of the wall, unless specified otherwise.

A union or flanged connection shall be provided within 2 feet of each threaded end valve.

3.04 FLEXIBILITY

Unless otherwise specified, piping passing from concrete to earth shall be provided with two pipe couplings or flexible joints (or a single Flexijoint) as specified on the buried pipe within 2 feet

of the structure for 2-inch through 6-inch diameter pipe; within 3 feet of the structure for 8-inch through 24-inch diameter pipe; and within one and one-half pipe diameters of the structure for larger pipe. Where required for resistance to pressure, mechanical couplings shall be restrained in accordance with Chapter 13 of AWWA M11, including Tables 13-4, 13-5 and 13-5A, and Figure 13-20.

3.05 EQUIPMENT CONNECTION FITTINGS

Where shown, equipment connection fittings shall be provided between field piping systems and equipment inlet and outlet connections.

** END OF SECTION**

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SECTION 15102

RESILIENT-SEATED GATE VALVES

PART 1--GENERAL

1.01 DESCRIPTION

This section specifies iron-body, resilient-seated gate valves.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ANSI B16.1-89	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
ASTM A126-84	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
AWWA C-111-17	Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C-509-87	Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C550	Protective Interior Coatings for Valves and Hydrants
NTUA	Navajo Area Standards & Construction Requirements

PART 2--PRODUCTS

2.01 GATE VALVES FOR WATER MAINS

Gate valves 3 through 12 inches in size shall comply with AWWA C509, including applicable hydrostatic testing. The seal shall be drop-tight. All internal and external surfaces of the valve including the interior of the gate shall be coated with a two part epoxy coating in accordance with AWWA C550.

Valve working pressure rating shall the greater of 235 psi minimum or equal to or greater than the rated pressure of the waterline on which the valve is installed.

Gate valves shall be supplied by a single manufacturer.

2.02 MATERIALS

The body of the valve shall be cast iron, with a full round port opening equal to or exceeding the diameter of the corresponding pipe. The body shall have integrally cast guides to insure the gate is properly guided through complete travel, and shall be free of pockets and bridges in the valve bottom.

The sealing mechanism shall consist of a free draining bi-directional compression seating gate, which ensures a 100 percent bubble tight seal in the closed position against the line flow. The gate shall be constructed with a rubber seal mechanically retained between two epoxy coated gate halves which are securely fastened with stainless steel recessed capscrews.

Gate valves shall be of the nonrising stem type. The stem shall be 400 series stainless steel and shall be independent of the bronze stem nut. A four bolt bonnet cover shall contain a grit and dust cap protecting two O-ring stem seals and the nylon bushing located above the stem collar. A teflon washer shall be located between the stem collar and bonnet as an antifriction device.

End connections shall be furnished as specified in Section 15050 and shown on the drawings. Mechanical joints are to be per ANSI/AWWA C111/A21.11; flanged joints shall conform to ANSI standard B16.1, Class 150. End connections shall be restrained.

2.03. MANUAL OPERATORS:

Gate valves shall be provided with counter clockwise opening geared operators.

Exposed valves shall be supplied with an enclosed bevel gear and handwheel to permit side operation.

Buried valves shall be provided with enclosed spur gears and 2" square operating nuts to permit operation through a valve box from above.

2.04 VALVE BOXES

Valve boxes shall be installed on all buried valves and shall be 5-1/4-inch Nominal diameter shaft, two-piece adjustable screw type equal to Tyler no. 6850 series. The length of the box shall be sufficient to permit access to the valve at the specified depth of bury. Tyler series extensions will be utilized to extend the valve box when required. The word "water" shall be cast onto the Lid.

2.05 SUBMITTAL DATA

The following information shall be provided in accordance with Contractor submittal requirements:

1. Full product submittal including manufacturer's cut sheets, details of construction, and product information.

PART 3--EXECUTION

3.01 VALVE INSTALLATION

Gate valves shall be installed in the closed position.

Before installing the valve, care shall be taken to see that all foreign material and objects are removed from the interior of the valve. The valve shall be opened and closed to see that all moving parts are in working order.

All valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connecting ends furnished. All valves shall be set in and tied to poured in-place concrete support blocks as per the NTUA Standard Detail, WS-14.

Valves and valve boxes shall be set plumb and valves boxes shall be placed over the valve in such a manner that the valve box does not transmit shock or stress to the valve. The cast iron valve box cover shall be set flush with, or slightly above, the finished grade. A 2-foot by 2-foot by 4-inch reinforced concrete pad shall be poured around each valve box. Before the concrete has hardened, the Contractor shall neatly scribe in the concrete pad the valve size and a line representing the direction of flow of water through the valve.

END OF SECTION

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SECTION 15150

AIR RELEASE AND VACUUM VALVES FOR CLEAN WATER SERVICE

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies air release valves, air and vacuum valves, and combination air valves for clean water service, pumping, and storage applications.

B. TYPES:

1. AIR RELEASE VALVES: Air release valves (ARV) shall have a small venting orifice to vent the accumulation of air and other gases with the line or system under pressure. Size and capacity shall be as specified.

2. AIR AND VACUUM VALVES: Air and vacuum valves (AVV) shall have a large venting orifice to permit the release of air as the line is filling or relieve the vacuum as the line is draining or is under negative pressure. Size and capacity shall be as specified.

3. COMBINATION AIR VALVES: Combination air valves (CAV) shall have operating features of both the air and vacuum valve and the air release valve. They include both single- and dual-body construction. Size and capacity shall be as specified.

4. AIR VALVES FOR VERTICAL TURBINE PUMPS: Air valves for vertical turbine pumps (ATP) shall consist of an air and vacuum valve with throttling device for sizes 3-inch and less, and a dual body construction combination air valve mounted on top of a surge check for sizes 4-inch and larger. Size and capacity shall be as specified.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the

following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A240	Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

PART 2--PRODUCTS

2.01 ACCEPTABLE PRODUCTS

Air release and vacuum valves shall be APCO as manufactured by Valve and Primer Corporation, Crispin as manufactured by Multiplex Manufacturing Company, or equal, modified to provide the specified features and to meet the specified operating conditions.

2.02 MATERIALS

Component	Material
Body, cover	Cast iron, ASTM A126, Grade B
Float	Type 316 SS, ASTM A240
Seat	Buna-N or Type 316 SS
Trim	Type 316 SS, ASTM A240

Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

2.03 CONSTRUCTION

Air release valves shall be float operated, compound lever type, except air release valves less than 1-inch may be simple lever type.

Air and vacuum valves shall be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover and shall be easily removed if necessary. The float shall be center or peripheral guided for positive shutoff into the seat.

Combination air valves, unless otherwise specified, shall be single-body construction in sizes 1- through 6-inch and dual-body construction in sizes 8-inch and larger. Single-body construction shall be designed to provide all functions within one housing. The body inlet shall be baffled to protect the float and the large and small orifices shall be designed so that during large orifice closure, the small air release orifice will open to allow small amounts of air to escape. Dual-body construction shall combine one air and vacuum valve and one air release valve with interconnecting piping and gate valve. All combination air valves shall be 1-inch in size.

Air valves for vertical turbine pumps (sizes 3-inch and less) shall be designed and constructed as specified for air and vacuum valves except the discharge orifice shall be fitted with a throttling device to regulate and restrict air venting and establish a pressure loading on the rising column of water on pump start. Unless otherwise specified, air valves, 4-inch and larger, shall be dual body combination air valves except the inlet shall be fitted with a surge check to prevent water column entering the valve on pump start.

Valves shall be suitable for pressures up to 150 psi.

2.04 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Manufacturer's product data.

2. Applicable O&M instruction manuals per Section 01730.

PART 3--EXECUTION

Air release and vacuum valves shall be installed in accordance with the manufacturer's recommendations. Unless otherwise specified, isolation valves per Section 15050 shall be provided below each air valve. Piping from air release and vacuum valves shall be provided to equipment drains or floor drains, located in the Pump Houses for the disposal of nuisance water releases.

END OF SECTION

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Appendix A: Construction Permit Obtained by Owner

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Appendix B: NTUA Required Forms

Water Line Pressure Test Certification

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WATER LINE TEST CERTIFICATION Page _____ of _____

GENERAL LOCATION OF LINE TESTED: _____
(Vicinity/State)

DATE(S) TEST WAS CONDUCTED ON: _____

TEST SECTION LOCATION IS BASED ON: _____
Project Drawing's Name & Project Number

_____ _____
Drafting Agency Date of Drawings

STANDARD LENGTH OF PIPE USED ON THIS PROJECT IS _____ FEET

TEST INFORMATION CERTIFIED BY:

Signature: _____

Name, Organization: _____

Address, Telephone Number: _____

Date of this Report: _____

TEST RESULTS: APPROVED (√) _____
DISAPPROVED (√) _____

TEST REVIEWED AND RETURNED TO SENDER BY:

_____ _____
NTUA Headquarters Operations Date

COMMENTS:

_____

_____

_____

_____

_____

_____

PRESSURE TEST DATA SHEET

Date: _____ Page _____ of _____

Gage's Manufacturer Name and Model Number (2 required): 1. _____

2. _____

Conducted by: _____ Observed by: _____

(contractor/NECA representative) (NTUA/IHS representative)

Test Section Line Designation (Sta. to Sta.)	Pipe Pressure Rating (psi)	Test Pressure at Pump (psi)	Gage Response Check (√)	Observed Test Pressure Range at Pump (psi)	Total Leakage (gallons/2 hr)	Allowable Leakage (gallons/2 hr)

Highest Point in Elevation = _____ Lowest Point in Elevation = _____ Test Pump Elevation = _____

Description of Test Pump Location _____

Differential in Elevation from Highest Point to Lowest Point = _____ feet x 0.433 = _____ psi

Differential in Elevation from Pump Location to Lowest Point = _____ feet x 0.433 = _____ psi (A)

Test Pressure at Pump = _____ psi − _____ psi = _____ psi

(pipe press rating) (A) (test press at pump)

$Q = (N \bullet D \bullet P^{½}) \div 7400$

Where: Q = Allowable leakage
N = Number of Joints of Pipes Being Tested
D = Nominal Pipe Diameter in Inches
P = Pipe Pressure Rating

For _____ inch (PVC/PE/DI) Q = [( ) • ( ) • ( )] ÷ 7400 = _____ gal/hr

For _____ inch (PVC/PE/DI) Q = [( ) • ( ) • ( )] ÷ 7400 = _____ gal/hr

For _____ inch (PVC/PE/DI) Q = [( ) • ( ) • ( )] ÷ 7400 = _____ gal/hr

SUM TOTAL = _____ gal/hr

TOTAL ALLOWABLE LEAKAGE FOR TEST SECTION = SUM TOTAL X 2 = _____ gal/2 hrs

Nov 98

Exhibit A: Geotechnical Investigation Report

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Please be advised that, effective September 21, 2022, Wood Environment & Infrastructure Solutions, Inc. Was acquired by WSP. Due to the acquisition, we have changed our name to WSP USA Environment & Infrastructure Inc. No other aspects of our legal entity or capabilities have changed for this report, including our Federal Tax ID which remains 91-1641772. Correspondence for this report should continue to be addressed to the undersigned.

GEOTECHNICAL ENGINEERING STUDY

WESTWATER PIPELINE
BLANDING, UTAH

PREPARED FOR:

BROWN AND CALDWELL

6975 UNION PARK CENTER SUITE 490, MIDVALE, UT 84047

PROJECT NO.: 22-517-00049
DATE: FEBRUARY 14, 2023

WSP USA ENVIRONMENT & INFRASTRUCTURE INC.
4221 BALLOON PARK RD. N.E.
ALBUQUERQUE, NM 87109

T: +1 505.821.1801
WSP.COM

February 14, 2023

Confidential

Brown and Caldwell
6975 Union Park Center, Suite 490
Midvale, UT 84047

Attention: **Mr. Corwin Wilmore**

Re: **Geotechnical Engineering Study**
Westwater Pipeline
Blanding, UT

Dear Mr. Wilmore,

WSP Environment & Infrastructure Inc. (WSP) has performed a geotechnical investigation for the Westwater Pipeline in Blanding, UT. The results of our field investigation, laboratory testing, shear wave velocity geophysics, and geotechnical engineering recommendations for the project are presented herein.

Should you have any questions concerning the recommendations presented in this report, please do not hesitate in contacting us.

Yours sincerely,

WSP USA Environmental & Infrastructure Inc. **Reviewed by:**

Jacob S. Hays, P.E.
Geotechnical Engineer

John C. Lommler, Ph.D., P.E., D.GE
Principal Geotechnical Engineer

TABLE OF CONTENTS

1 INTRODUCTION

WSP performed a geotechnical engineering evaluation for the proposed pipeline to be constructed in Blanding, Utah. The study evaluates the physical properties of the soils underlying the site to provide recommendations for pipeline design and related earthwork.

2 PROPOSED CONSTRUCTION

We understand that the project consists of installing a new 8-inch diameter polyvinyl chloride (PVC) transmission pipe approximately 2,700 linear feet from the existing water distribution system from the City of Blanding and a new 8-inch diameter polyvinyl chloride (PVC) transmission pipe approximately 7,200 linear feet within the Westwater subdivision.

Should final design details vary significantly from those outlined above, this firm should be notified for review and possible modification of recommendations.

3 SITE CONDITIONS AND GEOTECHINCAL PROFILE

3.1 Subsurface Exploration

Our geotechnical field study was conducted on November 8th, 2022. Eight (8) exploratory borings were advanced along the proposed alignment to depths ranging from 2.5 to 11.5 feet below existing grades. A truck-mounted, Central Mine Equipment Company (CME), rotary drill rig equipped with an 8-inch outer diameter (O.D.), hollow-stemmed auger, was used for the drilling. Standard penetration testing (ASTM D 1586) was performed at selected intervals in the subsurface and soil samples collected using split-spoon samplers. The soils were continuously examined, visually classified, and logged by a WSP Field Engineer. Bedrock was encountered during the field investigation. Logs of the borings are presented in Appendix A.

The boring logs are indicators of subsurface conditions at the specific locations of drilling. Subsurface conditions, including groundwater levels, at other times and locations in the project area, may differ significantly from the conditions represented by the sampling locations.

3.2 Geotechnical Profile

The soils below the alignment consist primarily of silty, clayey sands (SC-SM), lean clay (CL), silt (ML), silty clay (CL-ML), and clayey sand (SC).

- the silty, clayey sand and clayey sand were predominantly fine grained, low to medium plasticity, and dark brown to reddish brown in color
- the lean clay was generally of low plasticity, with traces of rock, and slight calcium carbonate cementation identified as white streaks
- the silt and silty clay were generally of low plasticity, fine grained, with slight to moderate calcium carbonate cementation present only in the silty clay

Laboratory test results are presented in Appendix B.

3.3 Laboratory Analysis

Laboratory tests were performed on soil samples collected at each boring location. Moisture content, particle-size analysis, and Atterberg limits were performed to aid in soil classification. Additionally, sulfates content, chloride content, electrical resistivity, and pH testing were performed on selected samples. Results of laboratory soil testing are presented in Appendix B.

3.4 Seismic Site Characterization

Seismic site class was estimated by measuring the response of generated waves across an array using P-wave geophones. A total of three (3) locations were analyzed (denoted as array A-01 to A-03) and results of the seismic geophysics study are presented in Appendix C.

4 DISCUSSION AND RECOMMENDATIONS

This section presents our geotechnical engineering conclusions and recommendations concerning site preparation and pipeline installation. ASTM International (ASTM) specification codes cited herein refer to the most current applicable ASTM manual.

4.1 Analysis of Shallow Bedrock

Results of the geotechnical field investigation and seismic site characterization revealed shallow depth to bedrock at the location of the proposed pipeline. The exploratory borings indicated common earthmoving equipment can be used to excavate surficial soils above the bedrock. The depth of excavatable surficial soils ranged from 2.5 to 11.5 feet at the site.

Seismic site characterization tests (arrays 1, 2, and 3), indicate that bedrock is present at shallow depths. The average P-wave velocities to a depth of 20 feet below grade was 4050 ft/s with greater velocities observed at array 2 and 3. The average p-wave velocities of each array are as follows: 3890 feet per second (ft/s) for array 1, 4700 ft/s for array 2, and 4170 ft/s for array 3. According to Rucker and Fergason (2006), the excavatabilty of rock-like soil based on p-wave veolcities and backhoe equipment were compared with ripper performance from the Caterpillar Performance Handbook. Seismic testing indicates, the excavatability of the soils in the project area are 'rippable' using the following equipment:

John Deere 710D or Cat 325 (p-wave velocities of 3000 ft/s), Cat 330BL (p-wave velocities of 3500 ft/s), and Cat 345BL (p-wave velocities of 4000 ft/s).

4.2 Pipeline Soil Support and Installation

The soils encountered along the proposed alignments should provide adequate support for the pipelines. Differential settlement in the pipe should not exceed ½ inch across 20-foot pipe sections if the recommended site preparation and backfill requirements are followed. Settlement will primarily result from elastic movement of the soil mass during backfill and compaction operations.

Pipes should be installed using typical industry standards, and in accordance with subsequent Section 4.4.

4.3 Fill Materials

Pipe Bedding and Backfill: Pipe backfill should conform to Utah Department of Transportation (UDOT) Section 02056-2.2 (C) and Section 02056-2.4 (A). Pipe backfill and haunch should be compacted in accordance with UDOT Section 02056-3.1 (F-2) and American Public Works Association (APWA) standards specifications. A one (1) foot backfill cover should be compacted in accordance with APWA standards specifications. Pipe bedding materials should be placed in accordance with UDOT Section 02056-3.4 (A) and UDOT standard drawing (DG-5). Pipe bedding materials should be compacted in accordance with UDOT Section 02056-3.1 (F) and APWA standards specifications.

Structural Fill: Material should consist of soil that conforms to the following physical characteristics:

Table 1: Imported Structural Fill Grain Size Requirements

SIEVE SIZE (SQUARE OPENINGS)	PERCENT PASSING BY DRY WEIGHT
1 ½ INCH	90-100
1 INCH	20-55
¾ INCH	0-15
3/8 INCH	0-5

The plasticity index of the material, as determined in accordance with ASTM D 4318, shall not exceed 10. The structural fill material shall be free from roots, grass, other vegetable matter, clay lumps, rocks larger than 3 inches in any dimension, or other deleterious materials.

4.4 Chemical and Electrical Testing

The purpose of this testing was to evaluate corrosive potential of on site soils and the concrete sulfate exposure class (per ACI 318-14 Chapter 19) for concrete materials in contact with these soils. Chemical and electrical test results of the combined bulk sample are presented in Table 2. The tests performed

for this study included Laboratory Electrical Resistivity (ASTM G187-20/AASHTO T288), pH (ASTM D4972/AASHTO T289), Sulfate Content (ASTM C1580-20/AASTHO T290), and Chloride Content (ASTM D512/AASHTO T291).

Table 2: Chemical and Electrical Testing and Analysis

Sample Description	Soil Resistivity (Ωcm)	pH of Soil	Soluble Sulfate, SO_4 (ppm)[1]	Soluble Chloride, Cl (ppm)[1]
Combined boring sample: B-02 @ 4.5', B-03 and B-05 @ 2.5', 5.0', 7.5', and B-08 @ 2.5'	2500	8.2	3	81

Note: 1. Parts per million

The sulfate results were 3 ppm, which indicates a 'negligible' (less than 150 ppm) potential for sulfate reaction with the concrete. A Type I cement (ASTM C150) may be used at this site.

Laboratory test results indicate a minimum electrical resistivity of 2500 Ω·cm^2, a pH value of 8.2, and chloride content of 81 ppm. The soil chloride content (81 ppm) and sulfate content (3 ppm) are low, and do not have significant potential to create acidic conditions within the soils when saturated. The electrical resistivity (2500 Ω·cm^2) classifies as 'moderately corrosive' in accordance with ASTM standards.

4.5 Frictional Resistance

For smooth surfaced pipelines, such as PVC, a frictional resistance of 0.2 is recommended. For pipelines with somewhat roughened surfaces, such as concrete coated pipes, a coefficient of friction of 0.3 may be used. It is not recommended that frictional resistance be combined with passive resistance for pressure pipelines.

4.6 Construction Observation and Testing

Recommendations presented in the previous sections of this report are predicated on there being continuous observation and testing by the geotechnical engineer's representative during earthwork operations. Verification of recommended moisture contents and degree of compaction should be documented.

5 CLOSURE

The conclusions and recommendations presented in this report are based, in part, on the explorations WSP performed and used for this study; therefore, if variations in the subgrade conditions are observed, we may need to modify this report to reflect those changes. WSP is available to provide geotechnical engineering throughout the design process and to perform monitoring services throughout construction.

APPENDIX

A

FIELD EXPLORATION PROCEDURES, SITE LOCATION AND EXPLORATION PLAN, BORING LOGS

APPENDIX

Appendix A – Field Exploration Procedures and Logs

The following paragraphs describe the procedures used for field explorations and field tests that WSP conducted for this project. Descriptive logs of our explorations are enclosed in this appendix.

Auger boring procedures

Exploratory borings were advanced with a hollow-stem auger using a truck-mounted drill rig operated by an independent drilling firm working under subcontract to WSP. An engineer from WSP continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to the laboratory for further visual examination and testing. After each boring was completed, the borehole was backfilled with a mixture of bentonite chips and soil cuttings, and the surface was patched with asphalt or concrete (where appropriate).

Throughout the drilling operation, soil samples were obtained at 2.5- or 5-foot depth intervals by means of the Standard Penetration Test (SPT) per ASTM D-1586. This testing and sampling procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval was counted, and the total number of blows struck during the final 12 inches was recorded as the Standard Penetration Resistance, or "SPT blow count." If a total of 50 blows were struck within any 6-inch interval, the driving was stopped and the blow count was recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The enclosed Boring Logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on field classifications and supported by subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, boring logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. The boring logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.

CLIENT:

Brown & Caldwell Consultants

Global Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

LEGEND

B-01 Boring Number and Approximate Location

A-01 Geophysics seismic line

DWN BY:	JA
CHK'D BY:	JH
DATUM:	NAD83
PROJECTION:	N/A
SCALE:	AS SHOWN

PROJECT:

Westwater Water System Design
Blanding, UT

TITLE:

Site and Exploration Plan – Westwater Water System Design

REV. NO.:	
DATE:	01/19/2023
PROJECT NO:	2251700049
CONTRACT NO:	N/A
FIGURE NO:	1

C:\Users\jason.alcantar\Desktop\2251700049 Westwater Pipeline, Blanding UT\CAD\Site and Exploration Plan – 2251700049 Westwater Pipeline Blanding UT.dwg

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-01

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6154'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6154.0	0								SC		**CLAYEY SAND (SC)**, fine grained, dark brown, low plasticity, moist
					SS	15-30-35					
					SS	14-40-50/4"		6.1	CL-ML		**SILTY CLAY (CL-ML)**, fine grained, cemented material, pinkish, low plasticity dry
6149.0	5										End of Boring (EOB) @ 5' End of Sample (EOS) @ 6.5'
6144.0	10										
6139.0	15										
6134.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-02

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6135'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6135.0	0				A						Roadway surfacing 2"
					SS	10-17-17		9.7	ML		**SILT (ML)**, fine grained, reddish brown, low plasticity, moist
6130.0	5				SS	12-16-17		7.6	CL-ML		**SILTY CLAY (CL-ML)**, fine grained, cemented white material, hard, brown, low plasticity, dry
											End of Boring (EOB) @ 4.5' End of Sample (EOS) @ 6'
6125.0	10										
6120.0	15										
6115.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
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Albuquerque, NM 87109

BORING LOG I.D.: B-03

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6111'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6111.0	0								ML		**SILT (ML)**, trace rock 2", fine grained, reddish brown, low plasticity, moist
					SS	7-8-9		5.2			
6106.0	5				SS	9-12-14					
					SS	14-17-20		5.6	CL-ML		**SILTY CLAY (CL-ML)**, fine grained, cemented white material, hard, brown, dry white cemented material @ 9'
6101.0	10				SS	16-26-28					
											End of Boring (EOB) @ 10' End of Sample (EOS) @ 11.5'
6096.0	15										
6091.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-04

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6101'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6101.0	0								ML		**SILT (ML)**, light brown, low plasticity, moist
				X	SS	10-50/4"		7.2			
				X	SS	50/3"				NR	whitish pulverized sandstone
6096.0	5										Auger refusal @ 3' moved 10' north (renamed B-04A) Auger Refusal @ 4.5' (B-04A) End of Boring (EOB) @ 4.5' End of Sample (EOS) @ 4.5'
6091.0	10										
6086.0	15										
6081.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
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Albuquerque, NM 87109

BORING LOG I.D.: B-05

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6125'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6125.0	0										Gravel surfacing 2" to 4"
									SC-SM		**CLAYEY, SILTY SAND (SC-SM)**, fine grained, hard, light reddish brown, low to med. plasticity, moist
					SS	12-17-17					
6120.0	5				SS	14-15-12		7.1	CL		**CLAY (CL)**, trace rock, fine grained, reddish brown, low plasticity, moist white streaks @ 5' and 10'
					SS	21-28-28		8.0			
6115.0	10				SS	15-50/4"					End of Boring (EOB) @ 10' End of Sample (EOS) @ 10.25'
6110.0	15										
6105.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-06

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6131'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6131.0	0										Gravel surfacing 2" to 4"
									SC-SM		**CLAYEY, SILTY SAND (SC-SM)**, fine grained, hard, reddish brown, low plasticity, moist
					SS	9-15-22		4.1			white streaks @ 3.5'
6126.0	5				SS	18-32-50/3"		5.8	SC		**CLAYEY SAND (SC)**, fine grained, reddish brown, medium plasticity, moist
											whitish pulverized sandstone
											End of Boring (EOB) @ 5'
											End of Sample (EOS) @ 6.5'
6121.0	10										
6116.0	15										
6111.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-08

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6143'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6143.0	0								SC-SM		**CLAYEY, SILTY SAND (SC-SM)**, fine grained, hard, light reddish brown, low plasticity, moist
					SS	27-40-50/3"		5.6			
											SPT attempt @ 3.5' bedrock
					SS	50/3"					End of Boring (EOB) @ 5'
6138.0	5										End of Sample (EOS) @ 6.5'
6133.0	10										
6128.0	15										
6123.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

WSP Gobal Inc.
4221 Ballon Park Rd. N.E.
Albuquerque, NM 87109

BORING LOG I.D.: B-09

PROJECT:	Westwater Water System Design	**PROJECT LOCATION:**	Blanding, UT (Navajo Nation)
LOGGED BY:	Jacob Hays	**PROJECT FEATURE:**	N/A
DRILLER:	N/A	**WOOD PROJECT #:**	22-517-00049
DRILLER FIRM:	Integrity Drilling	**STATION/OFFSET:**	N/A
RIG I.D.:	N/A	**REFERENCE:**	N/A
RIG TYPE:	CME-55	**COORDINATES:**	N/A
BORING TYPE:	N/A **BORING DIA.:** N/A	**COORDINATE SYS:**	N/A
ORIENTATION:	N/A	**SURFACE ELEV. (FT):**	6143'
HAMMER TYPE:	N/A	**VERTICAL DATUM:**	N/A
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:		**COMPLETION DATE:**	11/08/2022 **COMPLETION TIME:** N/A
START DATE:	11/08/2022 **START TIME:** N/A		

Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
6143.0	0								SC	grinding @ 2.5'	**CLAYEY, SILTY SAND (SC-SM)**, fine grained, dark brown, low to med. plasticity, moist
					SS	27-50/2"					whitish pulverized sandstone
6138.0	5										End of Boring (EOB) @ 2.5' End of Sample (EOS) @ 4'
6133.0	10										
6128.0	15										
6123.0	20										

GROUNDWATER

	DEPTH(ft)	HOUR	DATE
▽	none		
▼			
▼			
▼			

METHOD _____

A - Drill cuttings / Hand Sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery
EOB - End of Boring
EOS - End of Sample

APPENDIX

B

LAB PROCEDURES AND RESULTS

APPENDIX

Appendix B – Laboratory Testing Procedures and Results

This appendix describes procedures associated with the laboratory tests WSP assigned for this project. Geotechnical laboratory testing was performed by a local, accredited geotechnical testing laboratory, subcontracted to WSP. Results of certain laboratory tests are enclosed in this appendix.

Visual Classification Procedures

Visual soil classifications were conducted on all samples in the field and on selected samples in the laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs contained in Appendix A.

Moisture Content Determination Procedures

Moisture content determinations were performed on representative samples to aid in identification and correlation of soil types. All determinations were made in general accordance with ASTM D-2216. The results of these tests are shown on the exploration logs contained in Appendix A.

Grain-size Analysis Procedures

A grain-size analysis indicates the range of soil particle diameters included in a particular sample. Grain-size analyses were performed on representative samples in general accordance with ASTM D-422. The results of these tests are presented on the enclosed grain-size distribution graphs and were used in soil classifications shown on the exploration logs contained in Appendix A.

Client: Brown & Caldwell Consultants
6975 Union Park Center, Suite 490
Murray, UT 84047

Attn: Corwin Wilmore

Project Name: Westwater Water System Design

Blanding, UT

PO Number: 07192022

Project Manager: Jacob Hays

Report Date: November 21, 2022

Project #: 22-517-00049
Report #: 2493
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 11/8/2022

SOILS / AGGREGATES

MOISTURE CONTENT OF SOIL (ASTM D2216-19) AND IN-SITU DENSITY

Lab #	Color & Type of Material	Sample Source	Test Method	Oven Temp. (C)	Mass less than Min Req.	Material Type *	Moisture (%)	Dry Density (pcf)
22-0466-02	See Boring Log	B-01 @ 5.0-6.5'	B	60	☐	☐	6.1	
22-0466-03	See Boring Log	B-02 @ 0.5-2.0'	B	60	☐	☐	9.7	
22-0466-04	See Boring Log	B-02 @ 4.5-6.0'	B	60	☐	☐	7.6	
22-0466-05	See Boring Log	B-03 @ 2.5-4.0'	B	60	☐	☐	5.2	
22-0466-06	See Boring Log	B-03 @ 7.5-9.0'	B	60	☐	☐	5.6	
22-0466-07	See Boring Log	B-04 @ 2.5-4.0'	B	60	☐	☐	7.2	
22-0466-08	See Boring Log	B-05 @ 5.0-6.5'	B	60	☐	☐	7.1	
22-0466-09	See Boring Log	B-05 @ 7.5-9.0'	B	60	☐	☐	8.0	
22-0466-10	See Boring Log	B-06 @ 2.5-4.0'	B	60	☐	☐	4.1	
22-0466-11	See Boring Log	B-06 @ 5.0-6.5'	B	60	☐	☐	5.8	
22-0466-12	See Boring Log	B-08 @ 2.5-4.0'	B	60	☐	☐	5.6	

***Sample contains more than one type of material.**

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

WSP USA Environment
& Infrastructure Inc.
4221 Balloon Park Rd
NE Albuquerque, NM
87109 Tel 5058211801
Fax

www.wsp.com

Client: Brown & Caldwell Consultants
6975 Union Park Center, Suite 490
Murray, UT 84047

Attention: Corwin Wilmore

Project Name: Westwater Water System Design

Blanding, UT

PO Number: 07192022

Project Manager: Jacob Hays

Report Date: November 18, 2022

Project #: 22-517-00049
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 11/8/2022

Sieve Analysis (ASTM C117-17/C136-19)
Plasticity Index (ASTM D4318-17)
Soil Classification (ASTM D2487-17)

SOILS / AGGREGATES

				Sieve Sizes																				Sieve Result are as Percent Passing.
Sample Location	Soil Class.	L.L.	P.I.	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4'	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	6"	12"	Lab Number
B-01 @ 5.0-6.5'	CL-ML	23	7	55	71	86	95	98	99	99	100														22-0466-02
B-02 @ 0.5-2.0'	ML	21	3	61	88	97	99	100																	22-0466-03
B-02 @ 4.5-6.0'	CL-ML	26	7	64	93	97	98	99	100																22-0466-04
B-03 @ 2.5-4.0'	ML	19	3	62	87	91	94	95	95	96	96	96		96	97	100									22-0466-05
B-03 @ 7.5-9.0'	CL-ML	20	4	64	93	97	99	100																	22-0466-06
B-04 @ 2.5-4.0'	ML	27	5	56	80	86	90	92	95	97	98	100													22-0466-07
B-05 @ 5.0-6.5'	CL	25	9	62	83	84	84	85	85	85	85	86		87	89	93	100								22-0466-08
B-05 @ 7.5-9.0'	CL	26	12	76	98	99	100																		22-0466-09
B-06 @ 2.5-4.0'	SC-SM	19	5	48	70	83	90	93	94	95	95	96		98	100										22-0466-10
B-06 @ 5.0-6.5'	SC	31	15	24	35	56	67	71	77	82	84	91		98	100										22-0466-11
B-08 @ 2.5-4.0'	SC-SM	23	6	32	49	78	92	98	99	99	99	100													22-0466-12

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Project Name: Westwater Water System Design

Blanding, UT

PO Number: 07192022

Project Manager: Jacob Hays

Report Date: November 18, 2022

Project #: 22-517-00049
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 11/8/2022

Sieve Analysis (ASTM C117-17/C136-19)
Plasticity Index (ASTM D4318-17)
Soil Classification (ASTM D2487-17)

SOILS / AGGREGATES

Lab Number	Sample Location	Soil Class.	L.L.	P.I.	D10	D20	D30	D50	D60	D70	CC	CU	Cmu
22-0466-02	B-01 @ 5.0-6.5'	CL-ML	23	7	0	0	0	0	0.092	0.146	0	0	0
22-0466-03	B-02 @ 0.5-2.0'	ML	21	3	0	0	0	0	0	0.094	0	0	0
22-0466-04	B-02 @ 4.5-6.0'	CL-ML	26	7	0	0	0	0	0	0.085	0	0	0
22-0466-05	B-03 @ 2.5-4.0'	ML	19	3	0	0	0	0	0	0.092	0	0	0
22-0466-06	B-03 @ 7.5-9.0'	CL-ML	20	4	0	0	0	0	0	0.085	0	0	0
22-0466-07	B-04 @ 2.5-4.0'	ML	27	5	0	0	0	0	0.083	0.112	0	0	0
22-0466-08	B-05 @ 5.0-6.5'	CL	25	9	0	0	0	0	0	0.097	0	0	0
22-0466-09	B-05 @ 7.5-9.0'	CL	26	12	0	0	0	0	0	0	0	0	0
22-0466-10	B-06 @ 2.5-4.0'	SC-SM	19	5	0	0	0	0.078	0.108	0.150	0	0	0
22-0466-11	B-06 @ 5.0-6.5'	SC	31	15	0	0	0.105	0.245	0.338	0.530	0	0	0
22-0466-12	B-08 @ 2.5-4.0'	SC-SM	23	6	0	0	0	0.153	0.195	0.248	0	0	0

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Infrastructure Inc.
4221 Balloon Park Rd NE
Albuquerque, NM 87109 Tel
5058211801
Fax

www.wsp.com

MOTZZ LABORATORY, INC.

Report: 944623
Reported: 12/1/2022
Received: 11/29/2022
PO: 22-0466

Laboratory Analysis Report

WSP USA Environment & Infrastructure Inc.
Jesse Boam
8519 Jefferson NE
Albuquerque, NM 87113

Project: 22-517-00049

Lab Number	Sample ID	
944623-1	Combined Boring Samples	22-0466

Test Parameter

Test	*Method*	*Result*	*Units*
Sulfate	AASHTO T290	3	ppm
Chloride	AASHTO T291	81	ppm

Client:	Brown & Caldwell Consultants 6975 Union Park Center, Suite 490 Murray, UT 84047	**Report Date:**	November 22, 2022
		Project #:	22-517-00049
		Work Order #:	1
Attn:	Corwin Wilmore	**Lab #:**	22-0466-01
Project Name:	Westwater Water System Design	**Sampled By:**	Jacob Hays
		Date Sampled:	11/8/2022
	Blanding, UT	**Visual Description of Material:**	See Boring Log
PO Number:	07192022	**Sample Source:**	Combined Boring Samples
Project Manager:	Jacob Hays	**SOILS / AGGREGATES**	

Determining Soil Resistivity Using the Two-Electrode Soil Box Method (ASTM G187-20)

Soil Resistivity: 2500 Ωcm

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Albuquerque, NM 87109 Tel
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Client:	Brown & Caldwell Consultants 6975 Union Park Center, Suite 490 Murray, UT 84047	**Report Date:**	November 22, 2022
		Project #:	22-517-00049
		Work Order #:	1
Attn:	Corwin Wilmore	**Lab #:**	22-0466-01
Project Name:	Westwater Water System Design	**Sampled By:**	Jacob Hays
		Date Sampled:	11/8/2022
	Blanding, UT	**Visual Description of Material:**	See Boring Log
PO Number:	07192022	**Sample Source:**	Combined Boring Samples
Project Manager:	Jacob Hays		

SOILS / AGGREGATES

pH of Soils (ASTM D4972)

Method Used: A

pH Value Tested In Water: 8.2

pH Value Tested in 0.01 M Calcium Chloride Solution:

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Tel 5058211801
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APPENDIX

C

GEOPHYSICS REPORT

SUPPLEMENTAL SUBSURFACE SITE CHARACTERIZATION

Westwater Pipeline Project
Near Blanding Utah
WSP Project No. 2251700049
Geolines Project No. NM-220044

Prepared for:

WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109

Attention: Mr. Jacob Hays, PE

Prepared by:

Geolines LLC
PO Box 52065
Albuquerque, NM 87181

Tel: (505) 250-0058
Email: zachary.rockhold@geolinesllc.com

SUBSURFACE SITE CHARACTERIZATION

Westwater Pipeline Project
Near Blanding Utah
WSP Project No. 2251700049
Geolines Project No. NM-220044

INTRODUCTION

Background

This Subsurface Site Characterization is intended to provide engineering properties of subsurface materials to WSP. This exploration was requested by Mr. Jacob Hays at three (3) array location, and is intended to supplement a geotechnical evaluation of the site by Wood.

SURFACE SESMIC EXPLORATION

Refraction Microtremor (ReMi) methods were used to calculate the average velocity of shear waves in materials underlying geophone array locations. Calculated average shear wave velocities over segments of the arrays were used to develop cross sections showing shear wave velocities v. depth.

Shear Wave Velocity Profiles

Refraction Microtremor (ReMi) techniques are routinely used to establish calculated average shear wave velocity of subsurface profiles to 100 feet depth for seismic design. ReMi is used to explore subsurface conditions to more than 1000 feet in oil and mineral exploration (Faster Better Shear Wave Velocity to 100 Meters Depth from Refraction Microtremor Arrays: John N. Louie, Seismological Laboratory and Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, Feb 27, 2001). The method can generally estimate shear wave velocities to within 20 per cent of measurements by direct methods such as down-hole surveys. The total depth of investigation varies with material type and seismic velocities. Two-dimensional cross sections are presented to 40 feet below existing grades. For most site conditions, resolution for bed thickness is usually 0.3 to 1 times the geophone spacing. In this exploration the geophone spacing, or distance between geophones, was ten feet for all Arrays.

Fieldwork

Surface wave measurements for ReMi analysis were obtained at three geophone array locations using a Seismic Source DAQ III Data Acquisition Link seismograph. Each geophone array consisted of 24, 10-Hz (nominal) Geospace Technologies p-wave geophones. Digital samples of surface waves under passive and active conditions were recorded at one and two millisecond intervals for events of 15 and 30 seconds duration, respectively, for ReMi analysis. After setting up each geophone array, about seven, 15 and 30 second events were recorded to obtain surface wave measurements under ambient conditions. After ambient conditions were recorded, about seven, 15 and 30 second active source recordings were obtained while striking the ground with a 12-pound sledgehammer about twice per second for about three seconds. The data collected from each array was reduced, processed and stacked. Useable data collected under active and passive conditions at each geophone array location are stacked, as some readings emphasize different portions of the total frequency spectrum available for analysis. Approximate array locations are shown with array beginnings and endings (Geophone 1 and 24) on Plates 1-1c, *Site Map* in Attachment 1.

Data Reduction and Results

Data collected from five overlapping segments of each array were analyzed to provide one-dimensional profiles of calculated shear wave velocities for materials underlying the geophone locations. The analytical segments included eight geophone spacings for the arrays. The analytical segments overlapped adjacent segments. In this investigation the overall geophone arrays consisted of 24 geophones. The one-dimensional profile developed for each array segment averages the calculated shear wave velocity of underlying materials over the length and depth of each segment.

The one-dimensional shear wave velocity profile and average shear wave velocities were modeled for each array data set using Optim Software's SeisOpt® ReMi™v4.0 software. The field data were reduced and processed by the software to produce a velocity spectrum by slowness-frequency (p-f) transformation of the records. Using the processed data, the software produces a p-f image and the normal-mode dispersion trend is identified. Frequency-velocity pairs comprising the dispersion curve are picked at the lower bounds of the trend of the high spectral ratio band identified in the p-f image.

To draw two-dimensional cross sections of shear wave velocities in materials underlying a geophone array, the one-dimensional profile from each segment is applied to the overall array length at the center of the analyzed segment. Two-dimensional cross sections showing the averaged results of shear wave velocity profiles developed as described are presented on Plates 3 through 5. One-dimensional profiles of shear wave velocities for analytical segments used to construct the cross sections are presented below the images shown on the plates.

The calculated average shear wave velocities shown on the plates presented in Attachment 1 can be used to estimate rippability of subsurface materials. The values shown in the tables for p-wave velocities are estimated by multiplying shear wave velocities by 1.75. When using charts developed by heavy equipment manufacturers to determine the applicability of a particular piece of equipment for excavation, the suggested practice is to multiply by 1.5 to 2 times the shear wave velocity shown on the profiles or cross sections in this report to enter the "seismic wave velocity" axis on the manufacturer's charts. The term "seismic wave velocity" used in most rippability charts provided by equipment manufacturers are compression or p-wave velocites.

Limitations of Refraction Microtremor Techniques and Assumptions

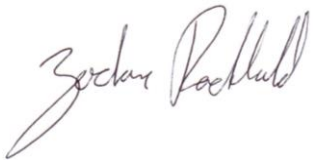
The ReMi analytical method presents solutions that are not necessarily unique. Application of averages over overlapping segments and inherent uncertainties from non-unique solutions suggest that indicated depths where velocity changes occur, and the calculated velocities shown should be considered approximate. The software used to evaluate surface wave measurements as presented in this report used some assumptions to facilitate the analysis. The bulk density of soils was assumed at 2 g/cc and a Poisson's Ratio of 0.3 is inherent in the calculations.

Closure

The information provided in this report is the result of remote sensing instruments and techniques. Data provided are approximate and should be considered supplemental to the overall characterization efforts performed by others.

Professional services for this project were performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this or similar localities. No warranties, express or implied, are intended or made.

Respectfully Submitted:



Zachary J. Rockhold
Project Manager

Reviewed By:

Otto C. Holmquist, PE
Principal Engineer

Attachment 1:
Plates

SUBSURFACE SITE CHARACTERIZATION

Westwater Pipeline Project
Near Blanding Utah
WSP Project No. 2251700049
Geolines Project No. NM-220044

Prepared for:

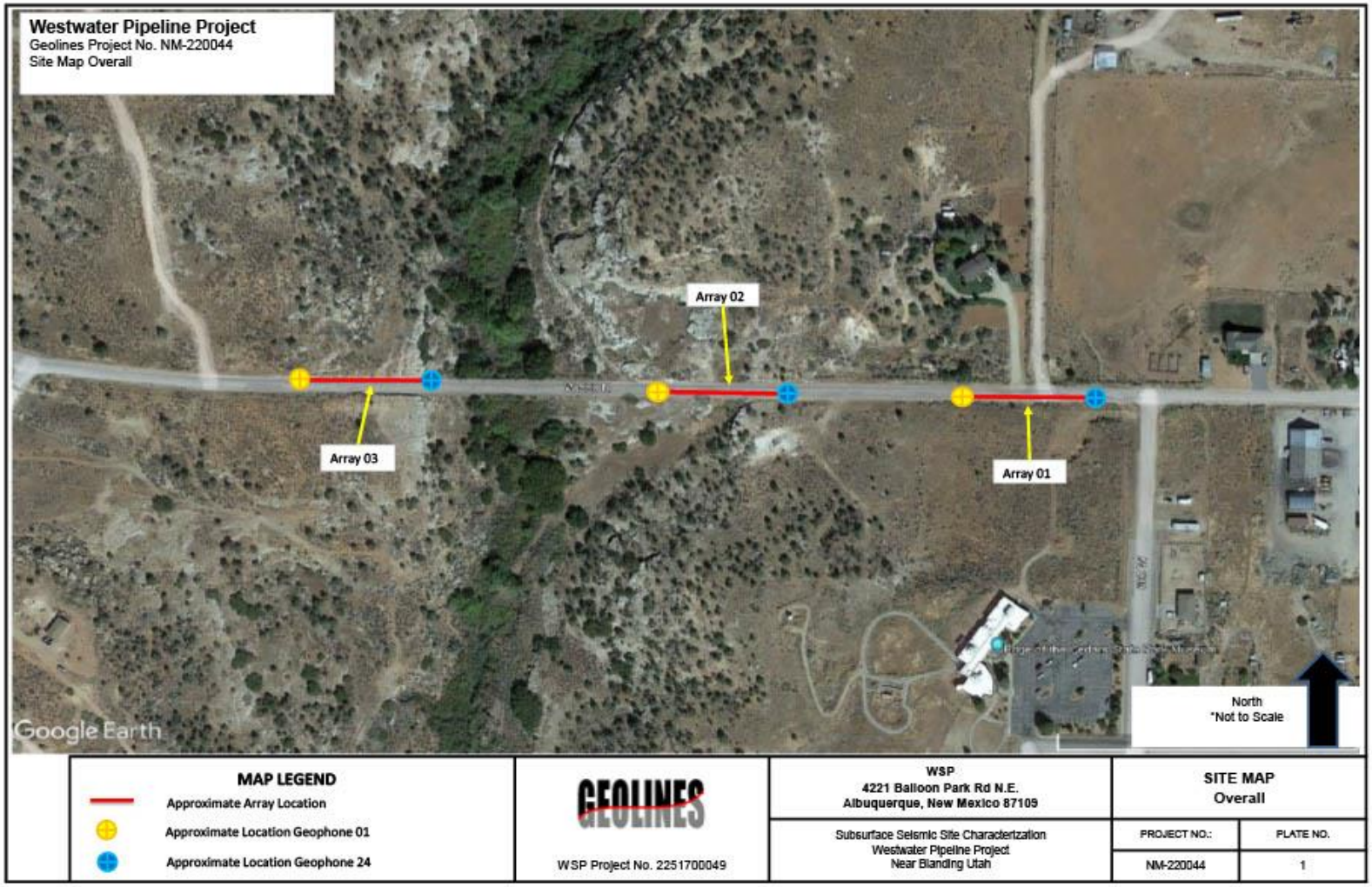
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109

Attention: Mr. Jacob Hays, PE

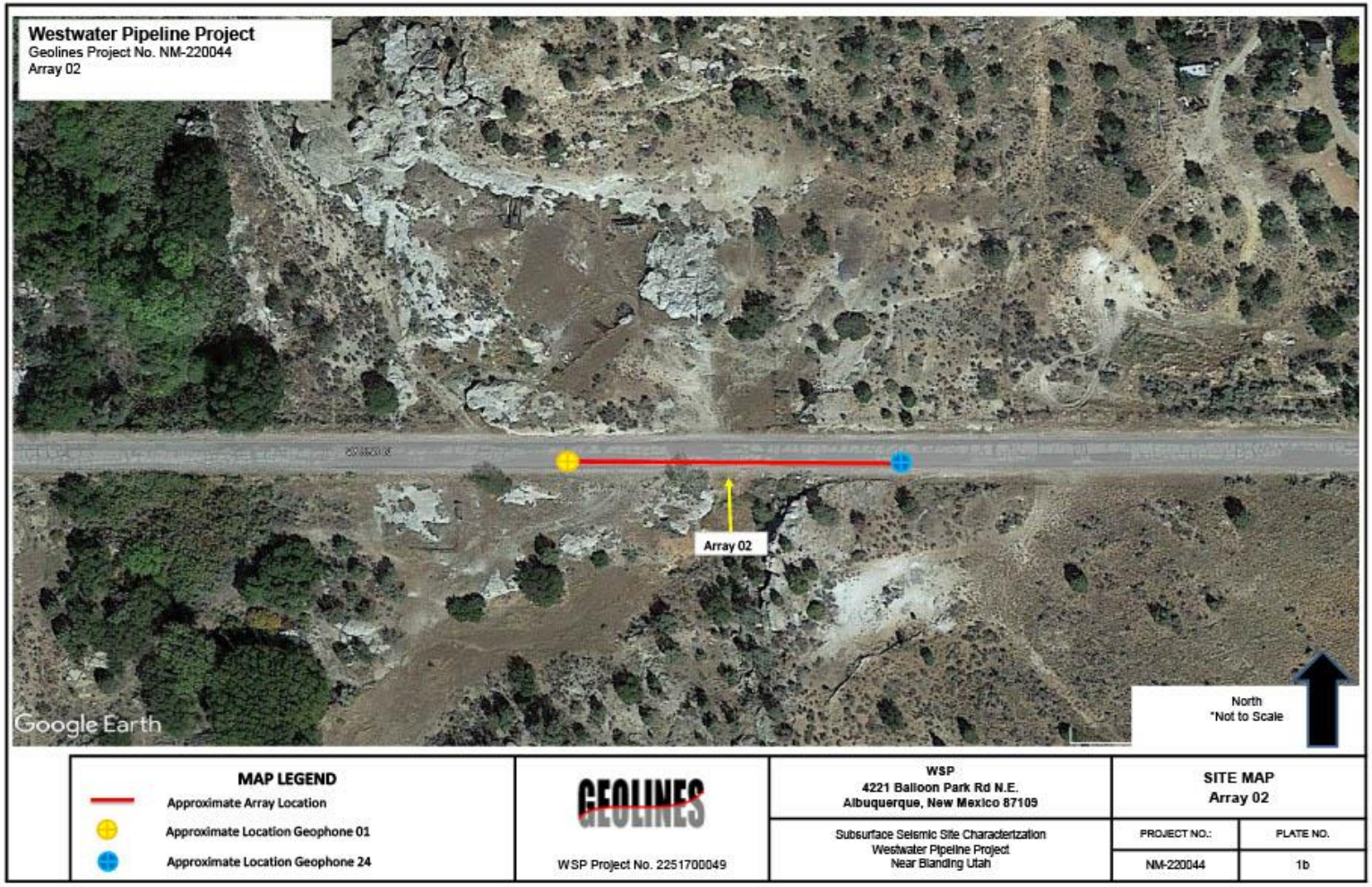
Prepared by:

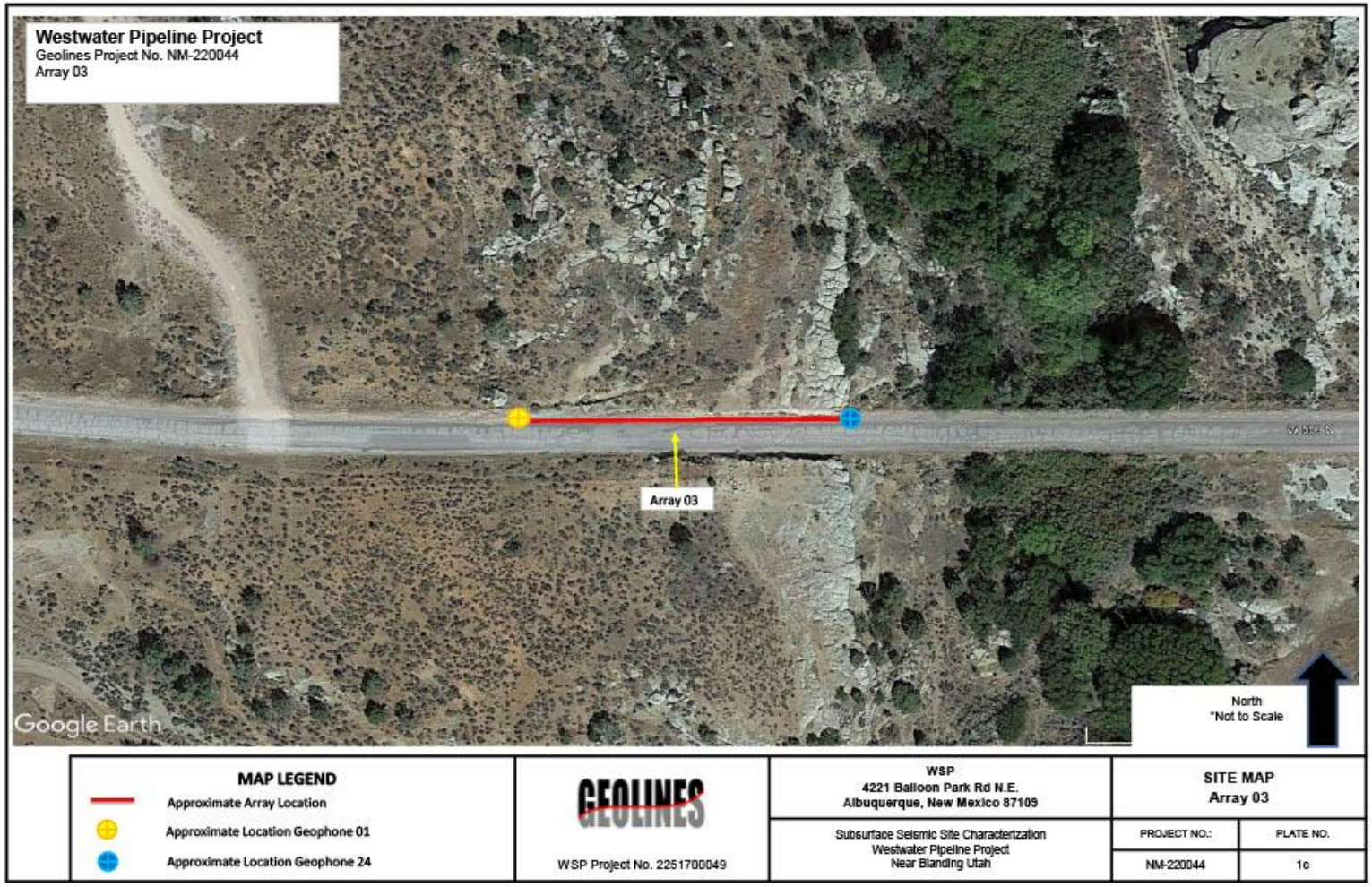
Geolines LLC
PO Box 52065
Albuquerque, NM 87181

Tel: (505) 250-0058
Email: zachary.rockhold@geolinesllc.com


Westwater Pipeline Project
Geolines Project No. NM-220044
Site Map Overall
Array 02
Array 03
Array 01
Google Earth
North
*Not to Scale
MAP LEGEND
Approximate Array Location
Approximate Location Geophone 01
Approximate Location Geophone 24
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
SITE MAP
Overall
PROJECT NO.:
PLATE NO.
NM-220044
1


Westwater Pipeline Project
Geolines Project No. NM-220044
Array 01
Array 01
Google Earth
North
*Not to Scale
MAP LEGEND
Approximate Array Location
Approximate Location Geophone 01
Approximate Location Geophone 24
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
SITE MAP
Array 01
PROJECT NO.:
NM-220044
PLATE NO.
1a


Westwater Pipeline Project
Geolines Project No. NM-220044
Array 02
Array 02
Google Earth
North
*Not to Scale
MAP LEGEND
Approximate Array Location
Approximate Location Geophone 01
Approximate Location Geophone 24
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
SITE MAP
Array 02
PROJECT NO.:
PLATE NO.
NM-220044
1b


Westwater Pipeline Project
Geolines Project No. NM-220044
Array 03
Array 03
Google Earth
North
*Not to Scale
MAP LEGEND
Approximate Array Location
Approximate Location Geophone 01
Approximate Location Geophone 24
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
SITE MAP
Array 03
PROJECT NO.:
NM-220044
PLATE NO.
1c

Global Positioning System Coordinates for Seismic Arrays

Project No.:	NM-220044
Project:	Subsurface Seismic Site Characterization Westwater Pipeline Project Near Blanding Utah
Date:	Thursday 12/15/2022
Comments:	General investigation area location provided by WSP. Acutal loactions of seismic lines adjusted based on field conditions. Endpoint coordinates provided by Geode Sub-Meter GPS manufractured from Juniper Systems, and map datum WGS84 was used.

Array Name	Array Orentation Geophone 1-24	Geophone Spacing (f)	Number of Geophones	Array Length (m)	Location Latitude/Longitude Latitude (Degrees)	Longitude (Degrees)	Comments
Array 01	W to E	10.00	24	230.00	37.632930°	-109.490089°	Geophone 01
					37.632932°	-109.489711°	Geophone 12
					37.632938°	-109.489304°	Geophone 24
Array 02	W to E	10.00	24	230.00	37.632915°	-109.492226°	Geophone 01
					37.632915°	-109.491853°	Geophone 12
					37.632920°	-109.491435°	Geophone 24
Array 03	W to E	10.00	24	230.00	37.632962°	-109.494714°	Geophone 01
					37.632966°	-109.494337°	Geophone 12
					37.632963°	-109.493927°	Geophone 24

GEOLINES

WSP Project No. 2251700049

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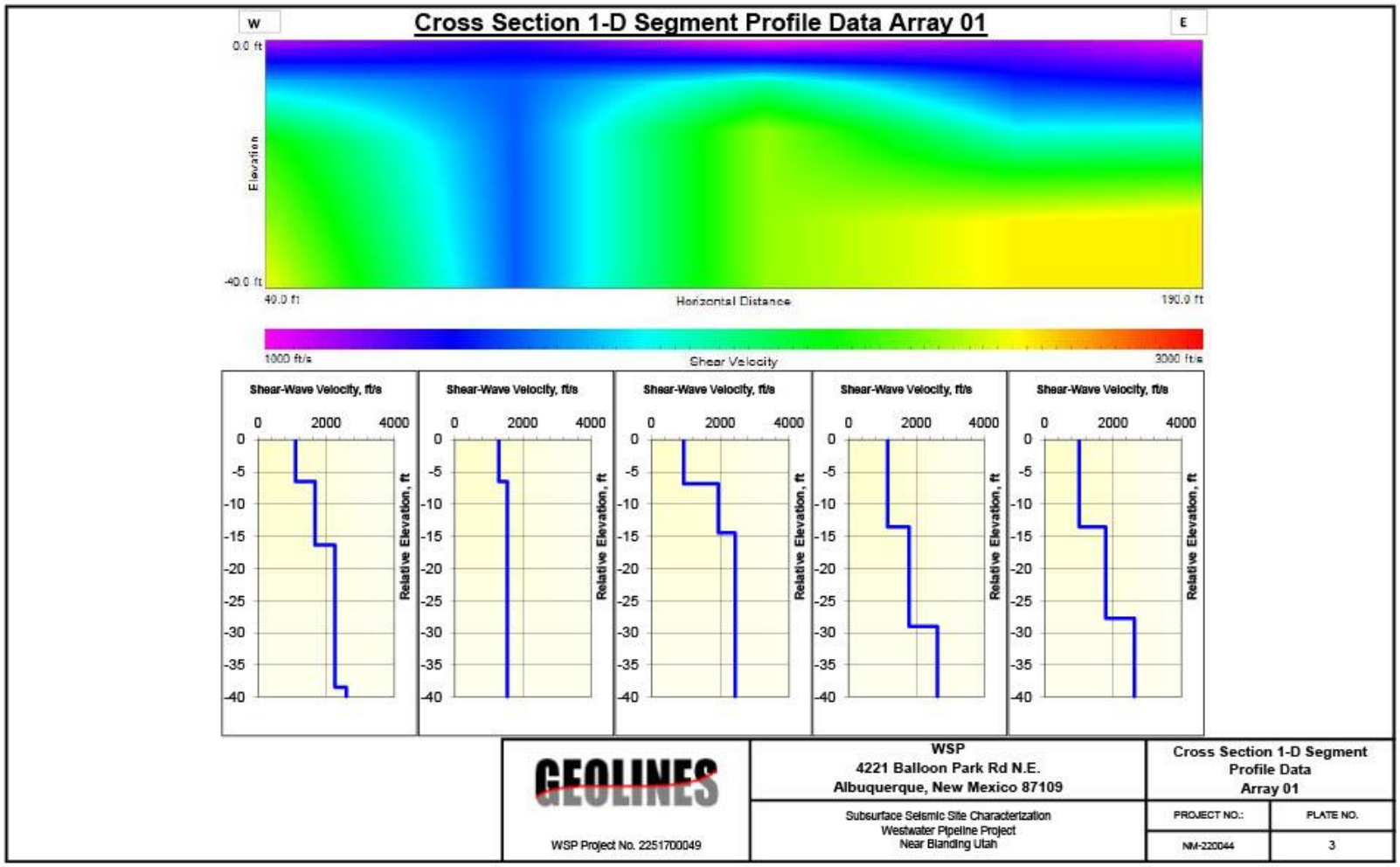
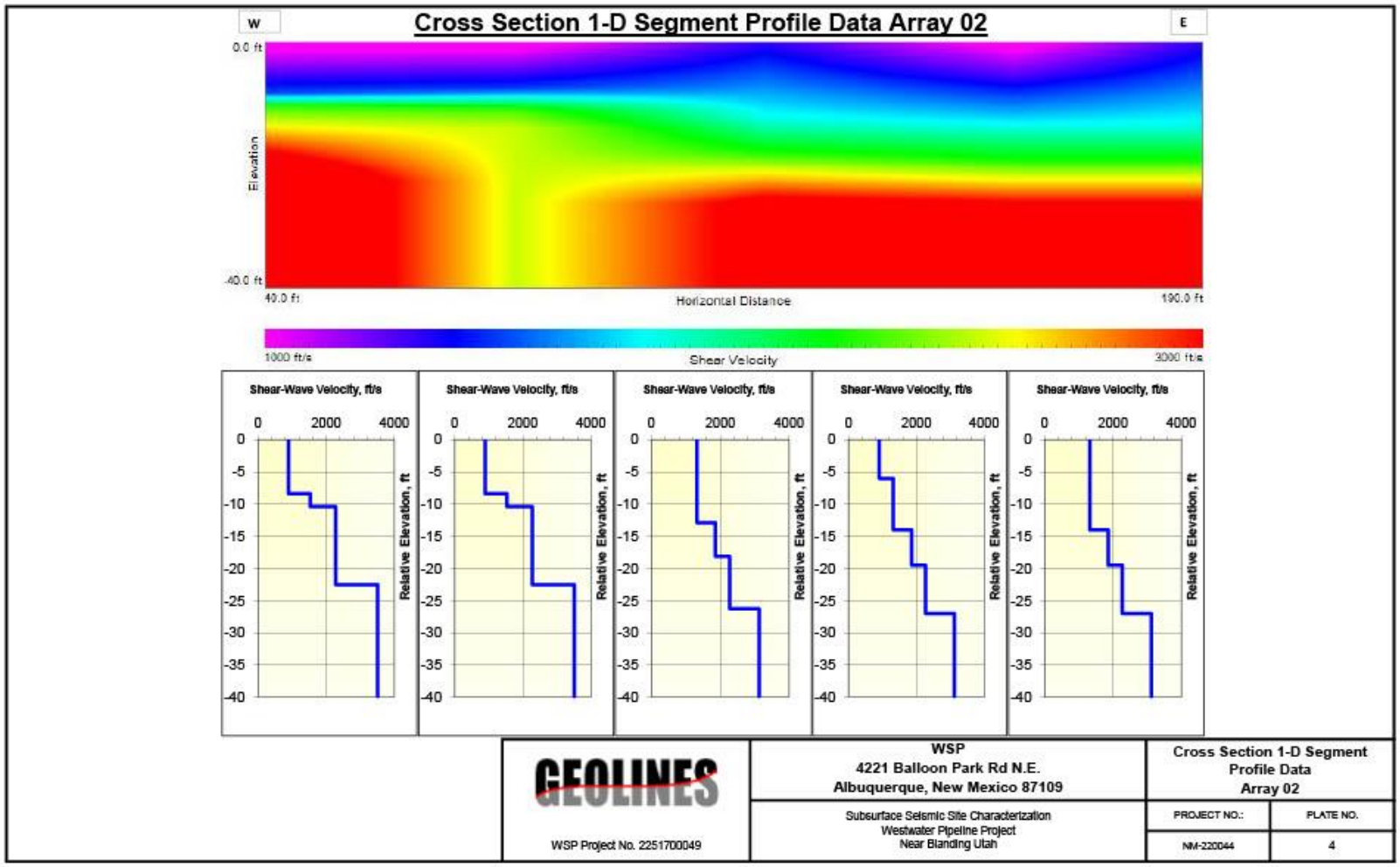
Albuquerque, New Mexico 87109

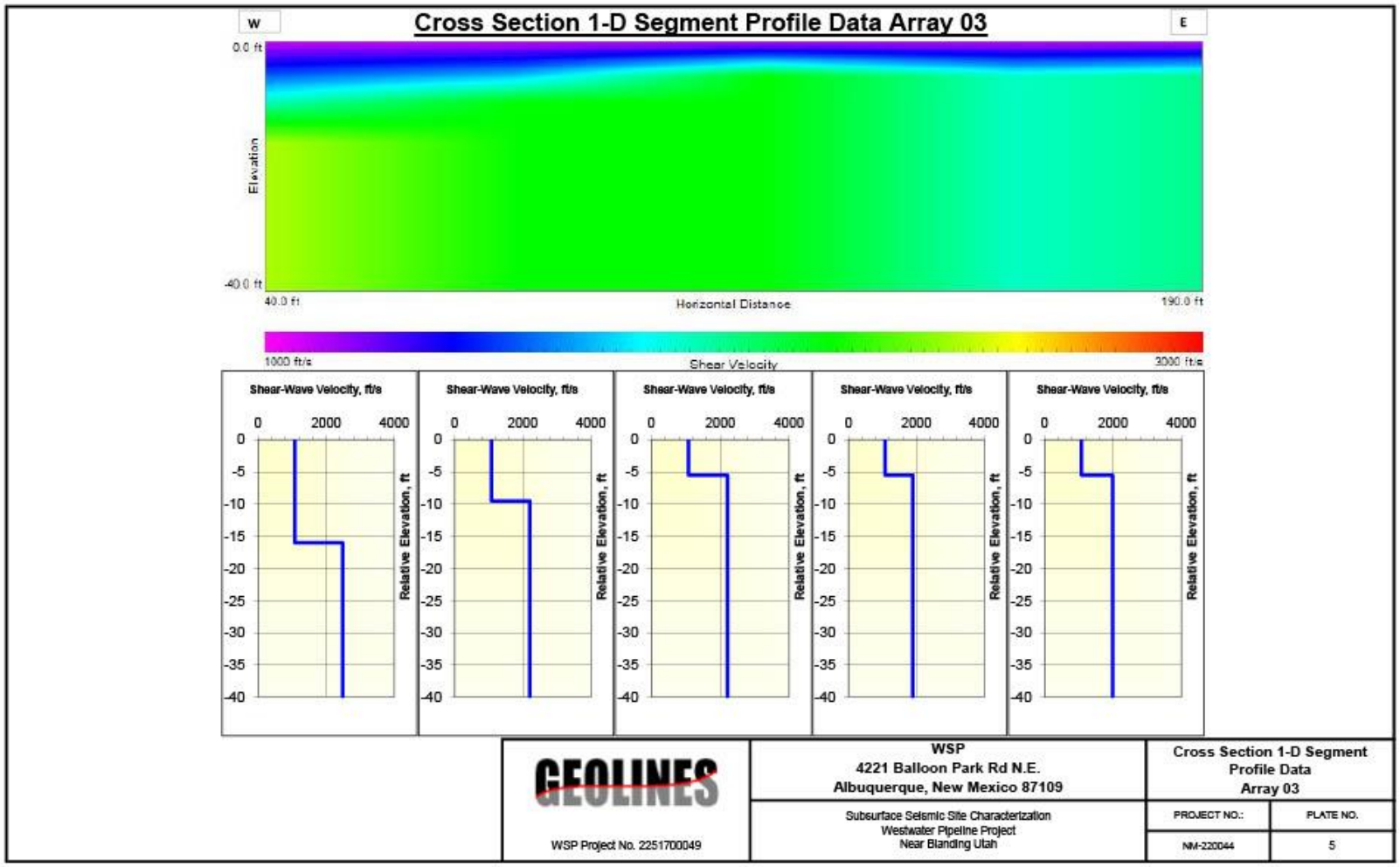
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah

GPS Data

PROJECT NO.:	PLATE NO.
NM-220044	2


Cross Section 1-D Segment Profile Data Array 01
W
E
0.0 ft
-40.0 ft
Elevation
40.0 ft
Horizontal Distance
190.0 ft
1000 ft/s
Shear Velocity
3000 ft/s
Shear-Wave Velocity, ft/s
0
2000
4000
0
-5
-10
-15
-20
-25
-30
-35
-40
Relative Elevation, ft
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
Cross Section 1-D Segment Profile Data Array 01
PROJECT NO.:
NM-220044
PLATE NO.
3


W
Cross Section 1-D Segment Profile Data Array 02
E
0.0 ft
Elevation
-40.0 ft
40.0 ft
Horizontal Distance
190.0 ft
1000 ft/s
Shear Velocity
3000 ft/s
Shear-Wave Velocity, ft/s
0
2000
4000
0
-5
-10
-15
-20
-25
-30
-35
-40
Relative Elevation, ft
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
Cross Section 1-D Segment Profile Data Array 02
PROJECT NO.:
NM-220044
PLATE NO.
4


Cross Section 1-D Segment Profile Data Array 03
W
E
0.0 ft
-40.0 ft
Elevation
40.0 ft
Horizontal Distance
190.0 ft
1000 ft/s
Shear Velocity
3000 ft/s
Shear-Wave Velocity, ft/s
0
2000
4000
0
-5
-10
-15
-20
-25
-30
-35
-40
Relative Elevation, ft
GEOLINES
WSP Project No. 2251700049
WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109
Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah
Cross Section 1-D Segment Profile Data Array 03
PROJECT NO.:
NM-220044
PLATE NO.
5

Array 1

Array 1D Segment	Geophone Segment	Horizontal Array Segment (feet)	Placement on array (feet from 0)	Depth Below Surface (feet) From	To	Calculated Shear Wave Velocity (Feet/second)	Estimated p-Wave Velocity (Feet/second)
Seg 1	1 to 9	0 to 80	40	0	6	1095	1916
				6	16	1671	2924
				16	38	2259	3953
				38	40	2585	4524
Seg 2	5 to 13	40 to 120	80	0	6	1294	2265
				6	40	1546	2706
Seg 3	9 to 17	80 to 160	120	0	7	935	1636
				7	14	1945	3404
				14	40	2431	4254
Seg 4	13 to 21	120 to 200	160	0	14	1152	2016
				14	29	1785	3124
				29	40	2625	4594
Seg 5	16 to 24	150 to 230	190	0	14	1152	2016
				14	28	1785	3124
				28	40	2625	4594

Array 2

Array 1D Segment	Geophone Segment	Horizontal Array Segment (feet)	Placement on array (feet from 0)	Depth Below Surface (feet) From	To	Calculated Shear Wave Velocity (Feet/second)	Estimated p-Wave Velocity (Feet/second)
Seg 1	1 to 9	0 to 80	40	0	8	892	1561
				8	10	1531	2679
				10	23	2273	3978
				23	40	3513	6148
Seg 2	5 to 13	40 to 120	80	0	8	892	1561
				8	11	1531	2679
				11	14	2273	3978
				14	40	2520	4410
Seg 3	9 to 17	80 to 160	120	0	13	1322	2314
				13	18	1861	3257
				18	26	2273	3978
				26	40	3125	5469
Seg 4	13 to 21	120 to 200	160	0	6	906	1586
				6	14	1322	2314
				14	20	1861	3257
				20	27	2273	3978
				27	40	3125	5469
Seg 5	16 to 24	150 to 230	190	0	14	1322	2314
				14	20	1861	3257
				20	27	2273	3978
				27	40	3125	5469

GEOLINES

WSP Project No. 2251700049

WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109

Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah

Velocity Tables
Arrays 1 and 2

PROJECT NO.:	PLATE NO.
NM-220044	6

Array 3

Array 1D Segment	Geophone Segment	Horizontal Array Segment (feet)	Placement on array (feet from 0)	Depth Below Surface (feet) From	To	Calculated Shear Wave Velocity (Feet/second)	Estimated p-Wave Velocity (Feet/second)
Seg 1	1 to 9	0 to 80	40	0	16	1075	1881
				16	40	2478	4337
Seg 2	5 to 13	40 to 120	80	0	10	1075	1881
				10	40	2206	3861
Seg 3	9 to 17	80 to 160	120	0	6	1075	1881
				6	40	2206	3861
Seg 4	13 to 21	120 to 200	160	0	6	1075	1881
				6	40	1896	3318
Seg 5	16 to 24	150 to 230	190	0	6	1075	1881
				6	40	1987	3477

GEOLINES

WSP Project No. 2251700049

WSP
4221 Balloon Park Rd N.E.
Albuquerque, New Mexico 87109

Subsurface Seismic Site Characterization
Westwater Pipeline Project
Near Blanding Utah

Velocity Table
Arrays 3

PROJECT NO.:	PLATE NO.
NM-220044	6a