RECLAMATION

Managing Water in the West

San Juan Lateral
Block 9-11

Navajo-Gallup Water Supply Project
New Mexico

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

SPECIFICATIONS

JUNE 2017

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U.S. Department of the Interior
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SPECIFICATIONS

JUNE 2017

SECTION C - DESCRIPTION/SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 33 - UTILITIES

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

DIVISION 51 – INFORMATION AVAILABLE TO OFFERORS

DIVISION 52 - DRAWINGS

DIVISION 53 - GEOLOGIC INVESTIGATIONS AND RECORDS

END OF SECTION

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

A. Work is located approximately between 12-40 miles north of Gallup, New Mexico, in San Juan and McKinley Counties, parallel to US 491.

1.02 PRINCIPAL COMPONENTS OF WORK

A. Provide: Approximately 28 miles of 42- to 48-inch water transmission pipe.

1. Valves, air valves, and blowoffs.
2. Wash crossings.
3. Jack and Bore Crossings

1.03 SPECIFICATIONS REQUIREMENTS

A. Requirements in Division 1, General Requirements, apply to Divisions 2 through 53.

B. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.

C. Where specifications are written in streamlined form, the words “shall be” are included by inference where a colon (:) is used within the sentence or phrase.

1.04 DEFINITIONS

A. When specifications use a word or term defined in the Federal Acquisition Regulations (FAR), definition of word or term shall be in accordance with FAR sections in effect at the time solicitation was issued.

1.05 ACRONYMS

A. The following acronyms apply to specifications Divisions 1 through 53:

1. CO: Contracting Officer.
2. COR: Contracting Officer’s Representative.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 14 10
USE OF SITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	Cleaning Manual	Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (Technical Memorandum No. 86-68220-07-05) 2012 Edition. Available online at: http://www.usbr.gov/mussels/prevention

1.03 SUBMITTALS

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

B. RSN 01 14 10-1, Land Use and Landscape Rehabilitation Plan:

1. Use site on ROW or easements.

a. Show use location and extent of impact. Uses include but are not limited to the following:

1) Buildings and service areas including onsite offices, shops, warehouses, storage areas, fuel and oil storage areas, and fabrication yards.

2) Parking areas, temporary roads, and haul routes.

3) Utilities including gas, air, power, and water lines; fire hydrants; and compressor station.

4) First-aid and medical facilities.

5) Concrete, CLSM and aggregate plants. Show sizes, rated capacities, and general features of aggregate processing plant including transporting, storing, screening, and washing facilities; concrete batching and mixing plant; and concrete conveying, placing, and concrete washouts.

6) Areas for processing, storing, and disposing of waste materials from construction operations.

7) Temporary fences.

b. Describe methods to preserve, protect, and repair, vegetation (such as trees, shrubs, and grass) and other landscape features on or adjacent to jobsite, which are not to be removed and which do not interfere with work required under this contract. Include methods to mark work area limits, protect disturbed areas, and prevent erosion.

c. Describe methods to protect and repair, existing improvements and utilities at or near jobsite.

d. Describe methods for removing temporary structures and facilities, cleanup, and rehabilitating site after completion of construction activities.

2. Submit revised drawings of changes in use of Federal land made during design and erection stages or after use of Federal land is in operation.

1.04 PROJECT CONDITIONS

A. ROW or Easements as shown on drawings may be used for required construction facilities.

1. Refer to Staging Area drawing 1695-529-60163 for approved location of construction trailers.

B. When private land is used for construction facilities, or other construction purposes, make necessary arrangements associated with use of private land.

1. Prior to using land outside of ROW, obtain cultural and environmental approvals in accordance with Section 01 31 19 - Project Management and Coordination.

C. Location, construction, operation, maintenance, and removal of construction facilities on ROW or Easements will be subject to approval of COR.

D. Do not interfere with work of other contractors, Navajo Nation or Government in vicinity, or with reservations made by Government for use of such land.

E. See 01 51 00 – Temporary Utilities

F. Housing for construction personnel will not be permitted.

G. Natural Conditions:

1. Ambient Temperature Range: minus 30 degrees C to 40 degrees C.

2. Annual Average Precipitation: 8- to 12-inches

3. Altitude: 6,000 feet.

4. Wind:

a. Maximum sustained: 60 knots.

b. Maximum gust: 75 knots.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEANING

A. Construction Equipment:

1. In accordance with Cleaning Manual.
2. Before bringing on site, clean construction equipment, to remove dirt, vegetation, and other organic material to prevent introduction of noxious weeds, and invasive plant and animal species.
3. Contractor cleaning procedures shall result in equipment and vehicles being cleaned as well or better than procedures described in Cleaning Manual.
4. COR will inspect construction equipment following procedures described in Cleaning Manual before allowing equipment onsite.

3.02 RESTORATION

A. Restore Contactor use areas to pre-construction condition.

B. Restore temporary construction roads to original contours and make impassable to vehicular traffic when no longer required.

C. After completion of work, regrade and scarify Easements and ROWs used for construction purposes and not required for completed installation so that surfaces blend with natural terrain and are in a condition that will facilitate revegetation, provide proper drainage, and prevent erosion.

END OF SECTION

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SECTION 01 31 19
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions posted at: www.usbr.gob/ssle/safety/RSHS/rshs.html

1.03 SUBMITTALS

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

B. RSN 01 31 19-1, Written Summary:

1. Written weekly summary of upcoming work, traffic plans and progress meeting minutes.

C. RSN 01 31 19-2, Off ROW Land Use Coordination:

1. Show expanded use location and extent of impact.
2. Request cultural approvals.
   a. In accordance with Section 01 57 90 - Preservation of Historical and Archeological Data.
3. Request or revise Environmental Permits. In accordance with:
   a. Section 01 57 20 – Environmental Controls.
   b. Section 01 57 30 – Water Pollution Control.
   c. Section 01 57 50 – Tree and Plant Protection.
   d. Section 01 57 60 – Protected Species.
4. Do not use proposed land until approved by COR.
   a. Approvals may require up to 6 months.
5. Requirement does not apply to existing commercial facilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. No time extension shall be granted for Contractor's use of land outside Construction Easement.

3.02 PROJECT COORDINATION

A. Coordinate work with COR, other Bureau of Reclamation (Reclamation) staff, Bureau of Indian Affairs, and other local, state and Federal Agencies as needed.

1. Navajo Nation Water Code Administration and Navajo Nation Environmental Protection Agency.
2. City of Gallup
3. Oil and Gas Companies.
4. Electric Companies.
5. Environmental Services Contractor.
6. Navajo Tribal Utility Authority.
7. Navajo Nation Department of Fish and Wildlife.
8. Cultural Resources Contractor.

B. Facilitate on-site work with above listed agencies.

C. 48-Hour Look Ahead Notification:

1. Provide COR, via email, and phone with a 48 hour notice when Cultural Resource Contractor is required. Contact information will be provided at preconstruction meeting.

3.03 MEETINGS

A. Following meetings are considered significant, but do not relieve Contractor from responsibility of other meetings required by contract.

1. Preconstruction Meeting.
    a. Meet with Government prior to start of construction. Provide, as a minimum, Project Manager or Project Superintendent for Preconstruction Meeting. Review will include, but may not be limited to:
        1) Use of premises by Contractor, Government, and public.

2) Construction facilities and controls.

3) Access to work and haul routes.

4) Temporary utilities.

5) Survey layout.

6) Security.

7) Housekeeping procedures.

8) Schedules and sequence of work.

9) Procedures for testing.

10) Procedures for maintaining record documents.

11) Special Site Requirements.

a) Archeological: Refer to Section 01 57 90 - Preservation of Historical and Archaeological Data.

b) Biological: Refer to Section 01 57 60 - Protected Species.

c) Environmental: Refer to:

i. Section 01 57 20 - Environmental Controls.

ii. Section 01 57 30 - Water Pollution Control.

12) Roles and responsibilities:

a) Government organization and personnel.

b) Contractor organization and personnel.

c) Subcontractors.

d) Proposed work schedule.

13) Contract requirements:

a) Progress payments.

b) Invoices.

c) Differing site conditions.

d) Changes.

e) Superintendence by Contractor.

f) Payment for mobilization and preparatory work.

g) Submittal procedures.

h) Emails, faxes, and telephone calls.

2. Preconstruction Safety Meeting:

a. Meet with COR prior to start of construction.

b. Review will include:

1) Safety requirements.

2) Monthly joint safety policy meetings.

3) Weekly toolbox safety meetings.

4) Safety program.

5) Job hazard analysis.

6) Required safety inspections.

7) Government will monitor Contractor's operations for compliance with RSHS.

3. Progress Meetings:

a. Meet weekly with Government to review:

1) Progress made.

2) Review As-built drawings.

3) Difficulties in performing work.

4) Resolution necessary to meet specifications requirements.

5) Status of contract documents (RFI's, submittals, etc.).

6) Three week look ahead.

7) Updating of progress reports.

8) Other items as determined by COR.

b. Develop meeting agenda and minutes, may be used as Written Summary.

END OF SECTION

SECTION 01 31 30
CONTRACT DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Contract Document Management System:

1. Payment: Lump sum price offered in Price Schedule 1.

1.02 DEFINITIONS

A. CDMS: Contract Document Management System.

1. Contract Documents include, but are not limited to:
   a. Specifications.
   b. Contract Drawings.
   c. Submittals.
   d. RFCs: Request for Change (Contractor generated document).
   e. RFIs: Request for Information (Contractor generated document).
   f. RFPs: Request for Proposal (Reclamation generated document).
   g. CMs: Contract Modifications.
   h. Contractor Proposals.
   i. Value Engineering Proposals.
   j. Bureau of Reclamation (Reclamation) Inspection Reports.
   k. Invoices and Progress Payments.
   l. Contract Schedules.
   m. Meeting Agendas and Meeting Minutes.
   n. Letters and Memos.

1.03 SUBMITTALS

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

B. RSN 01 31 30-1, Approval Data:

1. Documentation of system capabilities.
2. Instructions for system use.

C. RSN 01 31 30-2, Final Data:

DVD or CD of documents uploaded to CDMS.

1.04 QUALIFICATIONS

A. System provider: At least 5 years successful performance in providing required services.

1.05 CDMS REQUIREMENTS

A. CDMS shall be capable of generating, storing, tracking, categorizing, and managing Contract Documents.

B. Access:

1. Web-based:
    a. Contract Documents are stored and accessed by authorized individuals via an internet site.
    b. Compatible with web browsers MS Internet Explorer, Apple Safari, and Mozilla Firefox, Google Chrome.
2. Ability to upload Contract Documents and make available for user download in supported file formats, minimum:
    a. Adobe Acrobat.
    b. MS Word.
    c. MS Excel.
    d. MS Project.
    e. Oracle Primavera P6 Project Manager.
    f. Autodesk AutoCAD Civil 3D.
    g. Contract Manager.
3. Allow Contract Documents to be prepared by Contractor or by Government.
    a. Preparing organization will control access of documents. See Document Security and Backup paragraph below.
4. Contractor and Government shall each have a project manager for CDMS.
    a. Each project manager shall have capabilities to assign users within their organization and to assign user rights which control access to documents based on user class and document type.
    b. Each organization shall be capable of defining its access hierarchy.
    c. Inclusion of users will be prerogative of organizational project manager.
    d. Government shall be able to create and modify project properties (i.e., Contractor, project location, description, bid amount, project directory, etc.)

5. Email notifications shall be automatically sent to selectable users when new documents are submitted and available for viewing, or alerts are generated. Examples:
    a. Updates to project information (e.g., entry of a new submittal);
    b. Changes to project information (e.g., approval of a submittal);
    c. Alerts (e.g., submittal under review for >15 days without action).
6. Ability to link files; examples:
    a. RFP linked to a CM.
    b. Submittal linked to a Specification or Drawing.

C. Reports:

1. CDMS shall generate reports that list and sort documents by status; examples:
    a. Submittals that have been approved.
    b. Invoices paid to date.
    c. RFIs under review.
2. Generate alerts when documents requiring action approach or exceed allowable time.
3. Generate customizable summary reports; examples include:
    a. Submittal Turn-around.
    b. RFI Turn-Around.
    c. CM Processing Turn-Around.
    d. Total CM costs.
    e. Total CM Request Exposure.
4. Reports shall be printable, exportable as searchable .pdf or printer friendly HTML, and exportable to Excel, XML, or CSV.
5. Ability to link from an item in a report directly to the item by clicking on it.
    a. For example: in a submittal report, clicking on a submittal that is 15 days old takes you directly to information on that submittal.
6. Capable of producing a complete and logically organized set of documents within CDMS in both .pdf and .xml format.

D. Document Security and Backup:

1. SSL encryption for secured data exchange between browser and server (Secure access to documents and information).
2. Allow document access security until authoring party chooses to share it with others.

a. Show parties that have access to a document.

b. Extent of document sharing shall be determined by authoring party.

c. Once documents are shared, track documents so that changes cannot occur without a record of changes.

3. Backup/Archiving to FTP site of documents to which an organization has access on a regular (minimum monthly) basis.

4. Documents shall be downloadable to FTP sites where Government and other organizations can each access their own data confidentially.

E. General Tracking and Control:

1. Documents shall be grouped into categories (Submittals, RFI, RFP, CM, Payments, Daily Inspection Reports, Meeting Minutes).

2. CDMS shall track:

a. When documents were received or returned, as well as status of documents (e.g. Under Review; or Returned, Approved or Rejected, etc.).

3. Document changes including who entered or changed document and date change was made.

4. When a reviewer has opened an item.

F. Submittal Tracking and Control:

1. Ability to create master list of submittals ("Schedule of Submittals".)

2. Customizable standard submittal form for entering information:

a. Required information includes:

1) Required submittal number (RSN), title, description, and specification section.

b. Upload submittal data in electronic format.

3. Track date received, date response due, date returned, and status:

a. Status designations may be modified to fit Government standard designations – Approved, approved subject to identified changes, or not approved.

4. Supply Submittal Tracking form for Government to enter review comments and action taken. Allow customizing of submittal tracking form.

a. Allow for Government to route submittal to third parties (e.g., consultant, internal design or operations and maintenance groups, etc.) by generating design-review transmittals with each submittal package item, to track status of individual sub-items within submittal package, and to route each sub-item to the appropriate reviewers.

5. Ability to generate automatic notification after specified days without response.

G. RFI Tracking and Control:

1. Supply standard RFI form to enter information.
2. Ability to create or attach documents to the RFI form or links to other documents within CDMS.
3. Ability for Government to route RFI to appropriate reviewers and for reviewers to enter comments into standard response form.

H. Inspection Reports Tracking and Control:

1. Ability to attach Reclamation standard inspection and report forms into CDMS and ability to create customizable inspection forms in CDMS. Typical forms:
   a. Daily Inspection Report (DIR).
   b. Survey requests.
   c. Plant inspection reports.
   d. Testing reports.
2. Ability to link or attach photos to forms and link forms to other documents within CDMS.

I. Contract Modifications:

1. Supply standard Contractor Proposal form with ability to attach documents and link to other documents within CDMS.
2. Supply ability to upload Government's standard CM form and RFP forms, or create an acceptable alternative, to enter information.
3. Ability to attach documents to these forms, and link to other documents within CDMS.
4. Ability for Contractor to respond to RFP and CM form with Cost and Time impacts.
5. Ability to track date CM issued and date responded, with automatic notification after specified days without response.

J. Cost Tracking and Payment Request Management:

1. Ability to import payment bid items cost from a MS Excel spreadsheet.
2. Ability to edit percent complete and payment amount each month. Format to be spreadsheet, e.g. items available for editing at once, rather than needing to edit one item at a time, save, open next item and edit that, etc.

K. Correspondence:

1. Ability to generate letters and memos.
    a. Ability to attach documents to letters and memos, and to reference other documents within CDMS.
    b. Ability to automatically assign sequential numbers to letters and memos.
2. Ability to generate responses to letters and memos.
    a. System automatically generates memo suffixes; e.g., 1st response to Memo 32 to be 32.1, 2nd response to be 32.2, etc.
3. Official correspondence from Reclamation to Contractor shall contain Reclamation's official letterhead and corresponding logos.
4. Ability to generate meeting agendas and meeting minutes and to attach documents to the minutes.
    a. CDMS shall automatically assign sequential meeting numbers.

L. Miscellaneous Tracking and Controls:

1. Ability to generate logs tracking RFIs, CORs, COs, Submittals, Payments, Memos, DIR's, survey requests, plant inspection reports and testing reports.
2. Ability to filter logs based on criteria e.g., for Submittals: Specification Section, Days Out, Status (approved, partially approved, approved subject to identified changes and resubmit, or not approved.); for RFI's: Days out, Status (Open/Closed), Specification Section/Dwg No., and Responsibility/Ball-In-Court.
3. Ability to sort Logs based on a criteria; e.g., for Submittal, Specification Section, Days Out, Status, or other criteria determined by COR.
4. Ability to provide forms to match Reclamation's CM Form and Progress Payment Form or other forms when needed.
5. Ability to track Cost Exposure with links to RFI and CM requests.
6. Ability to measure productivity benchmarks on a project such as computing average review days for RFIs and submittals, categorize CMs, and track total CM percentages by category.
7. Ability for keyword search of documents in database.
8. Ability to allow online Payment Requests (electronic invoicing) by Contractor.

M. Budget and Funding Source Tracking:

1. Ability to enter funding sources and assign contract line items to multiple funding sources.

PART 2 PRODUCTS

Procore, as manufactured by Procore, www.Procore.com, or equal with the following essential characteristics: Capable of performing requirements of Part 1 and Part 3.

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. CDMS shall be in place and operating before Contractor transmits any Contract Documents, to Government, except RSN 01 31 30-1, Approval Data.

1. CDMS operation includes COR, or other authorized Government representative, having program control to assign users and user rights to Government personnel to access appropriate areas of the system.

B. Contractor shall input entrees to the Schedule of Submittals before making submittals. Include:

1. RSNs listed in Table 01 33 00A – List of Submittals.
2. Scheduled submittal date.

C. Contractor shall provide a report of submittal status monthly or as requested by COR. Submittal status report shall be in a table format and include:

1. Required Submittal Number (RSN).
2. Section Title.
3. Submittal Title.
4. Date Submitted.
5. Date of Response.
6. Approval Status (approved, partially approved, approved subject to identified changes and resubmit, or not approved.)
7. Days in Review.
8. Due Date.

D. CDMS shall be operational until final project closeout.

END OF SECTION

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SECTION 01 32 10
CONSTRUCTION PROGRAM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Developing Baseline Schedule: Include in lump sum price offered in Price Schedule 1 for Mobilization and Preparatory Work.
2. Updating and Using Construction Program: Include as part of Contractor's overhead.

1.02 DEFINITIONS

A. Schedule: Critical Path Method (CPM) of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and critical path of project.

B. Project Calendar(s): Cross reference of numerical work days with calendar days. Project calendars serve as the basis for day/date conversion and assign work days and non-workdays.

C. Resources: Equipment, labor or crews, materials, subcontractors, fabricators, manufacturers, and consultants.

D. Out of Sequence Work: An activity that starts before its predecessor activities are completed.

1.03 REFERENCE STANDARDS

A. Associated General Contractors of America (AGC)

1.	AGC Manual-04	Construction Planning and Scheduling Manual 2004

1.04 SUBMITTALS

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

1. Furnish database files in format compatible with Oracle Primavera P6 Professional Project Management.
2. Furnish schedule and analysis data on DVD or USB drive.
3. Upon request, provide information and data used to develop and maintain the Construction Program to CO and COR.

B. RSN 01 32 10-1, Representative Information:

1. Designation of authorized representative and COR to develop and maintain Construction Program. Include resume with training and experience.

C. RSN 01 32 10-2, Baseline Schedule:

1. Include:

a. Construction Program/Schedule database.

b. Definition of project calendars.

c. Primavera layout file (.plf).

d. Gantt chart (Bar chart) for project on 11- by 17-inch prints and in portable document format (.pdf).

e. Activity report including logic constraints consisting of predecessors, successors, and constraint dates.

f. Tabular listings of resources and resource limitations used to produce baseline schedule. Correlate resources with schedule assumptions and offered price. Resource listings may be independent of schedule database.

g. Narrative explanation of project schedule development. Include impacts of resource limitations and weather conditions on project schedule development. Include planned number of work hours per day and hours per day for subcontractors.

D. RSN 01 32 10-3, Updated Schedule Reports:

1. This submittal is required for a proper invoice for progress payments in accordance with the clauses at FAR 52.232-27 – Prompt Payment for Construction Contracts and WBR 1452.232-82 – Other Invoice Requirements.

2. Include:

a. Construction Program database with updated activity and milestone data.

b. Definition of project calendars if revised from baseline calendars.

c. Primavera layout file (.plf).

d. Gantt chart for project on 11- by 17-inch prints and in portable document format (.pdf).

e. Narrative report specifically stating status of project:

1) When negative float exists, cite specific actions and conditions which caused "behind schedule" condition and provide proposed course of action to complete project within specified delivery time. When float changed from previous month’s updated schedule, explain reason for change.

2) List of Contractor-initiated changes to current schedule stating reason for action taken and unresolved issues relating to Construction Program. Government reserves right to reject Contractor-initiated changes to current schedule which negatively impact Government action which was initiated on basis of current schedule.

3) Discuss contract milestones and significant activities that were started, continued, or completed during the update period or scheduled during the next update period.

f. Submittal Register:

1) List submittals as listed in Table 01 33 00A.

2) Update Submittal Register monthly to include submittals and revised submittal. Register fields shall include RSN name and number, date submitted, date of response, status (e.g., approved, partially approved, approved subject to identified changes and resubmit, or not approved).

3) This register document is separate from scheduling database.

E. RSN 01 32 10-4, Time Impact Analysis:

1. Include:

a. Construction Program database with proposed revised activity and milestone data.

b. Proposed revised schedule due to change or delay. Highlight added, changed, or deleted activities.

c. Primavera layout file (.plf).

d. Gantt chart for project on 11 by 17-inch prints(s) and in portable document format (.plf).

e. Narrative report explaining results and conclusions.

1.05 QUALIFICATIONS

A. Representative: Experienced in developing and maintaining construction schedules and knowledgeable of activities and progress on-site to develop and maintain accurate and reliable schedules.

1.06 GENERAL

A. Develop, maintain, and use Construction Program to plan, monitor, evaluate, and report accomplishment of work.

1.07 SCHEDULES

A. Prepare construction schedules using Critical Path Method outlined in AGC Manual. Use a computer software program to perform mathematical analysis of scheduling data.

1. Prepare schedule based on required sequence and interdependence of activities. Logically sequence activities.

2. Prepare detailed activity network for accomplishing required work organized by Work Breakdown Structure (WBS). Utilize WBS in lieu of activity codes for organization of schedule. If activity codes are utilized in addition to WBS, use unique activity code names assigned as project codes rather than global codes.

3. Activities except "Award" shall have predecessor activities and activities except "Contract Complete" shall have successor activities.

4. Meet contract requirements; milestone(s) in accordance with the clause at FAR 52.211-10, Commencement, Prosecution, and Completion of Work; and relevant clauses and specification sections. Include interim milestone dates, Government interface dates, contract completion date, and other time or seasonal constraints specified in contract documents.

5. Include work of subcontractors, Government interfaces, and contract milestones.

6. Adjust Construction Program/schedule for seasonal weather conditions. Provide a narrative explaining the expected weather and plan for incorporation in schedule. Consider work influenced by high or low ambient temperatures or precipitation. Utilize Primavera P6 calendars to depict historical weather days that impact work. Assign weather calendars to work impacted by weather.

7. Define activities to level of detail resulting in their durations being no greater than 20 workdays.

    a. Durations for administrative activities (e.g., submittals and reviews) fabrication, manufacturing, and typical level of effort activities (e.g., dewatering, storm water management) will not be subject to workday duration limitation.

8. Include separate activities for submittal preparation and submittal reviews when submittal addresses work that involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by COR. Assign Government submittal review activities to a seven-day calendar with durations as specified in Section 01 33 00 - Submittals. Include Required Submittal Number (RSN) in activity description.

9. Include separate activities for fabrication or manufacturing when work involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by COR.

10. Include contract title, contract number, and Contractor's name on transmittal cover sheet and each sheet of Gantt chart.

11. For each activity on Gantt chart, display activity identification number, activity description, planned or original duration, start date, finish date, total float, and calendar identification. Do not display early start and late start fields.

12. Include table of abbreviations used in the schedule, listed and defined alphabetically.

13. Use finish to start logic relationships between activities. Do not utilize start to start, finish to finish, or start to finish logic relationships. Do not use negative lead or lag times.

14. Use durations in units of whole workdays.

15. Provide best estimate of time required to complete activity considering quantity of work, work conditions, location of work, and planned resources for activity.

16. Equate durations of Government reviews and other identified actions to maximum number of calendar days specified in their respective paragraphs.

17. Establish workday calendar(s) and use these in the schedule to translate activity's workday duration into calendar dates. Use unique calendar names; do not use software default calendar names. Save calendars as project calendars, not global calendars.

B. Baseline Schedule:

1. Represents Contractor’s as-planned approach to accomplishing the work. Do not include actual start dates, percent completes, or actual finish dates.

C. Updated Schedule:

1. Meet monthly with COR at Government’s project office, or at a location approved by COR, to review progress made to end date of progress payment period. Establish dates that activities were started and completed and remaining duration for each activity started but not completed during the period:

   a. Discuss and mutually agree upon changes to the schedule.

   b. Out-of-sequence activities are not allowed. Revise logic to reflect change in work plan.

   c. Finalize updated Construction Program database with mutually agreed upon changes.

2. Following receipt of executed contract modification, incorporate activity data stipulated in modification into current schedule for inclusion in next scheduled progress update. Provide appropriate logic relationships for revised activities.

3. Assign a unique project file name for each schedule update.

1.08 TIME IMPACT ANALYSIS

A. Provide time impact analysis for contract changes (e.g., change order, proposed modification, or value engineering change proposal) to support a claim or request for equitable adjustment to the contract due to delay or accelerated schedule.

B. CO may use time impact analysis to determine if time extension or reduction to contract milestone dates is justified:

1. Time impact analysis is required for contract changes whether Contractor's current schedule milestone dates are the same as, earlier than, or later than, those required under the contract.

2. Changes, additions, or deletions to activities; activity durations; activity time frames; or activity predecessors and successors will not automatically determine that extension or reduction of contract time is warranted or due Contractor.

3. Time extensions for performance will be considered only to the extent that Contractor's current scheduled milestone dates exceed contract milestone dates.

C. Float is not for exclusive use by or benefit of either Government or Contractor.

D. Perform time impact analyses using data in most recent approved schedule update prior to change or delay event:

1. Prepare proposed revised schedule and narrative description describing and highlighting changes or delays.

2. Prepare summary comparing results of two schedule analyses: One using current schedule data from last approved updated schedule prior to event requiring analysis, and one using proposed schedule data incorporating changes or delays:

a. Show contract milestones and activities whose periods of performance have shifted as result of change which affects production and/or manufacture schedules, material orders, construction seasons, and labor and/or equipment utilization.

b. For activities directly affected by change or delay, include the current and proposed items:

1) Activity description.

2) Types and quantities of major pieces of equipment, principal manpower, and pacing materials (materials that affect activity start, duration, or finish).

3) Activity duration.

4) Narrative containing rationale used in developing the proposed logic relationships and activity data.

c. Data date for impacted schedule used in comparison shall be the same as approved updated schedule data date.

d. Base schedule comparisons on status of work and available float at time CO directs or proposes change to the work, Contractor submits a value engineering change proposal, or when a delay occurs as shown in approved updated schedule.

1.09 REVIEW AND EVALUATION

A. Baseline Schedule:

1. Within 21 calendar days after receipt of baseline schedule:

a. CO will approve or not approve proposed baseline schedule.

b. Upon request from CO, meet with COR for a joint review of proposed baseline schedule.

c. If schedule is not approved, revise and resubmit within 7 calendar days following date of rejection letter.

2. Do not proceed with onsite work, except mobilization and surveying, until baseline schedule has been approved by Government.

B. Updated Schedules:

1. Government will require 21 calendar days after receipt of each monthly updated schedule to review and approve or not approve updated schedule.

2. Submit updated schedule at time of submission of each invoice request for progress payment.

3. If updated schedule is not approved, revise and resubmit updated schedule within 7 calendar days following date of rejection letter.

C. Failure to include elements of the work in schedules will not release Contractor from completing required work under the contract.

D. Performance will be evaluated by Government using approved CPM schedules.

1.10 FAILURE TO COMPLY

A. Failure to comply with requirements of this Section shall be grounds for determination by CO that Contractor is not prosecuting the work with sufficient diligence to ensure completion within specified time.

B. CO may terminate Contractor's right to proceed with the work, or separable part of it, in accordance with default terms of this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME Y14.1-12	Decimal-inch Drawing Sheet Size and Format

B. National Institute of Building Sciences (NIBS)

1.	NIBS NCS-14	United States National CAD Standards, Version 6

1.03 DEFINITIONS

A. Days: Calendar days.

B. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.

C. Submittal Types, as listed in Table 01 33 00A - List of Submittals:

1. A - Action:
   a. Government will respond as to adequacy of submittal.
   b. Action Submittals: Considered “shop drawings” within terms of the clause at FAR 52.236-21 - Specifications and Drawings for Construction.
2. I - Informational:
   a. Government will acknowledge receipt of Informational submittals.
   b. Government may reject an Informational submittal when submittal does not comply with contract. Contractor shall correct mistakes or deficiencies in rejected Informational submittals and resubmit.
   c. Informational Submittals: Considered “shop drawings” within terms of the clause at FAR 52.236-21 - Specifications and Drawings for Construction, except that approval by Government is not required.

1.04 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.
3. Measurement units: US Customary Units.
    a. Provide a unique transmittal number for each submittal.

C. Drawings:

1. Minimum identification in title block:
    a. Contract number and title.
    b. Contractor's or supplier's title and drawing number.
    c. Date.
2. Reserve 3- by 3-inch space next to title block for review stamps.
3. Print Size: D size (22-inches by 34-inches) as defined by ASME Y14.1.
4. Draw to scale using computer drafting or drafting equipment, unless otherwise specified.
    a. Computer drafted drawings:
        1) In accordance with NIBS NCS.
        2) Electronic file format: Compatible with AutoCAD, Version 2015 or later.
        3) Compile using "eTransmit" utility in AutoCAD.
    b. Drawing prepared with drafting equipment, when allowed: Lettering shall be neat.
5. Drawings designated as "Government Format" in specifications:
    a. Computer drafted.
    b. Government will provide an electronic AutoCAD format template.
    c. Title block and sheet format:
        1) As shown on standard drawing 40-D-7102.
        2) Government will provide template.
        3) Government will provide specific title block information to be used.

6. Final drawings:
    a. Computer drafted.
    b. Government will provide an electronic AutoCAD format template.
    c. Show as-built changes, including revision dates, made during installation. Indicate changes by clouding.
7. Electronic Files: On CD or DVD discs.

D. Product Data:
1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets.
    a. Identify manufacturer's name, type, model, size, and characteristics.
    b. Illustrate that product or equipment meets requirements of specifications.
    c. Mark items to be furnished in a manner that will photocopy (no highlighter).
    d. Strike through items that do not apply.

E. Certifications:
1. Certifications by a Registered Professional: Signed and sealed by registered professional.
    a. Not required for non-design work.
2. Manufacturer’s Certifications: Signed by authorized representative of manufacturer.

F. Manuals:
1. Copies:
    a. Printed copies: Bound and indexed.
    b. Electronic copies: Searchable Adobe pdf on CD or DVD discs.
        1) Bookmark longer files to assist in navigating file.
        2) Electronic files may be submitted as separate parts of a manual. After each separate electronic file is approved, compile each approved electronic file to assemble an entire manual which shall be consistent with a single final manual submittal.
2. Contents:
    a. Parts identification lists, lists of special tools, and accessories.
    b. Schematics and wiring diagrams.

c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.

d. As-built drawings, photographs, and test records or reports by specifications.

G. Photographs:

1. Include negatives, or digital files on CD or DVD in .jpeg or similar format.

1.05 SUBMITTALS PROCEDURES

A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.

B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01 33 00A - List of Submittals. A complete set includes listed items for RSNs with multiple parts.

C. Submit sets specified in "Sets to be sent:" columns in Table 01 33 00A - List of Submittals.

1. Submittals identified with "CDMS" in "Sets to be sent" column shall be submitted electronically in accordance with Section 01 31 30 - Contract Document Management System.

D. Include the following information in transmittal letters:

1. Contract number and title.
2. RSN for each attached submittal.
3. Responsible code.
4. Number of sets for each RSN.
5. Identify submittal as initial or resubmittal.

E. Resubmittal of submittals not approved:

1. Mark changes such that they are readily identifiable and show revision date.
2. Describe reasons for significant changes in transmittal letter.
3. Resubmit returned submittals within 28 days after receiving comments, unless otherwise directed.
4. Requirements for initial submittals apply to resubmittals.

1.06 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 28 days for review of each submittal or resubmittal, unless otherwise specified.

2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through return mailing postmark date.

B. Time in Excess of Specified:

1. CO may extend contract completion date to allow additional time for completing work affected by excess review time.

   a. Time extension will be to extent that excess review time caused delay to contract completion date.

   b. Time extension will not exceed time used in excess of specified number of days for review of submittals or resubmittals.

   c. Concurrent days of excess review time resulting from review of 2 or more separate submittals or resubmittals will be counted only once in extending contract completion date.

2. No time extension will be allowed if Contractor fails to make complete action submittals in sequence and within time periods specified.

3. Adjustment for delay will be made only to extent that:

   a. Approval was required under the contract, and,

   b. Requests for approval were properly and timely submitted and were approved.

4. Adjustment will be subject to terms of paragraphs (b) and (c) of the clause at FAR 52.242-14, Suspension of Work, however, no such delay shall be deemed to be a "suspension order" as the term is used in that clause.

5. Government will review a submittal and the first resubmittal at no charge.

   a. Review of subsequent submittals for the same RSN will be at Contractor's expense.

   b. At the sole discretion of CO, a non-refundable amount equal to the review charges will be deducted from contract price.

   c. Currently, charges vary between $74 and $116 per hour, depending upon complexity of submittal and level of expertise required to perform review.

C. Return of Submittals:

1. Return of submittals will be by CDMS response or hard copy, as applicable.

2. Action Submittals: 1 set of submittals required for action will be returned either approved, partially approved, approved subject to identified changes and resubmit, or not approved.

a. Revise and resubmit submittals not approved.

b. Do not change designs without approval of CO after drawings, documentation, and technical data have been approved.

3. Informational Submittals: Government will acknowledge Informational submittals.

a. Informational submittals will not be returned when they comply with specifications.

b. Informational submittals that do not comply with specifications may be returned for resubmittal or additional information may be requested.

c. Informational submittals that affect the critical path shown on the baseline schedule may be returned for resubmittal or additional information may be requested.

1.07 HARD COPY OF TRANSMITTALS

A. Addresses for codes listed in Table 01 33 00A - List of Submittals:

1. Contracting Officer, Bureau of Reclamation, Attn: UC-840, 125 South State St, Room 6107, Salt Lake City, UT 84138-1147.

2. Construction Engineer, Bureau of Reclamation, 1235 La Plata Hwy, Farmington, New Mexico, 87401.

3. Technical Service Center, Bureau of Reclamation, Attn: 86-68170, PO Box 25007, Denver CO 80225-0007; Express Mail Sixth and Kipling, Building 67, Room 152.

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01 33 00A - List of Submittals.

1. Responsible codes starting with "86-6" are located in the Technical Service Center. Send these submittals to the TSC address shown above.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not responsible code, but show "Sets to be sent" in Table 01 33 00A - List of Submittals.

D. When "Sets to be sent" is 0, send a copy of transmittal letter to that office.

E. Submittals required by specifications, but not listed in Table 01 33 00A - List of Submittals:

1. Submit in accordance with this section.

2. Submit to CE unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
I-1	Safety and Health (WBR 1452223-81)	Safety program	Submitted and accepted before commencing onsite work See section 3 of RSHS	A	CE	CDMS		
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 28 days before use of Federal land	A	CE	CDMS		
01 31 19-1	Project Management and Coordination	Written Summary	Monthly once on-site construction begins	I	CE	CDMS		
01 31 19-2	Project Management and Coordination	Off ROW Land Use Coordination	At least 6 months prior to use of land	I	CE	CDMS		
01 31 30-1	Contract Document Management System	Approval Data	7 days of after Award	A	TSC 86-68510	0	1	1
01 31 30-2	Contract Document Management System	Final Data	Within 14 days of completion of work	A	CE	0	2	2
01 32 10-1	Construction Program	Representative Information	Within 7 days after receipt of Notice of Award	I	CE	CDMS		
01 32 10-2	Construction Program	Baseline Schedule	Within 21 days after receipt of Notice to Proceed	A	TSC 86-68510	CDMS		
01 32 10-3	Construction Program	Updated Schedule Reports	Monthly or with Progress Payments	A	TSC 86-68510	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 32 10-4	Construction Program	Time Impact Analysis	Within 28 days after CO directs a contract change, with any proposal for a future modification, with any value engineering proposal, or with any request or claim for an equitable adjustment to the contract	A	TSC 86-68510	CDMS		
01 35 10-1	Safety Data Sheets	Complete LHM and SDS	At least 14 days before jobsite delivery of hazardous material	I	CE	CDMS		
01 35 10-2	Safety Data Sheets	Updated LHM and SDS	At least 14 days before jobsite delivery of hazardous material not previously listed	I	CE	CDMS		
01 35 20-1	Safety and Health	Emergency Action Plans Written Program and Training Records	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 20-2	Safety and Health	Job Hazard Analyses (JHA)	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 20-3	Safety and Health	Exposer Assessment Form	At least 30 days before beginning onsite work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 35 20-4	Safety and Health	Monthly Accident Summary Report	First day of each month. See paragraph 3.8 of RSHS.	A	CE	CDMS		
01 35 20-5	Safety and Health	Respirator User Documentation	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 20-6	Safety and Health	General Requirements for Hoisting Equipment	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 20-7	Safety and Health	Other Training Certificates, as applicable	At least 30 days before beginning onsite work	A	CE	CDMS		
01 35 22-1	First-Aid	Medical Facilities Plan	At least 28 days before beginning on-site construction	A	CE	CDMS		
01 35 30-1	Contractor‘s Onsite Safety Personnel	Resume	At least 28 days before beginning on-site construction	A	CE	CDMS		
01 35 30-2	Contractor’s Onsite Safety Personnel	Safety Inspection Reports	Once each week	I	CE	CDMS		
01 46 00-1	Quality Procedures	Contractor Quality control Plan (QC)	At least 28 days before beginning on site work	A	CE	CDMS		
01 46 00-2	Quality Procedures	Contractor’s Daily Report	No later than the end of the following work day	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 46 00-3	Quality Procedures	Quality Control Supervisor (QCS) Resume	At least 28 days before beginning on site work	A	CE	CDMS		
01 46 00-4	Quality Procedures	Contractor's Quality Testing Plan	At least 28 days before beginning on site work.	A	CE	CDMS		
01 46 00-5	Quality Procedures	Summary of Monthly Test Results	Monthly	A	CE	CDMS		
01 46 20-1	Testing Agency Services	Testing Agency Services Plan	At least 42 days before testing is required	A	CE	CDMS		
01 55 00-1	Vehicular Access and Parking	Pre-Construction Digital Recording	At least 21 days before beginning onsite work	A	CE	CDMS		
01 55 00-2	Vehicular Access and Parking	Post Construction and Post Repair Digital Recording	At least 21 days before release of final payment	A	CE	CDMS		
01 55 20-1	Traffic Control	Traffic Control Plan and Permit Applications	At least 70 days before affecting public traffic	A	CE	CDMS		
01 55 20-2	Traffic Control	Permits	At least 14 days before affecting public traffic	I	CE	CDMS		
01 56 10-1	Protection of Existing Installations	Plan for Protecting Existing Installations	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 56 15-1	Protection of Existing Utilities	Utility Owner Acknowledgment	At least 28 days before start of onsite construction work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 56 15-2	Protection of Existing Utilities	Utility Crossing Investigation	At least 28 days prior to submittal 33 11 10-2 Pipe Laying Diagrams	I	CE	CDMS		
01 56 15-3	Protection of Existing Utilities	Work Plan within Utility Easement	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 57 20-1	Environmental Controls	Copy of Applicable Air Quality Permit	At least 14 days before beginning on-site work	I	CE	CDMS		
01 57 30-1	Water Pollution Control	Updated Stormwater Pollution Prevention Plan (SWPPP)	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 57 30-2	Water Pollution Control	Spill Prevention Control and Countermeasure (SPCC) Plan	At least 28 days before delivery or storage of oil	A	CE	CDMS		
01 57 40-1	Pesticides	Pesticide Use Plan	At least 28 days before start of onsite construction work	A	CE	CDMS		
01 57 50-1	Tree and Plant Protection	Protection Plan	At least 28 days before beginning on-site work	A	CE	CDMS		
01 57 90-1	Preservation of Historical and Archeological Data	Alternate Use Area or Borrow Area	At least 6 months prior to use of land	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 71 20-1	Surveying	Surveying Plan	At least 28 days before beginning survey work	A	CE	CDMS		
01 71 20-2	Surveying	Resume	At least 28 days before beginning survey work; At least 28 days before personnel change	A	CE	CDMS		
01 71 20-3	Surveying	Accuracy Check Results	At least 28 days before beginning survey work	I	CE	CDMS		
01 71 20-4	Surveying	Completed and Reduced Survey Notes	Within 2 days of completing and reducing notes	I	CE	CDMS		
01 71 20-5	Surveying	Original Field Survey Books	Weekly	I	CE	CDMS		
01 71 20-6	Surveying	Quantity Survey Notes and Computations	Accompanying progress payment requests	I	CE	CDMS		
01 71 20-7	Surveying	Workday's Survey Notes	At conclusion of workday if requested by Government	I	CE	CDMS		
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Plan	Within 7 days of waste disposal	I	CE	CDMS		
01 74 00-2	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7 days of hazardous waste disposal	I	CE	CDMS		

Table 01 33 00A - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	At least 28 days before beginning environmental assessment	I	CE	CDMS		
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	Within 14 days of completion of work	I	CE	CDMS		
01 78 30-1	Project Record Documents	Final As-built Drawings	Within 14 days of completion of work	A	CE	CDMS		
						0	1	1
02 82 20-1	Removal and Disposal of Asbestos Containing Materials	Contractor Qualifications	At least 40 days before asbestos removal starts	I	TSC 86-8540	CDMS		
02 82 20-2	Removal and Disposal of Asbestos Containing Materials	Asbestos Hazard Abatement Plan	At least 40 days before asbestos removal starts	A	TSC 86-8540	CDMS		
02 82 20-3	Removal and Disposal of Asbestos Containing Materials	Emission Monitoring Results	Within 2 days after tests completed	I	TSC 86-8540	CDMS		
02 82 20-4	Removal and Disposal of Asbestos Containing Materials	Hazardous Waste Manifest	Within 15 days after disposal	I	TSC 86-8540	CDMS		
03 30 00-1	Cast-in-Place Concrete	Approval Data	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
03 30 00-2	Cast-in-Place Concrete	Concrete Placement Schedule	At least 20 days before start of concrete placement	A	CE	CDMS		
03 30 00-3	Cast-in-Place Concrete	Certifications	At least 28 days before start of onsite construction work	A	CE	CDMS		
03 30 00-4	Cast-in-Place Concrete	Cementitious Materials Certification and Test Reports	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		
03 30 00-5	Cast-in-Place Concrete	Test Reports	Within 2 hours of test results	A	CE	CDMS		
03 30 20-1	Concrete Reinforcing	Reinforcement Diagrams and Lists	At least 28 days before start of onsite construction work	A	CE	CDMS		
03 48 10-1	Precast Concrete Manholes	Approval Data	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		
03 63 00-1	Epoxy Grout	Approval Data	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		
07 21 20-1	Spray-On Insulation	Approval Data	At least 28 days before start of onsite construction work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
07 21 60-1	Insulation Jacket	Approval Data	At least 28 days before start of onsite construction work	A	CE	CDMS		
07 21 60-2	Insulation Jacket	Instructions	At least 28 days before start of onsite construction work	A	CE	CDMS		
09 96 20-1	Coatings	Approval Data	At least 28 days before start of onsite construction work	A	TSC 86-8540	CDMS		
09 96 20-2	Coatings	Final Approval Data	Within 28 days of final testing	A	TSC 86-8540	CDMS		
09 96 20-3	Coatings	Paint Chip Samples	At least 28 days before start of onsite construction work	A	CE	CDMS		
09 96 20-4	Coatings	Qualifications	At least 28 days before start of onsite construction work	A	TSC 86-8540	CDMS		
09 96 20-5	Coatings	Quality Control Plan	At least 28 days before start of onsite construction work	A	TSC 86-8540	CDMS		
09 96 20-6	Coatings	Contractor Quality Testing Report	Within 28 days of all coatings being applied	A	TSC 86-8540	CDMS		

Table 01 33 00A - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
10 14 26-1	Utility Markers	Utility Marker Plan	At least 28 days before start of onsite construction work	A	CE	CDMS		
23 33 13-1	Draft Control Damper	Approval Data	At least 28 days before start of onsite construction work	A	CE	CDMS		
23 33 13-2	Draft Control Damper	Final Data	Within 28 days of final testing	A	CE	CDMS		
26 42 10-1	Cathodic Protection and Corrosion Monitoring System	Certification and Data	At least 40 days before procuring materials	A	TSC 86-68540	CDMS		
26 42 10-2	Cathodic Protection and Corrosion Monitoring System	Interference Mitigation Method	At least 28 days before start of onsite construction work	A	TSC 86-68540	CDMS		
26 42 10-3	Cathodic Protection and Corrosion Monitoring System	Final Data	Within 28 days of final testing	A	TSC 86-8540	CDMS		
31 02 10-1	Water for Dust Abatement	Meter Calibration	At least 28 days before start of onsite construction work	A	CE	CDMS		
31 02 30-1	Dust Palliative	Proposed Application Area for Dust Palliative	At least 28 days before start of onsite construction work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

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** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
31 03 33-1	Removal of Water from Excavation	Removal of Water Plan	At least 28 days before start of onsite construction work	A	CE	CDMS		
31 23 02-1	Compacting Earth Materials	Test Results	Within 28 days of testing	A	CE	CDMS		
31 23 70-1	Controlled Low Strength Material (CLSM)	Approval Data for CLSM Produced Without Native Soil	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		
31 23 70-2	Controlled Low Strength Material (CLSM)	Approval Data for CLSM Produced with Native Soil	At least 28 days before start of onsite construction work	A	TSC 86-8530	CDMS		
31 23 70-3	Controlled Low Strength Material (CLSM)	Quality Control Test Results	Within 28 days of testing	A	CE	CDMS		
31 31 30-1	Soil-Supplied Herbicide	Use Plan	At least 28 days before start of onsite construction work	A	CE	CDMS		
31 31 30-2	Soil-Supplied Herbicide	Applier Certification	At least 28 days before start of onsite construction work	A	CE	CDMS		
32 15 10-1	Gravel Surfacing	Gravel Certification	At least 28 days before start of onsite construction work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
32 15 10-2	Gravel Surfacing	Geofabric Installation	At least 28 days before start of onsite construction work	A	CE	CDMS		
32 15 10-3	Gravel Surfacing	Geofabric Certification	At least 28 days before start of onsite construction work	A	CE	CDMS		
32 91 60-1	Erosion Control Blanket	Manufacturer's Information	At least 28 days before start of onsite construction work	A	CE	CDMS		
32 91 60-2	Erosion Control Blanket	Installation Plan	At least 28 days before start of onsite construction work	A	CE	CDMS		
33 05 21-1	Bored Utility and Road Crossings	Placement Plan	At least 28 days before beginning on-site work	A	CE	CDMS		
33 05 21-2	Bored Utility and Road Crossings	Material Certification	At least 28 days before beginning on-site work	A	CE	CDMS		
33 05 21-3	Bored Utility and Road Crossings	Copy of Application for Utility Permit	At least 28 days before beginning on-site work	A	CE	CDMS		
33 11 10-1	Pipeline General Requirement	Qualifications	At least 28 days before beginning on-site work	A	CE	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
33 11 10-2	Pipeline General Requirement	Pipelaying Diagrams	At least 28 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 10-3	Pipeline General Requirement	Filling and Testing Plan	At least 28 days before beginning on-site work	A	TSC 86-68140	CDMS		
33 11 10-4	Pipeline General Requirement	Floatation Prevention Plan	At least 28 days before beginning on-site work	A	TSC 86-68140	CDMS		
33 11 10-5	Pipeline General Requirement	Pipe Deflection Measurements	Within 14 days of completion of backfill	A	TSC 86-68140	CDMS		
33 11 10-6	Pipeline General Requirements	Connection to Reach 12A	At least 28 days before submittal of pipe laying diagram for end of Reach 11 Section	A	TSC 86-68140	CDMS		
33 11 12-1	Steel Line Pipe	Shop Drawings	At least 42 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 12-2	Steel Line Pipe	Ventilation Plan	At least 28 days before beginning on-site work	A	CE	CDMS		
33 11 13-1	Ductile Iron Pipe	Shop Drawings	At least 42 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 13-2	Ductile Iron Pipe	Commercial Products	At least 42 days prior to fabrication or procurement	A	TSC 86-68140	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
33 11 16-1	PVC Pressure Pipe	Shop Drawings	At least 42 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 16-2	PVC Pressure Pipe	Pipe Manufacture Certification	At least 40 days before procuring materials	A	CE	CDMS		
33 11 18-1	HDPE Pressure Pipe	Heat Fusion Joint Operator Qualifications	At least 40 days prior to beginning onsite work	I	CE	CDMS		
33 11 18-2	HDPE Pressure Pipe	Shop Drawings	At least 42 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 18-3	HDPE Pressure Pipe	Certification	At least 40 days before procuring materials	A	CE	CDMS		
33 11 18-4	HDPE Pressure Pipe	Fusion Procedures	At least 28 days prior to beginning on-site work	A	CE	CDMS		
33 11 19-1	Fiberglass Pipe	Qualification Reports	At least 28 days prior to beginning on-site work	A	TSC 86-68140	CDMS		
33 11 19-2	Fiberglass Pipe	Shop Drawings	At least 42 days before manufacture of pipe	A	TSC 86-68140	CDMS		
33 11 19-3	Fiberglass Pipe	Joint Repair Plan	At least 28 days before beginning on-site work	A	TSC 86-68140	CDMS		
33 21 95-1	Metal Piping for Line Pipe Installations	Shop Drawings	At least 28 days before beginning on-site work	A	TSC 86-68140	CDMS		

Table 01 33 00A - List of Submittals

* Submittal types A - Action, I - Information

** CO indicates Contracting Officer, CE indicates Construction Engineer, TSC indicates Technical Service Center

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No of sets to be sent to **		
						CO	CE	TSC
33 21 95-2	Metal Piping for Line Pipe Installations	Commercial Product Data	At least 28 days before beginning on-site work	A	TSC 86-68140	CDMS		
33 21 95-3	Metal Piping for Line Pipe Installations	Final Drawings	Within 14 days of completion of work	A	TSC 86-68140	CDMS		
						0	1	1
33 22 15-1	Valves and Equipment	Commercial Product Data	At least 28 days before beginning on-site work	A	TSC 86-68420	CDMS		
33 22 15-2	Valves and Equipment	Service Manuals	Within 13 days of completion of work	A	CE	CDMS		
						0	5	1
35 42 35-1	Bank Protection	Samples	At least 28 days before beginning on-site work	A	TSC 86-68240	CDMS		
35 42 35-2	Bank Protection	Certifications	At least 28 days before beginning on-site work	A	CE	CDMS		
35 42 35-3	Bank Protection	Field Verification of Wash Crossing Elevations	At least 28 days prior to submittal 33 11 10-2 Pipe Laying Diagrams	A	TSC 86-68240	CDMS		

END OF SECTION

SECTION 01 35 10
SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. LHM: List of Hazardous Materials.

B. SDS: Safety Data Sheet.

1. Referred to as Material Safety Data Sheets in the clause at 52.223-3, Hazardous Material Identifications and Material Safety Data - Alternate 1.

1.03 APPLICATION

A. For the purposes of this contract, “delivered under this contract” in paragraph (b) of the clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1, includes materials:

1. Delivered to Government.

2. Incorporated into work.

3. Materials used by Contractor during contract performance at jobsite.

1.04 SUBMITTALS

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

B. RSN 01 35 10-1, Complete LHM and SDS.

C. RSN 01 35 10-2, Updated LHM and SDS.

1. Comply with paragraph (e) of clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1.

1.05 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on original or previously updated LHM and SDS before receipt of updated LHM and SDS by CE.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 20
SAFETY AND HEALTH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

2. Form 7-2218 or other accepted form in accordance with paragraph 3.8 of RSHS.

B. Code of Federal Regulations (CFR)

1.	29 CFR Part 1910	Occupational Safety and Health Standards
2.	29 CFR Part 1926	Safety and Health Regulations for Construction posted at: www.OSHA.gov

C. National Fire Protection Association (NFPA)

1.	NFPA 1670	Standard Operations and Training for Technical Search and Rescue Incidents.

D. Navajo Nation Occupational Safety and Health Administration (NNOSHA)

1.	N.N.C Chapter 15	Navajo Nation Occupational Safety and Health Act of 2000. Contact: NNOSHA P.O. Box 1447 Window Rock, AZ 86515 Telephone: 928-871-6742 www.nnosha.org

1.03 PROJECT CONDITIONS

A. Comply with RSHS and CFR 1910.46 and NFPA 1670.

1. Including confined space rescue and equipment. Do not rely on local rescue.

B. Comply with NNOSHA regulation and direction when contract activities occur within the jurisdiction and boundary of the Navajo Nation.

C. Contractor shall maintain accurate records and complete reporting in accordance with RSHS requirements. For purposes of this contract, a serious accident or incident is defined as resulting in:

1. Fatality;
2. Hospitalization of three or more individuals; and/or
3. Property damage in excess of $250,000.

1.04 SUBMITTALS

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

B. RSN I-1, Safety Program:

1. Written safety program in accordance with RSHS.
2. Cover all aspects of onsite and applicable off site operations and activities associated with this contract.
3. Follow the outline in Appendix B of RSHS.
4. Will not be accepted for review by COR unless it addresses, in order, lettered and numbered per Appendix B, a narrative for each applicable item in the outline.
5. Generic company safety programs are not acceptable. Safety Program must be site specific for this contract.
6. Shall be submitted and accepted prior to commencing onsite work, including mobilization.
7. Safety Program Statement of Responsibility must state that "Contractor is responsible for ensuring that all work will be in compliance with Reclamation Safety and Health Standards and these specifications".

C. Submit the following supplements to, Safety Program in accordance with Section 01 33 00 - Submittals:

D. RSN 01 35 20-1, Emergency Action Plans Written Program and Training Records.

E. RSN 01 35 20-2, Job Hazard Analyses (JHA):

1. For each distinct phase of work under the contract.

F. RSN 01 35 20-3, Exposer Assessment Form:

1. If applicable.
2. Completed by a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP).
3. Available at: www.usbr.gov/pn/forms/ro-351.pdf

G. RSN 01 35 20-4, Monthly Accident Summary Report:

1. Form 7-2218 or other acceptable form in accordance with RSHS.

H. RSN 01 35 20-5, Respirator User Documentation:

1. Submit documentation of medical qualifications less than 12-months old for all respirator users at the site.
2. Submit results of fit tests less than 12-months old for all users of tight fitting negative pressure respirators at the site.

I. RSN 01 35 20-6, General Requirements for Hoisting Equipment:

1. Qualifications for all riggers and signalpersons.
2. Crane Operator Qualifications:
   a. Certifications for all crane and hoist operators.
   b. Physical Qualifications to operate a crane in accordance with RSHS.

J. RSN 01 35 20-7, Other Training Certificates, as applicable:

1. First Aid/CPR Training certifications for onsite foremen and/or safety personnel.
2. Proof of fall protection and prevention training for employees who work in elevated areas.
3. Proof of training for all contractor employees involved with confined space entry work.
4. Fall Protection and Rope-Access Work training certificates for Contractor rope team. Training shall be in accordance with RSHS Section 16.
5. Training certifications and experience for scaffolding competent person.
6. Training certifications and experience for excavation competent person.

1.05 SAFETY AND HEALTH

A. Contractor shall not require persons employed in the performance of this contract, including subcontracts, to work under conditions that are unsanitary, hazardous, or dangerous to the employee’s health or safety.

B. Provide and maintain a work environment and procedures that:

1. Safeguard the public and Government's personnel, and Contractor employees exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

C. Do not begin on site work, including mobilization, until COR accepts Safety Program.

D. Participate in Contractor Safety Program Review meeting prior to mobilization.

E. Minimum work crew shall consist of no less than two (2) people.

F. Develop Job Hazard Analyses for each distinct phase of work under the contract:

1. Do not begin a phase of work until a JHA is acceptable to COR and shared with construction employees.

2. Activities involving hazardous materials shall have appropriate Safety Data Sheet(s) attached to the JHA.

G. Comply with RSHS and 29 CFR 1926.

H. Correct safety and health violations identified by CO or COR.

I. When Contractor fails or refuses to correct a compliance directive, CO or COR may issue an order to stop all or part of work:

1. When satisfactory corrective action is taken, an order to resume work will be issued.

2. Contractor shall not be entitled to extension of time or to claim for damage or to additional compensation by reason of either the directive or stop order.

3. Failure of CO or COR to order discontinuance of Contractor's operations shall not relieve Contractor of responsibility for safety of personnel and property.

J. Maintain accurate record of and report to CO and COR the following occurrences during performance of this contract:

1. Any incidents, accidents and near misses as soon as reasonably possible, however no later than close of business the day of occurrence.

2. Death.

3. Occupational disease.

4. Traumatic injury to employees or public.

5. Property damage in excess of $2,500.

K. Rights and remedies of Government provided in this section are in addition to any other rights and remedies provided by law or under this contract:

1. In the event there is a conflict between requirements contained in RSHS, specification paragraphs, Contractor's approved Safety Program, referenced safety and health codes, and standards, or U.S. Department of Labor Construction Safety and Health Standards, promulgated under Section 107 of Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, the more stringent requirement shall prevail.

L. Provide appropriate safety barricades, signs, and signal lights.

M. Perform all training as required by Federal, State, Tribal and local regulations prior to any activity that requires it.

1. Training records must be submitted to COR upon request.
2. In no case shall an employee perform work until all required training is complete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 35 22
FIRST AID

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

1.03 SERVICE

A. First-aid and medical facilities: In accordance with Section 5 of RSHS.

B. Conform to most stringent requirement in cases of conflict between requirements of this section and requirements of RSHS.

C. Do not perform onsite work until first aid plans have been submitted, approved by CO, and implemented on site.

1.04 SUBMITTALS

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

B. RSN 01 35 22-1, Medical Facilities Plan:

1. Describe facilities for providing medical attention for injured or disabled employees.
2. Include onsite emergency facilities and ambulance service.

1.05 AVAILABILITY

A. Make facilities and services available for providing emergency aid to employees, subcontractor employees, Government employees, and public.

B. Provide services free of charge to Government employees injured on job.

C. Government employees not injured on job and public may be charged fees for rendered services based on reasonable and established fee rates.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 30
CONTRACTOR'S ONSITE SAFETY PERSONNEL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 SUBMITTALS

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

B. RSN 01 35 30-1, Resume:

1. Contractor's Onsite Safety Professional.

C. RSN 01 35 30-2, Safety Inspection Reports:

1. List noted deficiencies, their abatement dates, and follow-up action for jobsite activities.
2. Base inspection report on findings of jobsite walk-through with Government personnel.

1.03 QUALIFICATIONS

A. Contractor's Onsite Safety Representative:

1. Competent supervisory employee with appropriate level of safety related training and experience prior to start of the work.

1.04 APPLICATION

A. Designate an employee as Contractor's Onsite Safety Representative prior to start of construction.

1. Safety Professional requirements may be met by retaining appropriate level of services of an acceptable safety consultant.

B. Contractor's Onsite Safety Representative Authorities, Duties, and Responsibilities:

1. Responsible for effectively implementing Contractor's Safety Program.
2. Full authorization to correct unsafe acts on the spot.
3. Prepare safety inspection reports.
4. Onsite during construction activities.

1.05 QUALITY ASSURANCE

A. Contractor's Onsite Safety Representative:

1. Effectiveness of Contractor's Onsite Safety Representative in prosecuting the safety program will be subject to continued review and approval by CO.

2. Should Contractor's safety effort be considered inadequate, CO has option to require Contractor to employ a full-time qualified Safety Professional.

B. Safety Program:

1. Effectiveness of Contractor's Safety Program will be subject to continued review and approval by CO.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 42 10
REFERENCE STANDARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Referenced editions of standard specifications, codes, and manuals form a part of this specification to extent referenced.

B. These specifications take precedence when conflicting requirements occur between specifications and referenced standard.

1.03 JOBSITE REFERENCE STANDARDS

A. Maintain at fabrication site, access to referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by Government.

B. Maintain onsite, access to referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by Government.

1.04 AVAILABILITY

A. Code of Federal Regulation (CFR):

1. Available online, authorized by the National Archives and Records Administration (NARA) and the Government Printing Office (GPO), at www.gpoaccess.gov/cfr/index.html.

B. Federal Specifications, Standards, and Commercial Item Descriptions; and Military Specifications:

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service, see the provision at FAR 52.211-1, Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29.
2. Copies of Military Specifications may be obtained from Department of Defense, see the provision at FAR 52.211-2, Availability of Specifications, Standards, and Data Item Descriptions Listed in the Acquisition Streamlining and Standardization Information System (ASSIST).

C. Bureau of Reclamation Documents:

1. Reclamation Safety and Health Standards (RSHS), 2009 edition with revisions, may be downloaded at http://www.usbr.gov/ssle/safety/RSHS/rshs.html.

   a. Hard copies of RSHS, stock number 024-003-00204-6, may be purchased from The Superintendent of Documents at the U.S. Government Printing Office (GPO), phone number (202) 512-1800. Hard copies of RSHS are subject to revisions posted on the site shown above.

      1) GPO online bookstore:http://bookstore.gpo.gov/actions/GetPublication.do?stocknumber=024-003-00204-6.

2. Bureau of Reclamation Standard Specifications are designated with an M-number. Copies of individual standards may be obtained from Bureau of Reclamation, Attn: 86-68510, PO Box 25007, Denver CO 80225-0007. Specify standard(s) needed when requesting a copy.

3. Bureau of Reclamation manuals and other publications including significant scientific, technical, and engineering works are available from the National Technical Information Service (NTIS). Information regarding availability and pricing may be obtained by contacting NTIS at the following address:

   United States Department of Commerce
   National Technical Information Service
   5285 Port Royal Road
   Springfield, Virginia 22161
   Telephone: (703)487-4650 or 1-800-553-6847

D. Industrial and Governmental Documents:

1. When a reference has a joint designation (e.g. ANSI/IEEE) these specifications generally cite the proponent organization (e.g. IEEE).

2. Addresses for obtaining industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in Table 01 42 10A - Addresses for Specifications, Standards, and Codes.

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AA	Aluminum Association 1400 Crystal Drive Suite 430 Arlington, VA 22202 www.aluminum.org	703-358-2960

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AABC	Associated Air Balance Council 1518 K Street NW, Suite 503 Washington, DC 20005 www.aabc.com	202-737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Square, Suite 550Schaumburg, Illinois 60173-4268 www.aamanet.org	847-303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW., Suite 249 Washington, DC 20001 www.aashto.org	202-624-5800 800-231-3475
ABMA	American Bearing Manufacturers Association 2025 M. Street, NW, Suite 800 Washington D.C. 20036-3309 www.americanbearings.org	202-367-1155
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439 USA www.concrete.org	248-848-3700
AGC	Associated General Contractors of America 333 John Carlyle Street, Suite 200 Alexandria, VA 22314 www.agc.org	703-548-3118
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601-2001 www.aisc.org	312-670-2400
AISI	American Iron and Steel Institute 25 Massachusetts Ave., NW, Suite 800 Washington, DC 20001 www.steel.org	202-452-7100

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AMCA	Air Movement and Control Association International, Inc. AMCA International 30 W. University Dr. Arlington Heights, IL 60004 www.amca.org	847-394-0150
ANSI	American National Standards Institute 1819 L. Street, NW. Washington, DC 20036 www.ansi.org	202-293-8020
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	253-565-6600
ASME	American Society of Mechanical Engineers 3 Park Avenue New York, NY 10016-5990 www.asme.org	800-843-2763
ASTM	ASTM International P.O. Box C700 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 www.astm.org	610-832-9585
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	303-794-7711
AWS	American Welding Society 550 NW LeJeune Road Miami, FL 33126 www.amweld.org	800-443-9353 305-443-9353
BHMA	Builders Hardware Manufacturers Association 355 Lexington Avenue, 17th Floor New York, NY 10017 www.buildershardware.com	212-297-2122 Fax 212-320-9047

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
BICSI	Building Industry Consulting Services International 8610 Hidden River Pkwy Tampa, Florida www.bicsi.org	800-242-7405
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Rd. Suite B215 Columbia, MD 21046 www.chainlinkinfo.org	301-596-2583
HI	Hydraulic Institute 6 Campus Drive, First Floor North Parsippany, NJ 08807 www.pumps.org	973-267-9700
ICC	International Code Council 500 New Jersey Avenue, NW 6th Floor, Washington, DC 20001 www.iccsafe.org	888-422-7233
ICEA	Insulated Cable Engineers Association P.O. Box 1568 Carrolton, GA 80112 http://www.icea.net	
ICRI	International Concrete Repair Institute 3166 S. River Road, Suite 132 Des Plaines, IL 60018 www.icri.org	847-827-0830 Fax 847-827-0832
IEC	International Electrical Commission IEC Regional Centre for North America (IEC-ReCNA) 1740 Massachusetts Avenue, Suite D Boxborough, MA 01719. www.iec.ch	978-266 0414 Fax 978-266 0415
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue,17th Floor New York, NY 10016-5997 www.ieee.org	212-419-7900

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
ISO	International Organization for Standardization 1, ch. de la Voie-Creuse, Case postale 56 CH-1211 Geneva 20, Switzerland www.iso.org	+41 22 749 01 11
MBMA	Metal Building Manufacturers Association 1300 Sumner Avenue Cleveland, OH 44115-2851 www.mbma.com	216-241-7333
MIC	Masonry Industry Council Mason Contractors Association of America 1910 South Highland Avenue, Suite 101 Lombard, IL 60148 www.masonryinstitute.org	630-705-4200
MPI	Master Painters Institute 2800 Ingleton Ave. Burnaby, B.C. Canada V5C 6G7 www.paintinfo.com	604-298-7578
MSS	Manufacturers Standardization Society 127 Park St. NE Vienna, VA, 22180-4602 www.msshq.org	703-281-6613
NACE	NACE International 1440 South Creek Drive Houston, TX 77084 www.nace.org	281-228-6200
NAPF	National Association of Pipe Fabricators, Inc. 1901 N.W. 161st Street Edmond, OK 73013 www.napf.com	888-798-1924 Fax 800-860-5700
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org	301-977-3695
NECA / NEIS	National Electrical Installation Standards 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 www.neca-neig.org	301-657-3110

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
NEMA	National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209 www.nema.org	703-841-3200
NETA	International Electrical Testing Association 3050 Old Centre Ave., Suite 102 Portage, MI 49024 www.netaworld.org	269-488-6382
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org	800-344-3555 617-770-3000
NIBS	National Institute of Building Sciences 1090 Vermont Avenue, NW., Suite 700 Washington, DC 20005-4905 www.nibs.org	202-289-7800
NSF	National Sanitation Foundation 789 N. Dixboro Road Ann Arbor, MI 48105 www.nsf.org	734 769 8010
NNOSHA	Navajo Nation Occupational Safety and Health Administration www.nnosha.org	928-871-6742
SAE	Society of Automotive Engineers International SAE World Headquarters 400 Commonwealth Drive Warrendale, PA 15096-0001 www.sae.org	724-776-04841 Fax 724-776-0790
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	(847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967 www.steeldoor.org	(440) 899-0010

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
SJI	Steel Joist Institute 3127 10th Ave., North Ext. Myrtle Beach, SC 29577-6760 www.steeljoist.org	(843) 626-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr. Chantilly, VA 20151-1209 www.smacna.org	(703) 803-2980
SSPC	SSPC: The Society for Protective Coatings 40 24th Street, 6th Floor Pittsburgh, PA 15222-4656 www.sspc.org	800-837-8303 412-281-2331
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance	TIA/EIA
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 www.ul.com	847-272-8800

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 46 00
QUALITY PROCEDURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 DEFINITIONS

A. Quality Assurance: Inspection and tests performed by Government to ensure compliance with terms of contract.

B. Quality Control: Activities performed by Contractor to ensure work conforms to contract requirements.

1. The clause at FAR 52.246-12 - Inspection of Construction, requires Contractor to establish an inspection system to ensure quality.

2. Quality Control includes activities in addition to specified Contractor Quality Testing to ensure work conforms to contract requirements.

C. Contractor Quality Testing: Specified tests shall be performed by Contractor:

1. Government may use test results for Quality Assurance.

2. Contractor may use test results as part of Contractor's Quality Control:

a. Government anticipates that these tests will be part of Contractor's Quality Control Program, however the tests do not relieve Contractor of providing adequate quality control measures in accordance with the clause at FAR 52.246-12 - Inspection of Construction.

D. Definable Features of Work: A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or may be work by the same trade in a different environment.

1.03 SUBMITTALS

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

B. RSN 01 46 00-1, Contractor Quality Control Plan (QC):

1. Content of the Quality Control (QC) Plan shall clearly outline Contractors Quality Control Program. This plan shall include, as a minimum, the following to cover

all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. Description of the quality control organization, including a chart showing lines of authority and acknowledgement that Quality Control Supervisor (QCS) staff shall implement the three phase control system for all aspects of work specified.

b. Staff shall include a Quality Control Supervisor (QCS) who shall report to project superintendent:

    1) An alternate QCS with equal lines of authority to act on behalf of the primary QCS should they not be present on the project site.

    2) Names, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.

c. Letter to the QCS, signed by an authorized official of the firm, which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the QCS:

    1) Including authority to stop work which is not in compliance with the contract.

d. QCS shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities:

    1) Letters shall also be furnished to Government.

e. Procedures for:

    1) Scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.

    2) Control, verification, and acceptance testing procedures for each specific test to include:

        a) Test name.

        b) Specification paragraph requiring test.

        c) Feature of work to be tested.

        d) Test frequency.

        e) Person responsible for each test.

    3) Tracking:

        a) Preparatory.

        b) Initial

        c) Follow-up control phases and control.

        d) Verification and acceptance tests including documentation.

e) Construction deficiencies from identification through acceptable corrective action:

i. Procedures shall establish verification that identified deficiencies have been corrected.

4) Reporting procedures, including proposed reporting formats.

f. A list of Definable Features of Work. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section:

1) List will be agreed upon during a coordination meeting prior to start of construction.

2. Program shall be based upon definable features of work and include three phases for each feature:

a. Preparatory Phase:

1) Performed prior to beginning of work and as detailed below:

a) Review of each paragraph of applicable specifications and references.

b) Review of contract plans or shop drawings.

c) Check to assure that all materials and/or equipment have been tested, submitted, and approved.

d) Check to assure that provisions have been made to provide required control inspection and testing.

e) Examination of work area to assure all required preliminary work has been completed.

f) Physical examination of required materials, equipment, and sample work to assure:

i. Materials are on hand and conform to approved shop drawings or submitted data.

ii. Have been properly stored.

g) Review of appropriate job hazard analyses.

h) Discussion of procedures for constructing work, including review of repetitive deficiencies.

i) Notify COR 48-hours prior to beginning any required action of preparatory phase as required in quality control specifications.

j) Arrange quality control testing if required.

2) Preparatory Meeting: Conducted by QCS, and attended by the superintendent, other quality control personnel, foreman responsible for definable feature, and Government.

a) Results of preparatory phase actions shall be discussed in Preparatory Meeting and be documented by separate minutes prepared by QCS and attached to daily Contractor's Quality Control Report.

b. Initial Phase:

1) Accomplished at beginning of a definable feature of work.

2) Verify that control for feature of work developed in Preparatory Meeting is implemented and feature of work is performed to the level of workmanship required.

3) Perform as detailed below:

a) Review minutes of Preparatory Meeting.

b) Check preliminary work.

c) Verify adequacy of controls to ensure full contract compliance.

d) Establish levels of workmanship.

e) Resolve all differences.

f) Check safety to include compliance with safety plan and Job Hazard Analysis (JHA).

i. Review JHA with workers.

g) Notify COR 48-hours in advance of beginning any required action of initial phase as required in quality control specifications.

4) Include an Initial Phase Meeting conducted by QCS and attended by superintendent, other quality control personnel, foreman responsible for definable feature and Government:

a) Results of initial phase actions shall be discussed in Initial Phase Meeting, be documented by separate minutes prepared by QCS and attached to daily Contractor's Quality Control Report.

c. Follow-Up Phase:

1) Perform daily checks to assure continuing compliance with contract requirements, including safety and control testing until completion of particular feature of work.

2) Make checks a matter of record in Contractor's Quality Control documentation.

3) Conduct final follow-up checks and confirm all deficiencies are corrected prior to start of additional features of work.

4) Quality control personnel shall continually refer to standards set in Preparatory Meeting and Initial Phases.

C. RSN 01 46 00-2, Contractor's Daily Report:

1. Submit daily reports no later than the end of the following work day.

2. As a minimum, Contractor's Daily Report shall include the following:

a. Record of all Contractor's activities throughout shift regardless of how minor or complex:

b. Report shall be started at beginning of shift, written during shift, and completed at the end of shift.

c. Finished report shall be prepared in such detail that a person not familiar with the day's work could determine what was done and calculate Contractor's direct cost for that day.

d. Report shall state specific safety violations noted during shift including action(s) taken, including:

1) Names of people involved in infraction

2) Name of person confirming correction.

3) Document significant discussions held between Reclamation and Contractor personnel or other parties involved with project.

e. Main body of report shall contain:

1) Locations and a detailed description of all work, including:

a) Sketches or photographs where appropriate to assist in description.

b) Description shall reflect what, where, when, why, who, and how work was being performed.

c) Provide:

i. Record of quantities installed.

ii. Specific stations or location of work.

iii. Description by CPM program activity (if applicable).

iv. Show labor classification, work labor force and equipment actually used during shift.

3. Report shall also contain:

a. List of materials and equipment delivered to job site:

1) Materials installed during shift.

2) Materials refused or wasted during shift.

3) Other items to be reported include:

a) Changes in site conditions.

b) Modifications in design and installation.

c) Photographs taken.

d) Environmental compliance or noncompliance.

e) Hazardous waste and material concerns.

f) Landowner contacts.

g) Worker complaints.

h) Potential problems observed.

D. RSN 01 46 00-3, Quality Control Supervisor (QCS) Resume:

1. Designation of authorized individual as QCS to develop and manage quality control processes.

2. Designated QCS Resume.

E. RSN 01 46 00-4, Contractor's Quality Testing Plan:

1. Address methods, procedures, frequencies, and scheduling for performing quality testing as required in other specification sections.

F. RSN 01 46 00-5, Summary of Monthly Test Results.

1.04 QUALIFICATIONS

A. Contractor shall designate employee as Quality Control Supervisor (QCS).

B. Quality Control Supervisor (QCS):

1. Experienced QCS must be a graduate engineer, graduate architect, or graduate of construction management, with a minimum of 4-years' construction experience in charge of quality control for projects similar in nature to that required by this contract, or a construction person with 10-years in related QC work.

2. Both QCS and alternate will have the authority to stop work if necessary.

3. QCS shall hold no other duties.

1.05 TESTING ACCEPTANCE

A. Acceptance of material shall be based on passing of both quality control testing and quality assurance testing.

B. Government quality assurance testing results will prevail in the event of a discrepancy between Contractor's test results and Government test results.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

A. During course of work, Government may perform quality assurance tests. Tests performed by Government will be used to ensure compliance with contract requirements and not as a replacement for specified Contractor quality testing:

1. Upon request, make measuring and testing devises available for use by Government for verification tests.

B. Contractor's QCS:

1. The effectiveness of the QCS in prosecuting the QC Program will be subject to continued review and approval by CO.

2. Should the QCS's efforts be deemed insufficient Contractor may be required to replace the QCS at no additional cost to Government.

C. Contractor's Quality Control (QC) Program:

1. Effectiveness of Contractor's QC Program will be subject to continued review and approval by CO.

END OF SECTION

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SECTION 01 46 20
TESTING AGENCY SERVICES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedules for items of work requiring applicable testing agency services.

B. Progress Payments: If test reports are not submitted in a timely manner, Contractor will be considered to be in non-compliance and delaying that phase of the work to which the testing applies. CO may retain appropriate amounts of applicable progress payments.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C1077-16a	Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
2.	ASTM D3666-16	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
3.	ASTM D3740-12a	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
4.	ASTM E329-14a	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
5.	ASTM E543-15	Agencies Performing Nondestructive Testing

1.03 SUBMITTALS

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

B. RSN 01 46 20-1, Testing Agency Services Plan:

1. Names of agencies to perform sampling and testing.
2. Agency accreditation to perform specified testing or agency qualifications to perform specified testing.
3. Resumes of personnel performing tests.

4. Samples of report forms.

5. No change in the approved plan may be made without written concurrence by COR.

1.04 QUALIFICATIONS

A. Testing agency organization:

1. Agencies testing construction materials: Meet requirements of ASTM E329.

2. Agencies testing concrete and concrete aggregates: Meet requirements of ASTM C1077.

3. Agencies testing soil and rock: Meet requirements of ASTM D3740.

4. Agencies testing bituminous paving materials: Meet requirements of ASTM D3666.

5. Agencies engaged in nondestructive testing: Meet requirements of ASTM E543.

B. Equipment:

1. Calibrate measuring devices, laboratory equipment, and instruments at established intervals.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR QUALITY TESTING

A. Employ accredited independent agency to perform sampling, testing, and reporting as required in the following Sections:

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

2. Section 31 23 02 - Compacting Earth Materials.

3. Section 31 23 70 - Controlled Low Strength Material (CLSM).

4. Section 32 15 10 - Gravel Surfacing.

5. Other sections as required.

3.02 GOVERNMENT CONTRACT QUALITY ASSURANCE

A. During the course of the work, Government may perform quality assurance tests. Tests performed by Government will be used to ensure compliance with contract requirements and not as replacement for specified Contractor quality testing.

1. Upon request, make measuring and testing devices available for use by Government for verification tests.
2. If a conflict arises between Contractor quality testing results and Government quality assurance tests, Government testing results will take precedence over Contractor testing results.

END OF SECTION

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedule for other items of work.

a. Except:

1) Water for testing and filling.

2) Water for dust abatement.

1.02 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-17 National Electrical Safety Code (NESC)

1.03 TEMPORARY ELECTRICITY

A. Provide all electric power required for construction, testing and commissioning through contract completion and acceptance by Government.

B. Provide all generators, transmission lines, distribution circuits, transformers, and other electrical equipment and facilities required for obtaining power and distributing power to points of use.

C. Contractor is responsible for making all arrangements and payments to the Utility Companies for all temporary electricity required for construction, testing and commissioning through contract completion and acceptance by Government.

D. Comply with IEEE C2 clearances and spacing for temporary communications and supply lines.

E. Potential Sources:

1. Depending on availability the following entities may have electricity:

a. Navajo Tribal Utility Authority (NTUA)

1) Contact:

Navajo Tribal Utility Authority
P.O. Box 1749
Shiprock, NM 87420
Telephone: 800-528-5011
www.ntua.com

b. Continental Divide Electric Cooperative, Inc.

1) Contact:

Continental Divide Electric Cooperative, Inc.
2500 NM Highway 602
Gallup, NM 87305
Telephone: 505-863-3641
Fax: 505-863-2175
www.cdec.coop/

1.04 TEMPORARY WATER

A. Provide water required for construction purposes.

B. Potential Sources:

1. Depending on availability the following entities may have potable water:
2. Contact for access, metering, and billing arrangements.

a. The City of Gallup:

1) Contact:

Gallup Joint Utilities
P.O. Box 1270
Gallup, NM 87305
Telephone: 505-863-1289
www.gallupnm.gov

2) Potable water for cleaning, and filling and testing may only be available from November 30 to March 1.

b. Navajo Nation Water Code Administration (NNWCA) may have non-potable construction water.

1) Contact:

Navajo Nation Water Code Administration
P.O. Box 678
Fort Defiance, AZ 86504
Attn: Melvin Badonie
Telephone: 928-729-4132
Fax: 928-729-4421
www.watercode.navajo-nsn.gov

C. Arrange, pay and transport water for use during construction.

D. Use water which meets specified requirements for water used in concrete, soil-cement, masonry, grouting, and other permanent work.

E. Furnish means of conveying water to points of use.

1.05 SANITARY FACILITIES

A. Provide sanitary facilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL

A. Remove temporary equipment and facilities upon completion of work under this contract.

END OF SECTION

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SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REGULATORY REQUIREMENTS

A. Meet requirements established by jurisdictional authority for use of existing roadways and haul routes; including seasonal or other limitations or restrictions, payment of excess size and weight fees, and posting of bonds conditioned upon repair of damage.

B. Comply with applicable regulations for haul routes over public highways, roads, or bridges.

1.03 SUBMITTALS

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

1. RSN 01 55 00-1, Pre-Construction Digital Recording:

   a. Include roads, driveways, corrals, cattle guards, fences, and other areas as directed by COR.

2. RSN 01 55 00-2, Post Construction and Post Repair Digital Recording.

1.04 SITE CONDITIONS

A. Establish rights-of-way for access to work from existing roads.

1. In accordance with clause at FAR 52.236-10, Operations and Storage Areas, use only established roadways, parking areas, and haul routes; or temporary roadways, parking areas, or haul routes constructed by Contractor when and as authorized by CO.

2. Subject to clause at FAR 52.249-10, Default (Fixed-Price Construction), unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to maintain and repair existing roadways, parking areas, and haul routes: In accordance with requirements of jurisdictional authority.

B. Materials to construct, maintain, and repair temporary roadways, parking areas, and haul routes: As approved by COR.

C. Materials to maintain roadways and parking areas constructed under this contract and used by Contractor for construction work: In accordance with specified requirements for construction of those roadways and parking areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Investigate condition of available public or private roads for clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect access and transportation operations to and from jobsite.

3.02 RECORDS

A. Make pre-construction, post construction, and post repair digital recordings as directed by COR.

1. DVD format with a minimum 720p resolution.
2. Label:
    a. Contract number and title.
    b. Contractor’s name.
    c. Date recording is made.
    d. Preface video with this information.

B. COR will be present during recording. Notify COR at least 3-days prior to recording.

3.03 ESTABLISHED ROADWAYS AND PARKING AREAS

A. Established roadways and parking areas are available for Contractor's use subject to existing restrictions and approval of COR.

3.04 TEMPORARY ROADWAYS AND PARKING AREAS

A. Roadways:

1. Construct temporary roadways for access from public thoroughfares to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.
2. Construct temporary bridges or culverts at stream crossings or cross-drainage channels to allow for unimpeded surface drainage.

B. Parking Areas:

1. Construct temporary parking areas to accommodate use of construction personnel.

2. Provide additional offsite parking when site space is not adequate.

3. Locate as indicated on drawings.

3.05 HAUL ROUTES

A. Perform work on rights-of-way established by Government as necessary to construct and maintain any roads, bridges, or drainage structures required for establishment and use of haul routes for construction operations.

B. Use existing available public highways, roads, or bridges as haul routes subject to applicable local regulations.

C. Minimize interference with or congestion of local traffic.

D. Provide barricades, flaggers, and other necessary precautions for safety of public where haul routes cross public highways or roads in accordance with Section 01 55 20 – Traffic Control.

E. Detours: In accordance with Section 01 55 20 - Traffic Control.

3.06 MAINTENANCE

A. Maintain roadways, parking areas, and haul routes in a sound, smooth condition in accordance with these specifications and Jurisdictional Authorities.

B. Maintain surfacing of gravel surfaced roads and parking areas until completion and acceptance of work under this contract. As approved by COR, defer until latest practicable date within specified completion period, placement of surfacing on roads or parking areas subject to heavy and deteriorating use by Contractor's construction operations or equipment in accordance with these specifications and Jurisdictional Authorities.

C. Snow removal for convenience of Contractor or to facilitate work operations of Contractor is considered to be normal required maintenance.

3.07 REPAIR

A. Promptly repair ruts, broken pavement, potholes, low areas with standing water, and other deficiencies to maintain road surfacing and drainage in original or specified condition in accordance with these Specifications and Jurisdictional Authorities.

B. Notify contact below prior to making improvements:

1. New Mexico 811
   1021 Eubank Blvd NE
   Albuquerque, NM 87112
   www.nmonecall.org
   Statewide: Dial 811 or 800-321-ALERT (2537) during regular business hours.

By Fax: (505)260-1248 or (800)727-8809 24 Hours a day.
By Web: Request a Line Spot 24 Hours a day.

2. Bureau of Indian Affairs, Navajo Regional Office DOT
   301 West Hill Street
   Gallup, NM 87301
   www.bia.gov
   Telephone: 505-863-8314
   Fax: 505-863-8324

3. Mc Kinley County Roads Department
   1980 Warehouse Lane
   Gallup, NM 87301
   www.co.mckinley.nm.us/164/roads
   Telephone: 505-722-2303
   Fax: 505-722-9380

4. New Mexico Department of Transportation (NMDOT)
   1120 Cerrillos Road
   Santa Fe, NM 87504-1149
   www.dot.stat.nm.us
   Telephone: 505-827-5100
   Fax: 505-827-5469

3.08 REMOVAL

A. Remove materials used to construct temporary roadways, parking areas, and haul routes prior to contract completion. Recycle salvageable materials as approved by COR.

END OF SECTION

SECTION 01 55 20
TRAFFIC CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.
2. Include water for dust abatement in the Price Schedules for Water for Dust Abatement.

1.02 REFERENCE STANDARDS

A. Federal Highway Administration (FHWA)

1.	MUTCD, Part 6	Part 6, Temporary Traffic Control, Manual on Uniform Traffic Control Devices, 2009 Edition with Revisions 1 and 2, www.mutcd.fhwa.dot.gov/kno_2009r1r2.htm

1.03 SUBMITTALS

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

B. RSN 01 55 20-1, Traffic Control Plan and Permit Applications.

C. RSN 01 55 20-2, Permits.

1.04 PROJECT CONDITIONS

A. Project includes crossings at: BIA Route 9, Indian Service Routes, and various unnamed roads.

B. Access points off US 491.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Obtain permits from:

1. Navajo Division of Transportation (Navajo DOT)
   Physical Address:
   #16 Old Coalmine Road
   Mentmore, NM 87319
   Mailing Address:
   P.O. Box 4620
   Window Rock, AZ 86515
   www.navajodot.org
   Telephone: 505-371-8300
   Fax: 505-371-8399

2. Bureau of Indian Affairs, Navajo Regional Office DOT
   301 West Hill Street
   Gallup, NM 87301
   www.bia.gov
   Telephone: 505-863-8314
   Fax: 505-863-8324

3. Mc Kinley County Roads Department
   1980 Warehouse Lane
   Gallup, NM 87301
   www.co.mckinley.nm.us/164/roads
   Telephone: 505-722-2303
   Fax: 505-722-9380

4. New Mexico Department of Transportation (NMDOT)
   1120 Cerrillos Road
   Santa Fe, NM 87504-1149
   www.dot.state.nm.us
   Telephone: 505-827-5100
   Fax: 505-827-5469

B. Road Closures:

1. Keep public roads open.

2. Private roads, per written agreement with owner.

3.02 TRAFFIC CONTROL

A. Meet requirements of MUTCD, Part 6, RSHS and Jurisdictional Authorities.

B. Provide cones, delineators, concrete safety barriers, barricades, flasher lights, danger signals, signs, and other temporary traffic control devices as required to protect work and public safety.

C. Provide flaggers and guards as required to prevent accidents and damage or injury to passing traffic.

D. Do not begin work along public or private roads until proper traffic control devices for warning, channeling, and protecting motorists are in place in accordance with approved traffic control plan.

E. Maintain traffic flow and conduct construction operations to minimize obstruction and inconvenience to public traffic.

F. Provide unobstructed, smooth, and dustless passageway for two lane of traffic through construction operations.

G. Maintain convenient access to driveways, houses, and buildings along line of work.

H. Protect roads closed to traffic with effective barricades and warning signs. Illuminate barricades and obstructions from sunset to sunrise.

I. Remove traffic control devices when no longer needed.

3.03 DETOUR

A. Obtain COR approval prior to installing detours.

B. Construct and maintain detour to provide safe, continuous traffic flow during construction in accordance with Jurisdictional Authorities.

C. Limit detour use to 3 consecutive days without prior COR approval or as required by permits.

D. Obtain earth materials for detour embankments from required excavation or designated borrow sources. Construct stable compacted embankments.

E. Superelevate detour curves as directed by COR and in accordance with Jurisdictional Authorities.

F. Provide culverts and ditches as required to maintain surface drainage at detour.

G. Provide compacted gravel surfacing on detour.

H. Provide traffic control devices as required by MUTCD, Part 6.

I. Maintain detour in smooth, dust-free condition.

J. Remove the detour when no longer needed.

END OF SECTION

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SECTION 01 56 10
PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. Costs for repair of installations damaged by Contractor's operations are Contractor's responsibility.

1.02 SUBMITTALS

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

B. RSN 01 56 10-1, Plan for Protecting Existing Installations.

1.03 PROJECT CONDITIONS

A. Drawings included in these specifications show items of existing materials and equipment but may not show all equipment and materials existing at jobsite.

B. Obtain location of embedded conduit, pipe, cable, ground mat, and other buried items before performing any drilling, cutting of concrete, or excavation in or around existing installation or structures.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROTECTION

A. Provide protection for personnel and existing facilities from harm due to Contractor's operations. Protection shall be subject to approval of Government.

B. Arrange protective installations to permit operation of existing equipment and facilities by Government while work is in progress.

3.02 REMOVAL OF PROTECTIVE INSTALLATIONS

A. Remove protective installations after purpose has been served. Materials furnished by Contractor to provide protection remain property of Contractor.

3.03 REPAIR

A. Repair, at Contractor's expense, damage to existing installations due to Contractor's operations or Contractor's failure to provide proper protection. At Government's option, damage may be repaired by Government, and Contractor will be backcharged repair costs.

END OF SECTION

SECTION 01 56 15
PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Utility Crossing Investigation:

1. Payment: Lump sum prices offered in Price Schedules.

B. Cost:

1. Include Utility Owner Acknowledgments offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

B. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-17	National Electrical Safety Code (NESC)

1.03 SUBMITTALS

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

B. RSN 01 56 15-1, Utility Owner Acknowledgment:

1. Copy of notification acknowledgement showing underground and overhead utility agreements.

C. RSN 01 56 15-2, Utility Crossing Investigation:

1. As listed under “Project Conditions” in this section.

D. RSN 01 56 15-3, Work Plan within Utility Easement:

1. Proposed installation method including construction equipment.
2. Methods for protecting.
3. Approval of work plan from Utility owner.

1.04 PROJECT CONDITIONS

A. Drawings included in these specifications show existing utilities, but may not show all utilities existing at the jobsite.

B. Obtain location of buried conduit, pipe, cable, ground mat, and other buried items before submitting pipe laying diagrams.

C. Unknown existing utility lines may cross pipeline alignment.

D. Government does not represent that location of known existing utilities shown on drawings are exact. It is Contractor's responsibility to determine actual location of and make provision for all known and unknown utilities:

1. Verify locations, depths and clearances of both above and below ground utilities prior to excavation.

E. Ensure that each utility line is in service as required by each utility owner.

F. Coordinate work within existing pipeline and transmission line Right-of-Way with all utility owners. Contractor's shall comply with all Utility owner crossing requirements and shall be responsible for all costs associated with utility crossings. Obtain permission from Utility owners before procuring materials to be installed in Right-of-Way.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Have New Mexico One Call 811 locate utilities before doing underground work.

B. Navajo Tribal Utility Authority (NTUA) is not part of New Mexico One Call:

1. Have NTUA locate utilities before doing underground work. Contact Information:

Navajo Tribal Utility Authority
P.O. Box 170
Fort Defiance, AZ 86504
Telephone: 928-729-5721

C. Utility Crossing Investigation:

1. Determine height and voltage of overhead utility lines. Clearances in accordance with RSHS and OSHA, whichever is more stringent.

2. Determine location, elevations, diameters, and materials of each underground utility line by hydro-excavation or vacuum excavation or as approved by utility owners. Test pits may be used when approved by COR:

   a. Submit to COR before beginning preparation of pipelaying diagrams required by Section 33 11 10 - Pipeline General Requirements and excavation work.

   b. COR will determine if adjustment of pipeline grade and design is required and provide Contractor with revised drawings.

3. Obtain permission from utility or gasline owner before performing physical utility crossing investigation (potholing or test pits).

D. Coordinate with each utility line owner and schedule construction to adhere to each owner's in service, allowable out of service, and crossing requirements during construction. See Section 51 00 00 – Information Available to Offerors for crossing agreements.

E. Notify impacted property owner at least 2 working days before disturbing waterline that serves their property. Water service to property shall not be shut off for more than 8-hours.

F. No excavation will be permitted within 10-feet of gas lines when in service without written approval from Gas Company.

G. Protect and support existing utilities that intersect work area. Before commencing work, obtain approval and necessary permits from utility owners within project ROW.

H. Repair existing utilities damaged during construction as approved by COR and utility owner.

3.02 CLEARANCE

A. Obtain clearances required for construction operations: Contractor shall provide in accordance with RSHS.

3.03 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. Do not interfere with operation or maintenance service on utilities, existing on date offers are received:

1. Provide for access to utilities in a manner satisfactory to owners and operators and Government.

B. Provide required temporary structures; make necessary repairs, replacements, or similar operations; and furnish indemnity or other bonds.

END OF SECTION

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SECTION 01 56 20
EXISTING FENCES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rebuild fence with new material unless otherwise approved by COR.

B. Provide replacement materials of similar type, when available.

PART 3 EXECUTION

3.01 FENCE REMOVAL

A. Remove existing fences where necessary for performance of work, only when authorized by COR. Coordinate with chapter grazing official to offer the opportunity for grazing permit lessee(s) to be present when fence is cut to ensure fence is adequately braced and secured. Maintain fences, where designated, until work is completed or their removal is authorized.

3.02 TEMPORARY FENCES

A. Where fences are removed on rights-of-way, provide temporary fence protection for adjacent lands to prevent livestock from straying from or onto adjacent lands, complete with gates and cattle guards.

B. If Contractor does not provide necessary temporary fencing or protection within a reasonable time after need for fencing or protection arises, CO will cause work to be performed and backcharge Contractor for such work.

C. Remove temporary fences and protection as a part of cleanup operations prior to final acceptance of completed work.

3.03 FENCE REBUILDING

A. Where fences are removed to accommodate construction, rebuild at original locations.

B. Construct rebuilt fencing that is structurally sound and matches, or is better than, existing fencing installation.

END OF SECTION

SECTION 01 56 32
TEMPORARY SAFETY FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

PART 2 PRODUCTS

2.01 SAFETY FENCE

A. Fence:

1. High-density polyethylene grid.
2. Minimum height: 48-inch.
3. Color: Safety orange.
4. Recovered Material Content:
   a. 90 to 100 percent.
5. Postconsumer Content:
   a. 60 to 100 percent.

B. Posts: Steel fence posts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect fence around work areas at location approved by COR.

B. Space posts 10-foot, maximum, on center.

C. Secure grid to posts.

3.02 MAINTENANCE AND REMOVAL

A. Maintain fence until work in area is complete and accepted by COR.

B. Remove fence when no longer required.

END OF SECTION

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SECTION 01 57 10
CROSS DRAINAGE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work:

a. Damage due to Contractor's negligence or lack of appropriate controls shall be repaired at Contractor's expense.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Flows from natural drainage channels intercepted by work shall be controlled.

B. Provide and maintain temporary construction required to control, bypass, or otherwise cause flows to be harmless to work and to public or private property.

C. Perform additional ditching and grading for drainage as directed by COR.

D. Remove temporary construction and restore site to original condition, as approved by COR, when temporary construction is no longer needed and prior to acceptance of work.

E. Return drainage to original grade and slope once pipe is in place and backfilled.

F. Damage to work under these specifications and to public or private property shall be restored to original condition, as approved by COR, at Contractor's expense.

END OF SECTION

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SECTION 01 57 20
ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.
2. See Section 31 02 10 - Water for Dust Abatement, for measurement and payment for applying water used for dust abatement within rights-of-way.
3. See Section 31 02 30 – Dust Palliative, for measurement and payment for applying dust palliative for dust abatement within rights-of-way.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

1.03 SUBMITTALS

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

B. RSN 01 57 20-1, Copy of Applicable Air Quality Permit.

1.04 REGULATORY REQUIREMENTS

A. Comply with Federal, Tribal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

D. Contractor shall be responsible for damages resulting from dust originating from Contractor operations in accordance with clause at FAR 52.236-7, “Permits and Responsibilities”.

E. CO may stop construction activity in violation of Federal, Tribal, State, or local laws and additional expenses resulting from work stoppage will be responsibility of Contractor.

1.05 PERMITTING

A. Develop draft environmental permit applications not covered in other sections and forward to COR for review and submission by Government to relevant authorities having jurisdiction.

1.06 DUST CONTROL

A. Provide dust control and abatement during performance of work, as approved by COR.

B. Prevent, control, and abate dust pollution on rights-of-way provided by Government or elsewhere during performance of work.

C. Provide labor, equipment, and materials, and use efficient, environmentally acceptable methods to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, crops, cultivated fields, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

D. Provide means for eliminating atmospheric discharges of dust during mixing, handling, and storing of cement, pozzolan, and concrete aggregate.

1.07 AIR POLLUTION CONTROL

A. Air Quality Permits are not required for control of fugitive dust generated as result of construction-related activities on a short term basis, however permits are required with specific emission sources tied to aggregate processing and batch plant operations releasing particulates to atmosphere.

B. Air Quality Permits are required for certain construction-related activities including, but not limited to, sandblasting, aggregate processing, or other processes which discharge pollutants into open air.

C. Air Quality Permits, and information concerning requirements, are available from: New Mexico Environmental Department, telephone: 505-827-2855 and the USEPA.

D. Use reasonably available methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

E. Do not operate equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels.

1.08 NOISE CONTROL

A. Only construction activities approved by COR will be allowed between dusk and dawn.

1.09 LIGHT CONTROL

A. Shine direct stationary floodlights downward at an angle less than horizontal.

B. Shield floodlights so that floodlights will not be a nuisance to surrounding areas.

C. Direct lighting so that residences are not in direct beam of light.

D. Correct lighting control problems when they occur as approved by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 57 30
WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

B. Code of Federal Regulations (CFR)

1.	40 CFR, Part 112	Oil Pollution Prevention

C. Public Law

1.	Sections 311, 402, and 404	Clean Water Act (Public Law 92-500, as amended)

D. U.S. Environmental Protection Agency (USEPA)

1.	EPA CGP-17	Stormwater Discharge Permit associated with a Construction Site including revisions. www.epa.gov/npdes/epas-2017-construction-general-permit-cgp-and-related-documents
2.	EPA Developing a SWPPP	SWPPP template and instructional resources available at: www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp

1.03 SUBMITTALS

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

B. RSN 01 57 30-1, Updated Stormwater Pollution Prevention Plan (SWPPP):

1. Modifications to draft SWPPP shall comply with requirements outlined in part 7 of Construction General Permit (CGP), dated 2012.

2. Include copy of permits.

C. RSN 01 57 30-2, Spill Prevention, Control, and Countermeasure (SPCC) Plan:

1. Submit to COR when SPCC Plan is required in accordance with 40 CFR, Part 112.
2. SPCC Plan is required where release of oil and oil products could reasonably be expected to enter into or upon navigable waters of the United States or adjoining shorelines in quantities that may be harmful (40 CFR, Part 110), and aggregate on site oil storage capacity is over 1,320 gallons. Only containers with capacity of 55 gallons and greater are included in determining on site aggregate storage capacity.
3. Reviewed and certified by a registered professional engineer in accordance with 40 CFR, Part 112, as required by section 311 of the Clean Water Act (Public Law 92-500 as amended).
4. Submit spill prevention plan for oil storage equal to or greater than 1,320 gallons. Spill Prevention Plan shall be stamped by a professional engineer to BOR for formal submittal and include:
    a. Oil Storage Quantity.
    b. Drawings of containment system.
    c. Response plan to spill.

1.04 REGULATORY REQUIREMENTS

A. Construction Safety Standards:

1. Comply with sanitation and potable water requirements of section 7 of RSHS.

B. Laws, Regulations, and Permits:

1. Perform construction operations to comply, and ensure subcontractors comply, with:
    a. Applicable Federal, State, Tribal, and local laws, orders, regulations, and Water Quality Standards concerning control and abatement of water pollution; and terms and conditions of applicable permits issued by permit issuing authority.
    b. If conflict occurs between Federal, State, Tribal, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, verbally report noncompliance within 2-hours to CO. Submit specific written information within 24-hours including corrective actions.
2. Violation of applicable Federal, State, Tribal, or local laws, orders, regulations, or Water Quality Standards may result in CO stopping site activity until compliance is ensured.
3. Contractor shall not be entitled to extension of time, claim for damage, or additional compensation by reason of such a work stoppage.

4. Corrective measures required to bring activities into compliance shall be at Contractor's expense.

1.05 REQUIRED PERMITS

A. Wastewater Discharge Permit:

1. Permit:

   a. Prior to discharging wastewater or other pollutants, provide draft permit(s) to discharge pollutants as required under section 402 of Clean Water Act (Public Law 92-500 as amended), and New Mexico Environment Department, Surface Water Quality Bureau and Navajo Nation Environmental Protection Agency.

   b. Submit permit applications to Government, for review and Government's submittal.

   c. Government will support Contractor in obtaining permits, as deemed appropriate by Government.

2. Terms and Conditions: Comply with terms and conditions as stated in permit.

3. Monitoring and Treatment:

   a. Provide monitoring and water treatment to achieve compliance with permit conditions.

   b. Provide recordkeeping required of permittee, as stated in Section 402 permit.

4. Sampling: Include sampling in monitoring required of Contractor to meet Section 402 requirements, as well as required laboratory tests to determine effluent characteristics.

5. Monitoring Results:

   a. Provide monitoring results to appropriate agency as required by permit.

   b. Send copies of information transmitted to appropriate agency to COR.

B. Stormwater Discharge Permit Associated With a Construction Site (EPA Construction General Permit (CGP)):

1. Stormwater Pollution Prevention Plan (SWPPP):

   a. Government will submit the plan drafted by Contractor.

   b. Comply with terms and conditions to maintain CGP.

2. Notice of Intent (NOI):

   a. Both Government and Contractor shall submit a NOI to obtain coverage under CGP.

   b. Submit NOI via the EPA's eNOI system (go to www.epa.gov/npdes/electronic-notice-intent-enoi)

1) To obtain coverage under construction general permit to control stormwater and certain regulated non-stormwater discharges associated with construction activity including construction dewatering.

2) Outlined in part 1 of Final 2012 CGP required under provisions of Clean Water Act, 33 U.S.C § 1251.

3) Amended by Water Quality Act of 1987 (P.L. 100-4).

3. Monitoring and Water Treatment:

a. Provide monitoring and water treatment to achieve compliance with applicable Water Quality Standards and CGP.

b. Provide recordkeeping required by CGP associated with construction activity.

C. Stormwater Discharge Permit Associated With Industrial Activity:

1. Stormwater Discharge Permit:

a. If construction activities will entail use of a mobile CLSM plant, concrete plant, or nonmetallic borrow areas, a stormwater discharge permit associated with industrial activity may be required.

2. Terms and Conditions:

a. Comply with terms and conditions to obtain and maintain industrial stormwater discharge permit, including preparation of a Pollution Prevention Plan.

3. Monitoring and Water Treatment:

a. Provide monitoring and water treatment, if necessary, to achieve compliance with applicable Water Quality Standards.

b. Provide recordkeeping required by stormwater discharge permit associated with industrial activity.

D. 404 Permit and 401 Water Quality Certification:

1. Government will apply for a permit to discharge dredged or fill material into waters of the United States (including wetlands) as required under section 404 of Clean Water Act (Public Law 92-500 as amended).

2. If a 404 permit is required, Government will obtain a CWA 401 water quality certification from regulatory authority(s) having jurisdiction: NMED NNEPA and/or USEPA.

3. Contractor shall:

a. Coordinate with Government and meet requirements of 404 permit and water quality certifications.

b. Provide documentation to support permit application, monitoring and close out.

1.06 CONTRACTOR RESPONSIBILITIES

A. Permits: Obtain permits in Government and Contractor's name.

B. Monitoring:

1. Conduct monitoring in order to meet requirements of permits which may include:

a. Sampling,

b. Site inspections,

c. Required laboratory tests to determine effluent characteristics.

C. Reporting Results:

a. Provide monitoring results to appropriate agency as required by permit.

b. Send copies of information transmitted to appropriate agency to COR.

D. Recordkeeping: Retain records and data for life of project or as required by permits, whichever is longer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Control pollutants by use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls including Federal, Tribal State and local control requirements. As shown on approved SWPPP and as necessary to control pollutants.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion which address vegetative practices, structural control, sediment controls, and operator controls as appropriate.

2. Institute stormwater management measures as required, including velocity dissipators, and solid waste controls which address controls for building materials and offsite tracking of sediment.

C. Wastewater and Stormwater Management Controls:

1. Pollution prevention measures:

a. Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and loss of soil due to wind and water erosion, and which will intercept and settle runoff of sediment-ladened waters.

b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, and drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.

c. Divert stormwater runoff from upslope areas away from disturbed areas.

2. Turbidity Prevention Measures:

a. Use methods for prevention of excess turbidity which include, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life.

b. Wastewaters discharged into surface waters shall meet conditions of permits.

c. Do not operate mechanized equipment in waterbodies without having first obtained a section 404 permit and 401 water quality certifications, and then only as necessary to construct crossings or perform required construction.

D. Construction Site Management:

1. Contractor construction operations:

a. Perform construction activities by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources:

1) Pollutants and wastes include, but are not restricted to: refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

b. Comply with 404 permit and 401 water quality certifications.

2. Stockpiled or deposited materials:

a. Do not stockpile or deposit excavated materials or other construction materials, near or on, stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can encroach upon watercourse.

3. Petroleum product storage tanks management:

a. Place oil or other petroleum product storage tanks at least 100-feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and other water sources. Do not place petroleum product storage tanks within a watercourse's 100-year floodplain.

b. Do not use underground storage tanks.

c. Construct storage area dikes at least 12-inches high or graded and sloped to permit safe containment of leaks and spills equal to storage tank capacity located in the area plus sufficient freeboard to contain 25-year rainstorm.

1) Line diked areas with an impermeable barrier at least 50-mils thick.

d. Areas for refueling operations: Lined with impermeable barrier at least 50-mils thick covered with 4-inches of soil.

END OF SECTION

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SECTION 01 57 40

PESTICIDES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.
2. Contractor is responsible for damages resulting from use of pesticides under these specifications in accordance with the clause at FAR 52.236-7, "Permits and Responsibilities".

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. Pesticide Use Plan Form 7-2223

1.03 DEFINITIONS

A. Pesticides: Includes herbicides, insecticides, fungicides, rodenticides, piscicides, avicides, surface disinfectants, animal repellants, and insect repellants.

1.04 SUBMITTALS

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

B. RSN 01 57 40-1, Pesticide Use Plan:

1. Not required for insect repellant to be applied directly to clothing, or for small quantities of aerosol insecticide, such as fly and spider sprays, to be applied within or directly to offices or shop buildings
2. Submit pesticide use plan when chemicals or applications meet one or more of the following:
    a. Chemicals categorized by USEPA for restricted use.
    b. Chemicals applied to or that can reasonably be expected to contact water; except this requirement does not apply to Rodeo or copper sulfate used for control of noxious weeds.
    c. Chemicals expected to endanger threatened animal or plant species.
3. For each pesticide:
    a. Pesticide Use Plan Form 7-2223.
        1) Completed by entity responsible for pesticide application.

2) Form available from:

a) Bureau of Reclamation, Attn: 86-68200, P.O. Box 25007, Denver, CO 80225-0007.

b. Complete label as defined by Federal Insecticide Fungicide Rodenticide Act of 1947, as amended in 1972 and 1978, containing the following:

1) Brand, common, and chemical names.

2) Ingredients and net contents.

3) Use classification and registered uses.

4) Name and address of manufacturer or registrant, EPA registration number, and the establishment number.

5) Directions for use, including safety information, warnings, and precautions.

c. Safety Data Sheet (SDS).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with labeling and SDS requirements when dealing with pesticides.

B. Keep records of pesticide types and amounts purchased, delivered, stored, mixed, and actually used, and disposal means of excess. Make records available for review by COR upon request.

PART 2 PRODUCTS

2.01 PESTICIDES

A. Pesticides: Only those registered with EPA in compliance with Federal Environmental Pesticide Control Act of 1972, or State, Navajo Nation or local agencies.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 50

TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work, except as specified.

2. Costs for repair or treatment of injured vegetation and replacement of trees or shrubs are the Contractor's responsibility.

1.02 SUBMITTALS

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

B. RSN 01 57 50-1, Protection Plan:

1. Description of protective barriers or other methods used to protect vegetation from damage or injury caused by construction operations.

PART 2 PRODUCTS

2.01 REPLACEMENT TREES AND SHRUBS

A. Species: Same as removed tree or shrub or other species approved by COR.

B. Size: Same size as removed tree or shrub, or maximum practicable size that can be planted and sustained in the particular environment as approved by COR.

PART 3 EXECUTION

3.01 PRESERVATION AND PROTECTION

A. Preserve natural landscape and preserve and protect existing vegetation not required or otherwise authorized to be removed:

1. Submit requests to remove vegetation not specifically required to be removed to COR.

B. Conduct operations to prevent unnecessary destruction, scarring, or defacing of natural surroundings in vicinity of work.

C. Move crews and equipment within rights-of-way and over routes provided for access to the work in a manner to prevent damage to grazing land, crops or property.

D. Protect vegetation from damage or injury caused by construction operations, personnel or equipment by use of protective barriers or other methods approved by COR.

E. Minimize, to greatest extent practicable, clearings and cuts through vegetation. Irregularly shape authorized clearings and cuts to soften undesirable aesthetic impacts.

F. Do not use trees for anchorages except in emergency cases or as approved by COR:

1. For such use, wrap trunk with a sufficient thickness of approved protective material before rope, cable or wire is placed.

2. Submit requests to use trees for anchorage, except for emergencies. Include description of protective material.

G. Use safety ropes where tree climbing is necessary; do not use climbing spurs.

3.02 REPAIR, TREATMENT, OR REPLACEMENT

A. Contractor is responsible for injuries to vegetation caused by Contractor operations, personnel or equipment.

B. Employ the services of an experienced arborist or licensed tree surgeon to direct repair, treatment, and replacement of injured vegetation. Submit qualifications of experienced arborist or licensed tree surgeon to COR prior to employment.

C. Repair or treat injured vegetation without delay and as recommended by and under direction of an experienced arborist or licensed tree surgeon.

D. Removed and dispose of trees or shrubs not required or otherwise authorized to be removed that, in the opinion of COR, are injured beyond saving.

E. Replace removed tree or shrub with tree or shrub approved by COR:

1. For a period of 1 year, guy as required, water, and maintain replacement trees and shrubs.

2. Remove and replace any replacement tree or shrub that dies within the 1-year period, and maintain such replacements for a period of 1-year from date of replacement.

END OF SECTION

SECTION 01 57 60
PROTECTED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 PROJECT CONDITIONS

A. Certain native plant and animal species in the State of New Mexico are protected under Federal, State and Tribal laws. Government has ascertained that endangered Migratory Birds and Mesa Verde Cactus may exist in areas to be disturbed by construction activities.

B. This project is designed to comply with the Final Biological Opinion for the Navajo-Gallup Water Supply Project as issued by U.S. Fish and Wildlife Service on February 26, 2009.

C. Migratory Birds:

1. May occur in area between March 15th and August 15th:

a. Government will survey vegetated areas to be disturbed for endangered migratory birds. Evaluation shall be performed no more than 5-days before an area is to be disturbed.

b. Notify COR 10-days before disturbing an area.

c. Do not disturb a nesting pair of endangered migratory birds with eggs:

1) Avoid birds as directed by COR.

D. Mesa Verde Cactus:

1. If Mesa Verde Cactus is found in construction area, Government will monitor work in these areas:

a. Contractor shall coordinate work in these areas with COR.

E. In accordance with State Law, Government may arrange for removal of protected species, and Contractor shall cooperate with those performing such removal. If these species are not removed, cooperate with and abide by protection plans developed by appropriate Federal, State and Tribal entities to avoid damage to or disturbance of protected species.

1.03 REPLACEMENT PLANTS

A. Protected plant species shall not be removed or damaged by Contractor:

1. If inadvertent effects occur to protected species during construction:
   a. Notify Government:
      1) Verbal: Within 2-hours.
      2) Written: Within 24-hours.
   b. Cease work in affected work area until consultation commitments are completed.
2. Government, in consultation with Bureau of Indian Affairs (BIA) and State of New Mexico, will manage required removal/replacement planting in accordance with consultation commitments.
3. Replacement numbers/ratio in accordance with consultation commitments.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 90

PRESERVATION OF HISTORICAL AND ARCHEOLOGICAL DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Except as provided for an equitable adjustment, include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. Cultural resources: Includes prehistoric, historic, architectural, and traditional cultural properties. These include, but are not limited to, human skeletal remains, archaeological artifacts, records, and material remains related to such property.

B. Cultural items: Native American cultural items (i.e., funerary objects, sacred objects, objects of cultural patrimony, or human remains) for which protection is prescribed under the Native American Graves Protection and Repatriation Act (NAGPRA) - Public Law 101-601; 104 Stat. 3042, Section 3(d); and 43 CFR Part 10.4.

C. Human remains: Physical remains of the body of a person.

D. Funerary objects: Native American items that, as part of the death rite or ceremony of a culture, are reasonably believed to have been placed intentionally at the time of death or later with or near individual human remains.

E. Native American: Of, or relating to, a tribe, people, or culture that is indigenous to the United States.

F. Sacred Objects: Native American items that are specific ceremonial objects needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present-day adherents. These items are specifically limited to objects that were devoted to a traditional Native American religious ceremony or ritual and which have religious significance or function in continued observance or renewal of such ceremony.

G. Objects of cultural patrimony: Native American items having ongoing historical, traditional, or cultural importance central to the Indian tribe itself, rather than property owned by an individual tribal member. These objects are of such central importance that they may not be alienated, appropriated, or conveyed by any individual tribal member.

1.03 SUBMITTALS

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

B. RSN 01 57 90-1, Alternate Use Area or Borrow Area:

1. When use area or borrow area other than those approved is to be used, submit map showing location of unapproved use or borrow areas, for approval.

1.04 PROJECT CONDITIONS

A. Project site has been surveyed for construction within ROW by agencies having jurisdiction: Navajo Nation Historical Preservation Department (NNHPD), State Historical Preservation Office (SHPO) and Bureau of Indian Affairs (BIA).

B. Government will retain an Archeologist to monitor ground disturbing activity work within 100-foot, each side of known cultural sites:

1. Coordinate work with COR and Government Archeologist.

C. On-site Contractor personnel shall undergo cultural resource awareness training:

1. Government will provide training. Training will take approximately 1-hour. Schedule for training will be mutually agreed upon.

2. Inform on-site personnel of cultural resource requirements before initial groundbreaking takes place.

3. On-site personnel added after completion of cultural awareness training shall be informed by their management of cultural resource requirements before being allowed to work in project area.

4. Maintain training records.

D. Federal legislation provides for protection, preservation, and collection of scientific, prehistorical, historical, and archeological data, including relics and specimens, which might otherwise be lost due to alteration of terrain as a result of any Federal construction project.

E. Persons who, without permission, injure, destroy, excavate, appropriate, or remove historical or prehistorical artifact, object of antiquity, or archeological resource on public lands of the United States are subject to arrest and penalty of law.

F. Comply with Federal, State and Tribal laws when operating on non-Federal and non-Indian lands.

G. Attend weekly coordination meetings. Refer to Section 01 31 19 - Project Management and Coordination.

H. Discovery of Resources:

1. When Contractor or parties operating or associated with Contractor, in performance of this contract discover cultural resources on ROW:

a. Immediately cease work at that location.

b. Verbally notify CO and COR within 2-hours, giving location and nature of findings.

c. Verbally notify Reclamation staff archaeologist within 2-hours. Telephone: 970-385-6500, Durango, Colorado.

d. Follow with written confirmation to CO within 12 hours.

2. Do not disturb or damage cultural resources uncovered during construction activities. Provide cooperation and assistance to preserve findings for removal or other disposition by CO.

3. Do not resume work in area of discovery until receipt of written notice to proceed from CO.

I. Where appropriate by reason of discovery, CO may order delays in time of performance or changes in work, or both. When such delays or changes are ordered, an equitable adjustment will be made in contract in accordance with applicable clauses of contract.

J. Mitigate cultural resources as directed by Government on lands outside of Permanent or Construction ROW, including private lands:

1. Coordinate Government cultural resource identifications and inspections:

a. Obtain permission for Government access in arrangements for use of lands outside of ROW including private lands for use areas or borrow sources, access routes and areas of disturbance.

K. Insert this section in subcontracts which involve performance of work on jobsite terrain.

L. Obtain Government clearance before disturbing lands outside of ROW in accordance with Section 01 14 10 - Use of Site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXCLUSION ZONE

A. Fence exclusion zones as directed by COR and in accordance with Section 01 56 32 - Temporary Safety Fence.

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When Price Schedules include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in the price offered in Price Schedules for item.

2. When Price Schedules do not include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in price offered in Price Schedules for work for which material is required.

1.02 DEFINITIONS

A. Essential Characteristics: As used in these specifications, the term "essential characteristics" is synonymous with the term "salient characteristics."

B. Salient Characteristics: Those qualities of an item that are essential to ensure that intended use of item can be satisfactorily realized.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-03	Unified Inch Screw Threads, (UN and UNR Thread Form)
2.	ASME B1.20.1-13	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (Reclamation)

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

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle manufactured products in accordance with manufacturer's instructions.

B. Store and protect manufactured products in accordance with manufacturer's instructions and RSHS. Obtain instructions from manufacturer before delivery of materials to jobsite. Maintain a copy of instructions at jobsite.

C. Protect materials from adverse effects of moisture, sunlight, ultraviolet light or weather during storage at jobsite.

D. Remove and replace damaged items with new items.

E. Store curing compounds, sealants, adhesives, paints, coatings, sealers, joint compounds, grouts, and similar products at temperature and environmental conditions recommended by manufacturer.

1.05 MAINTENANCE

A. Extra Materials:

1. Furnish additional maintenance materials specified as "extra materials" in specifications. Provide maintenance material identical to installed material and provide from same manufacturer's production lot as installed material.
2. Package extra materials for storage and label with complete product identification on packaging.
3. Deliver extra materials to Government as directed by COR within 150-miles of project.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials required for completion of work.

B. Provide type and quality described in these specifications. Make diligent effort to procure specified materials from all available sources.

C. Furnish new materials conforming to referenced standards unless otherwise specified.

D. For materials not covered by these or referenced specifications, furnish materials of standard commercial quality.

E. If materials to be used deviate from or are not covered by recognized specifications and standards, submit, for approval, justification for and exact nature of the deviation, and complete specifications for materials proposed for use.

F. Make parts accurately to standard gauge where possible:

1. Use unified screw threads conforming to ASME B1.1 or ASME B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipefittings.
2. For internal connections only, Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

G. Permanently mark fasteners with a symbol identifying manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standard.

2.02 SUBSTITUTIONS

A. If materials required by these specifications become unavailable, because of Government priorities or other causes, substitute materials may be used.

B. Obtain written approval to use substitute materials from CO. State in request for approval amount of adjustment, if any, to be made in favor of Government.

C. Government's determination as to whether substitution will be permitted and as to what substitute materials may be used, shall be final and conclusive.

D. If approved substitute materials are of less value to Government or involve less cost to Contractor than specified material, a contract adjustment will be made in favor of Government. Where amount involved or importance of substitution warrants, a deductive modification to contract will be issued.

E. No payments in excess of prices offered in the Price Schedules will be made because of substitution of one material for another or because of use of one alternate material in place of another.

2.03 WORKMANSHIP

A. Accurately manufacture and fabricate materials in accordance with best modern practice and requirements of these specifications, notwithstanding minor errors or omissions therein.

B. Use liberal factors of safety and adequate shock-absorbing features in designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock.

C. Include provisions which prevent components from loosening for shock-absorbing features and parts subject to vibration.

2.04 GOVERNMENT CONTRACT SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause at FAR 52.246-12 “Inspection of Construction” at following locations, as determined by CO at:

1. Place of production or manufacture.
2. Shipping point.
3. Jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, copies of purchase orders, including drawings and other pertinent information, covering material

on which inspection will be made as advised by CO, or submit other evidence if such purchase orders are issued verbally or by letter.

C. Inspection of materials at locations specified above or waiving of inspection shall not be construed as being conclusive as to whether materials and equipment conform to contract requirements under the clause at FAR 52.246-12 “Inspection of Construction” nor shall Contractor be relieved thereby of responsibility for furnishing materials meeting requirements of these specifications.

D. Acceptance of materials will be made only at jobsite.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer’s recommendations unless otherwise specified.

3.02 GOVERNMENT CONTRACT FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at jobsite after installation and testing.

END OF SECTION

SECTION 01 71 20
SURVEYING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 DEFINITIONS

A. GPS: Global Positioning System.

B. GNSS: Global Navigation Satellite Systems.

C. TPS: Terrestrial Positioning Systems such as total stations and automatic levels.

1.03 SUBMITTALS

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

B. RSN 01 71 20-1, Surveying Plan:

1. Describe work layout and survey methods.
2. Surveying schedule.
3. Example of field records format on electronic data collection devices.

C. RSN 01 71 20-2, Resume:

1. Proof of Registration as a licensed surveyor or engineer in New Mexico.
2. Construction surveyor.

D. RSN 01 71 20-3, Accuracy Check Results:

1. Accuracy check of Government-established primary control.

E. RSN 01 71 20-4, Completed and Reduced Survey Notes:

1. Copy of completed and reduced survey notes (electronic or paper) for a survey or portion of survey. Include ASCII coordinate files.
2. Field records on electronic data collection devices: Include electronic files and paper copies of notes.

F. RSN 01 71 20-5, Original Field Survey Books.

G. RSN 01 71 20-6, Quantity Survey Notes and Computations:

1. Itemized statement for work covered by notes and computations:

    a. Electronic files that support calculations (i.e. dwg, ASCII, dems, landXML).

2. When progress payment invoice includes unit priced pay items that surveys required for computing quantities, this submittal is part of documentation required for a proper invoice for progress payments in accordance paragraph (a)(2)(xi) of the clause at FAR 52.232-27 – Prompt Payment for Construction Contracts.

H. RSN 01 71 20-7, Workday's Survey Notes:

1. Copies when requested by Government.

1.04 PRIMARY CONTROL

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

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

C. Government will provide complete listing and identification of primary control within 15 days after issuance of Notice to Proceed. See 51 00 00 – Information Available to Offerors.

D. Check and verify primary control and resolve discrepancies with Government before beginning work.

E. Preserve and maintain primary control points until otherwise authorized. Government may reestablish damaged or destroyed primary control points and backcharge reestablishment cost to Contractor.

1.05 QUALIFICATIONS

A. Responsible Surveyor:

1. Professional Land Surveyor or Professional Engineer.

2. Registered in New Mexico.

3. When GPS/GNSS is utilized, shall have working knowledge of geodesy, GNSS/GPS capabilities.

B. Certified Construction Surveyors (Level 3):

1. Under supervision and direction of Professional Land Surveyor or Professional Engineer.

2. Minimum 2-years' experience in charge of construction surveys for construction projects similar in nature to that required by this contract.

3. In charge of construction surveys for at least 2 projects similar in nature to that required by this contract.

PART 2 PRODUCTS

2.01 SURVEYING MATERIALS AND EQUIPMENT

A. Provide materials required for surveying work, including, but not limited to, stakes, spikes, steel pins, templates, platforms, and tools:

1. Except as required to be incorporated in work or left in place, surveying materials remain property of Contractor.

PART 3 EXECUTION

3.01 GENERAL

A. Construction surveyor shall be on site during construction activities to provide control of work.

B. Cultural Resources:

1. Obtain COR approval before entering site with a vehicle.
2. Refer to Section 01 57 90 - Preservation of Historical and Archeological Data if cultural resources are encountered.

3.02 LAYOUT OF WORK SURVEYS

A. Establish lines and grades for work layout from Government-established primary control points.

B. Establish measurements required for work execution to specified tolerances.

C. Provide stakes, markers, and other survey controls necessary to control, check, and guide construction. Place and mark controls so COR can monitor progress without the use of survey equipment.

3.03 QUANTITY SURVEYS

A. Perform surveys and computations to determine quantities of work performed or placed during each progress payment period.

B. Perform surveys necessary for Government to determine final quantities of work in place. Final payment quantities will be based on Government's original terrain data and submitted survey notes and computations.

C. Perform quantity surveys in presence of authorized Government representative, unless specifically waived. Notify Government at least 24-hours before performing a quantity survey.

3.04 SURVEY REQUIREMENTS

A. Alignment and ROW Staking: Each 50-feet on tangent and each 25-feet on curves.

B. Slope Staking: Each 50-feet on tangent and each 25-feet on curves, stake every 10-feet in elevation on slopes.

C. Structures: Stake out of structures and checkouts before and during construction.

D. Roads: Blue tops each 50-feet on tangent and each 25-feet on curves.

E. Cross-sections: Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys. Survey borrow areas before and after removal of materials, but before final shaping.

F. As-builts: As required for structures and other features of work.

G. A licensed surveyor shall survey and stake ROW boundaries.

3.05 ACCURACY

A. Degree of Accuracy:

1. Alignment of Tangents and Curves: Within 0.1-foot.
2. Structure Points: Set within 0.01-foot, except where installation or operation considerations require tighter tolerances.
3. Blue Tops: Set within 0.1-foot.
4. Cross-Section Points: Locate within 0.1-foot, horizontally and vertically.
5. Vertical Control Surveys: Close within 0.05-feet times the square root of circuit length in miles.

3.06 FIELD RECORDS

A. Record field notes, computations, and other surveying data on electronic data collection devices or in fieldbooks. Field records shall be complete and accurate record of survey.

B. Record survey data in accordance with recognized professional surveying standards:

1. Notes or data not in accordance with standard formats will be rejected.
2. Illegible notes or data or erasures on any page of a fieldbook will be sufficient cause for rejection of part or all of fieldbook.
3. Corrections by ruling or lining out errors will be permitted.
4. Copied notes or data will not be permitted.
5. Rejection of part or all of a fieldbook may necessitate resurveying.

C. Data and notes may be collected on electronic data collection devices with prior approval of COR:

1. Electronic files of notes: In approved format.
2. Include electronic files and paper copies of notes in submittals.

END OF SECTION

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SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work except as specified.
2. Cost of environmental site assessments are Contractor's responsibility.

1.02 DEFINITIONS

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, State, Tribal or local laws or regulations.

1.03 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

B. Code of Federal Regulations (CFR)

1.	40 CFR 261.3	Definition of Hazardous Waste
2.	49 CFR 171-179	Transportation - Hazardous Waste Regulations

1.04 SUBMITTALS

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

B. RSN 01 74 00-1, Waste Production and Disposal Plan:

1. For each type of waste, list estimated quantity and planned disposal location.

C. RSN 01 74 00-2, Waste Production and Disposal Records:

1. For each type of waste, list quantity and disposal location.
2. Certifications waste was properly disposed.
3. Recycled waste materials verification.
4. Hazardous wastes manifests.

D. RSN 01 74 00-3, Environmental Consultant Resume:

1. Describe experience on similar project.

E. RSN 01 74 00-4, Environmental Site Assessment.

1.05 QUALIFICATIONS

A. Environmental consultant: Minimum 2-years' experience in conducting environmental site assessments for similar construction.

1.06 REGULATORY REQUIREMENTS

A. Comply with Federal, State, Navajo Nation, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

1.07 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR:

1. Cease work in areas where waste may be hazardous until waste materials are investigated by Government.
2. Have Environmental Consultant investigate waste materials and make recommendations for continuing work. Government will review and approve of investigation and recommendations.
3. If waste is hazardous, CO may order delays in time of performance or changes in work, or both.
4. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. Keep work and storage areas free from accumulations of waste materials and rubbish.

3.02 FINAL CLEANUP

A. Remove temporary plant facilities, buildings, concrete footings and slabs, rubbish, unused materials, concrete forms, and other similar materials which are not part of permanent work.

B. Leave structures "broom clean".

3.03 DISPOSAL

A. Nonhazardous waste materials:

1. Dispose by removal from jobsite.
2. Dispose of nonhazardous waste materials that are not reused or recycled at appropriately permitted disposal facilities.

B. Hazardous Waste Disposal:

1. Dispose by removal from jobsite.
2. Recycle hazardous waste whenever possible.
3. Dispose of hazardous waste materials that are not recycled at appropriately permitted treatment or disposal facilities.
4. Transport hazardous waste in accordance with 49 CFR 171-179.

C. Certification: Certify that wastes are disposed of in accordance with Federal, State, Tribal and local regulations.

3.04 SITE ASSESSMENT

A. Upon completion of work, perform site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation areas.
2. Petroleum dispensing and storage areas where aggregate storage of petroleum at jobsite was over 110-gallons.
3. Hazardous material storage areas.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels.

3.05 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

SECTION 01 78 30
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for other items of work.

1.02 SUBMITTALS

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

B. RSN 01 78 30-1, Final As-built Drawings:

1. Certified marked sets.

1.03 RECORD DRAWINGS

A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of as-built conditions. Keep drawings at jobsite and mark as work progresses:

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents:

a. Include buried or concealed construction and utilities.

b. Include existing items, topographic features, and utility lines revealed during construction which differ from those shown on contract drawings.

2. Mark to define construction actually provided where choice of materials or methods is permitted in specifications, or where variations in scope or character of work from that of the original contract are authorized.

B. Use standard drafting practice to represent changes and include supplementary notes, legends, and details necessary to clearly portray as-built construction.

C. Mark as-built drawings in the following colors:

1. Red - Additions to original drawings.

2. Green - Deletions to original drawings.

3. Blue - Notations necessary for explanation of as-built markings.

D. Allow Government to review drawings during weekly construction meetings and be available at all other times.

E. Upon completion of work, sign marked prints as certified correct:

1. Sign and date each drawing as certified correct. Do not include or certify Information Only drawings.

2. If no revisions were necessary to illustrate as-built conditions, mark drawing with "No Changes."

F. Provide videos, phots and other pertinent documentation and as requested by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 82 20
REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Pipe Removal and Disposal:

1. Measurement: Removed length as approved by COR.
2. Payment: Linear foot price offered in Price Schedule 1 (Reach 9).
   a. Pipe depth: 0-feet (on the surface) to 3-feet.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

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

B. Code of Federal Regulations (CFR)

1.	29 CFR 1910	Occupational Safety and Health Standards
2.	29 CFR 1926	Safety and Health Regulations for Construction
3.	40 CFR 61	National Emission Standards for Hazardous Air Pollutants (NESHAP)
4.	40 CFR 262	Standards Applicable to Generators of Hazardous Waste

C. State of New Mexico Administrative Codes (NMAC)

1.	20 NMAC 9.1	Environmental Protection, Solid Waste, Solid Waste Management

1.03 DEFINITIONS

A. ACM: Asbestos Containing Material.

B. Regulated area: Areas where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of uncontrolled release of asbestos dust, fibers or debris. Areas on project site where Action Level is exceeded for asbestos levels.

1.04 SUBMITTALS

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

B. RSN 02 82 20-1, Contractor Qualifications:

1. Contractor/Supervisor qualifications, in accordance with 40 CFR 61.145(c)(8).

C. RSN 02 82 20-2, Asbestos Hazard Containment Plan:

1. Containment System:

a. Descriptions, detail project drawings, and site layout. Include work site containment area techniques, local exhaust ventilation system locations, decontamination units, temporary waste storage facility, location of temporary utilities, and boundaries of each regulated area.

b. If a modified containment area, glove-bag or outdoor technique can be safely used, these should be specified in detail.

2. Emissions Monitoring:

a. Monitoring airborne asbestos and reporting releases plan.

b. Decontamination of contaminated areas and surfaces plan.

c. Clearance testing plan.

3. Waste Handling and Disposal:

a. Plan for handling, storage, transporting, and disposal of project-generated waste and cleaning of reusable items.

D. RSN 02 82 20-3, Emission Monitoring Results:

1. Prepare and submit in accordance with approved Asbestos Hazard Containment Plan:

a. Airborne asbestos monitoring results during construction work, including field blanks.

b. Post construction asbestos visual inspection report.

E. RSN 02 82 20-4, Hazardous Waste Manifest:

1. Provide a copy of Waste Manifest completed in accordance with 20 NMAC 9.1 712.

1.05 QUALIFICATIONS

A. Onsite Supervisor:

1. Experienced in administration and supervision of asbestos abatement projects under OSHA and EPA regulations.

2. Successfully completed training and is therefore accredited under the EPA Model Accreditation Plan for asbestos and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course Sampling and Evaluating Airborne Asbestos Dust or equivalent.

3. Duties include:

   a. Control entry to and from any regulated area;

   b. Supervise employee exposure monitoring required by 29 CFR 1926.1101;

   c. Ensure engineering containment controls in use are in proper operating condition and are functioning properly.

B. Asbestos Abatement Workers:

1. Meet requirements contained in 29 CFR 1926.1101, 40 CFR 61, Subpart M and other applicable Federal, State of New Mexico, Tribal, and local requirements.

C. Independent Testing Laboratory:

1. Proficient in conduction Polarized Light Microscopy (PLM) and accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos analysis.

2. Proficient in conducting Phase Contrast Microscopy (PCM) of airborne samples using NIOSH Method 7400.

D. Transporter:

1. Approved for asbestos transport by Federal, State, Tribal, and local regulatory agencies.

E. Disposal Facility:

1. Approved for asbestos disposal by Federal, State, Tribal, and local regulatory agencies.

1.06 SAFETY AND HEALTH REGULATIONS

A. Comply with RSHS.

B. Limit employee exposure to asbestos and other airborne contaminants in accordance with 29 CFR 1926.1101.

1.07 PROJECT CONDITIONS

A. Existing 3-inch helium transite pipe to be removed contains asbestos. Asbestos may become regulated asbestos containing material (RACM) during demolition, depending upon method used to remove pipe. Conduct removal, and disposal of ACM in accordance with 40 CFR 61.145 Standard for Demolition and Renovation.

1.08 CONTRACTOR'S RESPONSIBILITIES

A. Obtain EPA Identification number, in accordance with 40 CFR 262.12 before treating, storing, or transporting hazardous waste.

B. Prepare manifest, in accordance with 40 CFR 262 Subpart B, before transporting hazardous waste for offsite treatment, storage, or disposal.

C. Before transporting hazardous waste, obtain written notice from owner or operator of hazardous waste facility, including documentation that facility has required permits and that facility will accept waste to be shipped under this contract, in accordance with 40 CFR 262.12.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 NOTIFICATION

A. Government will complete and submit New Mexico Department Asbestos NESHAP Notification.

B. Contractor shall notify COR 14-days before beginning removal work so Government can complete notification.

3.02 ASBESTOS ABATEMENT

A. Handle and dispose of ACM in accordance with Federal, State, Tribal and local regulations.

3.03 REPORTABLE RELEASES

A. Notify applicable agencies and COR.

3.04 DECONTAMINATION OF CONTAMINATED AREAS

A. Decontaminate contaminated areas in accordance with approved plan.

END OF SECTION

SECTION 03 11 10
CONCRETE FORMING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Furnishing and constructing forms:

a. Include in prices offered in Price Schedules as applicable, in accordance with Section 03 30 00 – Cast-In-Place Concrete:

1) Including:

a) Thrust Blocks.

b) Slabs.

c) Pipe Collars.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 318-14	Building Code Requirements for Structural Concrete and Commentary

B. APA - The Engineered Wood Association (APA)

1.	APA PS 1-09	Structural Plywood

C. Bureau of Reclamation (Reclamation)

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

D. Western Wood Products Association (WWPA)

1.	WWPA WLGR-17	Western Lumber Grading Rules

1.03 DESIGN

A. Design formwork in accordance with RSHS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 FORM MATERIALS

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

Table 03 11 10A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common or better, shiplap, or plywood	Steel sheathing permitted Steel lining permitted if approved
F4	Plane surfaces: Plywood. Warped surfaces: Plywood, or lumber which is free from knots and other imperfections and which can be cut and bent accurately without splinters or splitting. Severe curvature: May be lined with continuously supported flexible material such as Masonite or thin plywood. Use of material is subject to COR approval.	Steel sheathing permitted Steel lining not permitted.
Textured Surface	Use form liner specified for textured surface	Steel sheathing not permitted Steel lining not permitted

B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.

C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.

D. Plywood: APA PS 1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

E. Softwood Lumber:

1. Meet requirements of WWPA WLGR for dressed lumber or worked lumber of specified grade.
2. Use common boards surfaced on both edges (S2E) in accordance with WWPA WLGR.
3. Use 6- or-8 inch wide lumber for shiplap forms.
4. Use same lumber width in forms for F2 finishes.

3.02 INSTALLATION

A. Construct forms to confine and shape concrete to required lines so that completed work meets specified structural deviations, surface tolerances, and finish requirements.

B. Construct forms with sufficient strength to withstand pressure from placing and vibrating concrete. Maintain in proper position.

C. Adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.

D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.

E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.

F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.

G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.

H. F2 Finish:

1. Use 1 type of form sheathing or lining material for exposed F2 surfaces.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.
5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.

I. F4 Finish:

1. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
2. Align sheathing or lining horizontally and vertically and place to minimize joint marks on surfaces.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. Make vertical form marks continuous for entire height of surface.
5. Fill and smooth finish voids at joints in plywood form lining or sheathing.
6. Do not construct forms continuously from lift to lift. Remove forms after concrete in a lift has hardened and reset forms for next lift.
7. Reset forms to overlap hardened concrete in previous lift by 1-inch, maximum.
8. Tighten forms snugly against hardened concrete so that forms will not spread and cause offsets or loss of mortar at construction joints when concrete placement is resumed. Provide additional bolts or form ties required to hold reset forms tight against hardened concrete.

J. Form Ties and Anchors:

1. Embed ties for holding forms.
2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.
3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.
4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.

K. Cleaning and Oiling Forms:

1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.
2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3.03 REMOVAL

A. Remove forms within 24-hours after concrete has gained sufficient strength to prevent damage by form removal.

1. Non-supporting forms such as sides of beams, walls, columns, and similar items: Remove after cumulatively curing at not less than 50 degrees F for 24-hours from time of concrete placement when:
    a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
    b. Curing protection is maintained.
2. Forms for elevated structural slabs or beams:
    a. Remove in accordance with ACI 318, Chapter 6.
    b. Do not remove forms until concrete has reached compressive strength of at least 80 percent of specified 28-day compressive strength, as determined by test cylinders.
3. Forms on upper sloping faces of concrete, such as forms on waterside of warped transitions: Remove as soon as concrete has attained sufficient stiffness to prevent sagging.
4. Wood forms for wall openings: Loosen as soon as loosening can be accomplished without damage to concrete to prevent excessive stress in concrete from swelling of forms. Construct forms for openings to facilitate loosening.

B. Do not remove forms until concrete strength is such that form removal will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete.

C. Remove forms in a manner which prevents damage to concrete.

D. Repair damaged concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.

E. Begin required repair and curing immediately after form removal.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules as applicable in accordance with Section 03 30 00 – Cast-In-Place Concrete:

a. Includes:

1) Blocking and collars not covered in other sections.

2) Thrust Blocks.

3) Collars.

4) Slabs.

5) Sectionalizing Valve Assembly.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 315-99	Details and Detailing of Concrete Reinforcement (Part of SP-66-04 ACI Detailing Manual)

B. ASTM International (ASTM)

1.	ASTM A615/A615M-16	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2.	ASTM A996/A996M-16	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.03 SUBMITTALS

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

B. RSN 03 20 00-1, Reinforcement Diagrams and Lists:

1. Bar-placing diagrams, bar lists, and bar-bending diagrams required for reinforcement fabrication and placement:

a. Prepare bar-placing diagrams, bar lists, and bar-bending diagrams in accordance with ACI 315 and drawings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid rusting.

B. Protect from contaminants such as grease, oil, and dirt.

C. Furnish identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 STEEL REINFORCING

A. Reinforcing Bars:

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

2.02 ACCESSORIES

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

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

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.

B. Field bending not allowed unless approved by COR:

1. Do not use heat to bend.

C. Do not use torch to cut.

D. Accurately place reinforcement:

1. Place reinforcement as shown on standard drawing 40-D-60003, unless otherwise shown on reinforcement design drawings.
2. Unless otherwise prescribed, placement dimensions shall be to centerline of the bars.

3. Place reinforcement with a clear distance of 1-inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.

E. Splices:

1. Locate where shown on drawings, unless otherwise approved by COR.

2. Reinforcement may be spliced at additional locations for the convenience of the Contractor, subject to approval of COR.

F. Do not weld or tack weld reinforcing bars.

G. Secure reinforcement in place so that it will not be displaced during concrete placement.

H. Do not disturb reinforcement in concrete that has been placed.

I. Tolerances:

1. Maintain concrete cover over reinforcement within 1/2-inch of specified cover where specified cover is greater than 2 1/2-inches.

2. Maintain concrete cover over reinforcement within 1/4-inch of specified cover where specified cover is 2 1/2-inches or less.

3. Maintain spacing of reinforcing bars within 1-inch of required spacing.

J. Embedded Dowels:

1. Place dowels at locations shown on drawings.

2. Position dowels parallel to each other and to concrete surface as shown on drawings.

3. Maintain dowels accurately in position during concrete placement.

END OF SECTION

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete for miter bend thrust blocks in prices offered in Price Schedules for Line Pipe.
2. Include cost of concrete for thrust collars in prices offered in Price Schedules for Sectionalizing Valve Assemblies.
3. Include cost of concrete for steep pipe anchor blocks in prices offered in Price Schedules for Line Pipe.
4. Include cost of concrete for test station pipe and bollards in prices offered in Price Schedules for Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems.
    a. Including:
        1) Concrete.
        2) Aggregate materials, fine aggregate.
5. Include cost of concrete for guard posts and markers in prices offered in Price Schedules for appropriate other items of work.

1.02 ACRONYMS

A. NRMCA: National Ready Mixed Concrete Association.

1.03 DEFINITIONS

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

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 117-10	Tolerances for Concrete Construction and Materials
2.	ACI 201.2R-16	Guide to Durable Concrete
3.	ACI 301-16	Structural Concrete
4.	ACI 304R-00	Guide for Measuring, Mixing, Transporting, and Placing Concrete
5.	ACI 305.1-14	Hot Weather Concreting
6.	ACI 306.1-90(2002)	Cold Weather Concreting

B. ASTM International (ASTM)

1.	ASTM C31/C31M-15ae1	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C33/C33M-16e1	Concrete Aggregates
3.	ASTM C39/C39M-17	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C42/C42M-16	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5.	ASTM C94/C94M-17	Ready-Mixed Concrete
6.	ASTM C114-15	Chemical Analysis of Hydraulic Cement
7.	ASTM C117-13	Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
8.	ASTM C136-14	Sieve Analysis of Fine and Coarse Aggregates
9.	ASTM C138/C138M-17	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
10.	ASTM C143/C143M-15a	Slump of Hydraulic-Cement Concrete
11.	ASTM C150/C150M-17	Portland Cement
12.	ASTM C171-16	Sheet Materials for Curing Concrete
13.	ASTM C231/C231M-17	Air Content of Freshly Mixed Concrete by the Pressure Method
14.	ASTM C260/C260M-10a(2016)	Air-Entraining Admixtures for Concrete
15.	ASTM C295/C295M-12	Petrographic Examination of Aggregates for Concrete

16.	ASTM C309-11	Liquid Membrane-Forming Compounds for Curing Concrete
17.	ASTM C494/C494M-16	Chemical Admixtures for Concrete
18.	ASTM C566-13	Total Evaporable Moisture Content of Aggregate by Drying
19.	ASTM C595/C595M-17	Blended Hydraulic Cements
20.	ASTM C618-15	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
21.	ASTM C920-14a	Elastomeric Joint Sealants
22.	ASTM C989/C989M-16e1	Slag Cement for Use in Concrete and Mortars
23.	ASTM C1017/C1017M-13e1	Chemical Admixtures for Use in Producing Flowing Concrete
24.	ASTM C1064/C1064M-12	Temperature of Freshly Mixed Hydraulic-Cement Concrete
25.	ASTM C1260-14	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
26.	ASTM C1293-08b(2015)	Determination of Length of Change of Concrete Due to Alkali-Silica Reaction
27.	ASTM C1315-11	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
28.	ASTM C1567-13	Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
29.	ASTM C1602/C1602M-12	Mixing Water Used in the Production of Hydraulic Cement Concrete
30.	ASTM D1751-04(2013)e1	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
31.	ASTM D1752-04a(2013)	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

C. U.S. Army Corps of Engineers (USACE)

1.	USACE CRD-C 662-10	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

D. International Concrete Repair Institute (ICRI)

1.	ICRI 310.2-13	Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays (formerly No. 03732)

E. Bureau of Reclamation (Reclamation)

1.	USBR M-47	Standard Specifications for Repair of and Maintenance of Concrete, August 2015 (Part 2 of "Guide to Concrete Repair, Second Edition" available at www.usbr.gov/tsc/techreferences/mands/mands-pdfs/guide.pdf
2.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

F. National Sanitation Foundation International (NSF)

1.	NSF/ANSI 61-16	Drinking Water System Components - Health Effects

1.05 SUBMITTALS

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

B. RSN 03 30 00-1, Approval Data:

1. Mix Design: For each concrete mix:
   a. Mixture proportions.
   b. Material sources:
      1) Name and manufacturer of each cementitious material.
      2) Name of aggregate source(s).
      3) Product name and manufacturer of admixtures to be used in mix. Certify that admixtures:
         a) Contain no purposefully added chlorides.
         b) Chloride ion limits in accordance with ACI 201.2R.

4) Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

c. Physical properties:

1) Compressive strength:

a) Test data: ACI 301, paragraph 4.2.3.4.

b) Field test data: Performed within past 24-months.

c) Trial mixtures:

i. Incorporate admixtures that will be used in production mixes into trial mixes.

ii. Results from trial batches made within past 6 months.

iii. Trial mix test results, three six inch diameter cylinders each at 7, and 28 days.

iv. Average compressive strength of trial batch cylinders at specified design age.

d. Resubmit mix design for change in material source or type.

2. Name and manufacturer of curing compounds, and joint filler:

a. Include application instructions for curing compound.

3. Aggregate and Water Certifications and test reports:

a. Sealed by Professional Engineer.

b. Less than 12-months old.

c. Certifications and test reports:

1) Aggregate producer for:

a) ASTM C33 physical properties

b) ASR testing reports for each aggregate source.

2) Mixing water: ASTM C1602.

d. Submittal of certifications and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements.

C. RSN 03 30 00-2, Concrete Placement Schedule:

1. Complete, detailed concrete placement schedule showing Contractor's plan for individual placements including placement of reinforcement and embedded items.

2. Detail as necessary to show location, sequence, and date of concrete placements scheduled for each item of concrete work.

3. Show submittal schedule for placement and reinforcement drawings.

D. RSN 03 30 00-3, Certifications:

1. NRMCA Certification of Production Facilities. NRMCA certification shall be current and include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures. NRMCA certification shall be maintained throughout duration of project.
2. ACI Aggregate Testing Technician certification(s).
3. ACI Concrete Field Testing Technician certification(s).
4. ACI Concrete Strength Testing Technician certification(s).

E. RSN 03 30 00-4, Cementitious Materials Certification and Test Reports.

1. Less than 3-months old.
2. Certify materials were tested during production or transfer in accordance with specified reference standards.

F. RSN 03 30 00-5, Test Reports.

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

1.06 QUALIFICATIONS

A. Ready mix plant: Currently certified by NRMCA. NRMCA certification shall include automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures. NRMCA certification shall be maintained throughout duration of project.

B. ACI Aggregate Testing Technician: Currently certified ACI Aggregate Testing Technician - Level 1.

C. Flatwork foreman with at least 5-years of experience with similar type placements.

D. ACI Concrete Field Testing Technician: Currently certified ACI Concrete Field Testing Technician - Grade I.

E. ACI Strength Testing Technician: Currently certified ACI Strength Testing Technician.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Furnish legible and digitized batch ticket with each batch of concrete in accordance with ASTM C94. Deliver ticket to COR at jobsite during batch delivery.

B. Sponge rubber joint filler storage:

1. Store in protected area at temperature of 70 degrees F (21 degrees C) or less.
2. Do not expose to direct sun.

1.08 PRE-PLACING MEETING

A. At least 14-days before first concrete placement meet with COR for pre-placement meeting.

B. Coordinate time and place of meeting with COR at least 14-days before meeting.

C. Contractor attendees shall be at least the following:

1. Contractor onsite supervisor.
2. Concrete forming, placing, and finishing onsite supervisor(s); Contractor or subcontractor(s) employee as applicable.
3. Technical specialist from ready-mix supplier.
4. Concrete pump subcontractor onsite supervisor, if applicable.
5. Testing agency onsite supervisor(s).

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Portland cement:

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

B. Blended hydraulic cement:

1. ASTM C595, Type IS or IP.
2. Meet equivalent alkalies requirement of ASTM C595, Table 2, Option G or Table 3.

C. SCM:

1. Pozzolan:
   a. ASTM C618, Class F.
      1) Except:
         a) Sulfur trioxide, maximum: 4.0 percent.
         b) Loss on ignition, maximum: 2.5 percent.

2) In addition:

a) Meets Effectiveness in Controlling Alkali-Silica Reaction in Table 3 Supplementary Optional Physical Requirements of ASTM C618.

b) Calcium oxide, maximum: 8.0 percent.

c) Pozzolan "R" factor less than 2.5. Pozzolan with this "R" factor shall not decrease sulfate resistance of concrete:

i. R: (C-5)/F

ii. C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C114.

iii. F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C114.

2. Slag Cement:

a. ASTM C989, Grade 100 or 120.

2.02 WATER

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

2.03 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C33:

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

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

C. Alkali Silica Reaction (ASR):

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

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

b. Acceptance criteria specified below are based on 28-day readings after the zero readings.

c. Expansion is no greater than 0.10 percent: Aggregates are acceptable.

d. Expansion is greater than 0.10 percent:

1) Test aggregates according to ASTM C1567 using components (e.g. coarse aggregate, fine aggregate, cementitious materials, and ASR inhibiting admixtures) in proportions proposed for mixture design:

a) For mixes using lithium admixtures use test procedure COE CRD-C 662.

b) Expansion of proposed mixture design test specimens, tested in accordance with ASTM C1567 does not exceed 0.10 percent:

i. Aggregates are acceptable.

c) Expansion of proposed mixture design test specimens is greater than 0.10 percent:

i. Aggregates are not acceptable unless adjustments to mixture design can reduce expansion to less than 0.10 percent, or testing by ASTM C1293 indicates aggregates will not experience deleterious expansion.

2) Use tested materials. Materials may be rejected if they do not match tested materials.

2. ASTM C1293 test results may be substituted for ASTM C1260 test results:

a. Average ASTM C1293 concrete prism expansion less than 0.04 percent at one year: Aggregates acceptable.

D. Appropriate for use in accordance with ASTM C295.

2.04 ADMIXTURES

A. Air-entraining admixture: ASTM C260.

B. Chemical admixtures:

1. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2. Admixtures shall be compatible with each other.

3. Allowable chemical admixtures:

a. ASTM C494, Type A, D, F, G, or S.

b. ASTM C1017, Type I or II.

c. ASTM C494, Type C and E, provided they do not contain chlorides.

C. Specialized chemical admixtures:

1. When batch plant has not previously used a specialized chemical admixture, admixture manufacturer shall provide on-site representative to assist with mix design and to trial batch plant personnel in dispensing and mixing operations.

2. Do not use specialized chemical admixtures which contain more than 0.1 percent chloride, by weight.

3. Alkali Silica Reaction (ASR) Inhibiting Admixture:
    a. Lithium Nitrate Admixture for ASR mitigation of reactive aggregates having the following characteristics:
        1) Meets NSF/ANSI 61.
        2) Nominal 30 percent aqueous solution of Lithium Nitrate:
            a) Density: 10 pounds/gallon (1.2 kg/L).
            b) Approximate chemical constituents (percent by mass):
                i. LiNo3 (Lithium Nitrate): 30 plus or minus 0.5.
                ii. SO4-2 (Sulfate Ion), maximum: 0.1.
                iii. Cl- (Chloride Ion), maximum: 0.2.
                iv. NA+ (Sodium Ion), maximum: 0.1.
                v. K+ (Potassium Ion), maximum: 0.1.
    b. Coordinate with manufacturer regarding Lithium Nitrate dosage.
    c. Do not use Lithium Nitrate Admixture for concrete in continuous or nearly continuous contact with water.
4. Extended set control admixture:
    a. MasterSet Delvo hydration controlling admixture manufactured by BASF Construction Chemicals, Inc. www.basf-admixtures.com; or equal, with the following essential characteristics:
        1) Meets ASTM C494, Type B.
        2) Retards setting.
        3) Does not reduce concrete strength.
    b. Use within manufacturer's time limits.
    c. Include admixture on batch ticket.
    d. Admixture quantity required to stabilize concrete shall be pre-determined using jobsite materials. Initial concrete setting time shall be monitored and adjusted during project by qualified concrete technician.

2.05 CURING MATERIALS

A. Water: ASTM C1602, including optional requirements of Table 2.

B. Curing compound: ASTM C309:
1. Capable of meeting moisture retention at manufacturer's application rate.
2. Meet Federal, State, Tribal and local regulations for VOCs.

C. Sheet materials:

1. Polyethylene film: ASTM C171, white opaque.
2. White burlap-polyethylene sheeting: ASTM C171.

2.06 ACCESSORIES

A. Sponge rubber joint filler:

1. ASTM D1752, Type I, except:
   a. Test specimen compression load: 50 to 150 pounds per square inch.
2. Joint filler adhesive: Non-bituminous adhesive recommended by filler manufacturer.}

B. Bituminous joint filler: ASTM D1751.

C. Elastomeric sealant: ASTM C920, polyurethane, Use M, Grade NS, Class 25.

D. Evaporation control:

1. MasterKure ER 50 manufactured by BASF Construction Chemicals, Inc., www.basf-admixtures.com; or equal having the following essential characteristics:
   a. Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
   b. For application after finishing and prior to applying curing compound.
   c. For use when the evaporation rate is high.
2. Do not use as finishing aid.

2.07 MIX

A. Contractor shall design and adjust concrete mix:

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

B. Cementitious materials options:

1. Specified Portland cement plus specified pozzolan by percent weight specified in Table 03 030 00A - Concrete Mixes.
2. Specified Portland cement plus specified slag cement by percent weight specified in Table 03 03 00A - Concrete Mixes.

3. Blended Hydraulic: ASTM C595 provided, specified Portland cement with percent of specified pozzolan or specified slag cement specified in Table 03 30 00A - Concrete Mixes.

C. Design concrete mixes in accordance with Table 03 30 00A - Concrete Mixes. General concrete mix shall be used for concrete unless otherwise specified:

1. Net water-cementitious materials ratio (w/c) is maximum, by weight. Cementitious material weight is cement plus SCM.

2. Slump at point of placement: In accordance with ASTM C143.

3. Air Entrainment: Percent air by volume of concrete as discharged at point of placement, in accordance with ASTM C231.

Table 03 30 00A - Concrete Mixes

Mix No	Feature	f'c (lb/in^2)	Max w/c*	NMSA**	Percent SCM*** A: Class F Pozzolan B: Slag Cement	Slump (inches)	Air Content (percent)	Notes
1	General Concrete and other not specified	4500 at 28 days	0.45	57, 67	A: 20 plus or minus 5	2 to 4	4.5 to 7.5	1
2	Collars	4500 at 28 days	0.45	57, 67	A: 20 plus or minus 5	2 to 4	4.5 to 7.5	1, 2
3	Structural Concrete Pipe Encasement /Thrust Blocks	4500 at 28 days	0.45	57, 67	A: 20 plus or minus 5	2 to 5	4.5 to 7.5	1, 2

*Maximum water/cementitious materials ratio.
**Nominal Maximum Size Aggregate.
*** SCM as percent of total cementitious material, by weight.
NOTES:
1. Ternary blended cementitious materials which meet the specifications may be submitted for approval.
2. Concrete with ASTM C1017, Type I or II plasticizing admixtures, ASTM C494 Type F high-range water-reducing admixtures, or Type G high-range water-reducing and retarding admixtures:
   i. Admixture shall be incorporated into trial batch or historical data.
   ii. Use slump appropriate for placing conditions.

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

E. Concrete trial mixes:

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

2.08 BATCHING, MIXING, AND TRANSPORTING

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

B. Manufacture and deliver in accordance with ASTM C94 and ACI 304R:

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

C. Cold weather: When air temperature has fallen to or is expected to fall below 40 degrees F, prepare ingredients and mix in accordance with ACI 306.1:

1. Do not use frozen materials or materials containing ice or snow.
2. Uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of not less than 50 degrees F.

D. Hot Weather: When precautions are necessary, prepare ingredients and mix in accordance with ACI 305.1:

1. Cool ingredients before mixing to maintain specified maximum concrete temperature at time of placement.
2. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Ice replacing batch water shall be melted prior to discharge.
3. Using liquid nitrogen to cool concrete is Contractor’s option.

E. Prevent appreciable segregation of ingredients.

F. Place concrete within 90-minutes from introduction of cement to water or aggregates:

1. For placing times exceeding 90-minutes, extended set control admixtures may be used when approved by COR.

2.09 CONCRETE TEMPERATURE

A. Concrete temperature at placing:

1. 50 to 85 degrees F (10 to 29 degrees C).

2.10 CONTRACTOR SOURCE QUALITY TESTING

A. Perform sampling, testing, and reporting as required in Table 03 30 00B - Batch Plant Testing:

1. Independent testing agency shall meet requirements specified in Section 01 46 20 - Testing Agency Services.

2. Personnel conducting tests: Qualified as ACI Aggregate Testing Technician, Level 1; or equal.

B. Perform tests at least as often as frequencies specified in Table 03 30 00B - Batch Plant Testing.

C. Notify COR immediately of test results showing failure of materials to meet specifications. Provide passing test to COR within 24-hours. Submit reports of test results as specified.

2.11 BATCH PLANT TESTING

Table 03 30 00B- Batch Plant Testing

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

PART 3 EXECUTION

3.01 PREPARATION

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

B. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with air-water jet and dry to uniform surface-dry condition.

C. Prepare earth foundations free from frost or ice.

D. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete. Keep subgrade moisture uniform without puddles or dry areas.

E. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete:

1. Remove laitance, loose or defective concrete, coatings, and sand, curing compound, and other foreign material.
2. Sandblast, steel shotblast, or high-pressure water jet surfaces, or use other method approved by COR to create a surface equivalent to or larger than CSP 5 in accordance with ICRI 310.2.
3. Wash surface thoroughly, and surface dry immediately before placement of adjoining concrete.

3.02 PLACING

A. Notify COR at least 24-hours before placing concrete.

B. Provide placement checkout cards in a watertight container. COR will approve placement card format:

1. Sign each line item indication work is completed in accordance with specifications.
2. Obtain COR signature after each line item.
3. Do not place concrete without required signatures.
4. Use of placement checkout cards shall be required by COR.

C. Do not place concrete without approval of COR.

D. Place concrete in presence of COR.

E. Perform concrete placing under the direct supervision of a qualified flatwork foreman for placements.

F. Allow at least 7-days between adjacent placements, or as approved by COR.

G. Do not use aluminum pipes and chutes for placing or pumping concrete.

H. Adding water to concrete batch at site will be allowed only once and only when approved by the COR:

1. Add additional water before concrete is discharged.
2. Do not exceed specified water to cement ratio.
3. After water is added, concrete shall be mixed for at least 30 revolutions of mixer drum at mixing speed.
4. Record added water on the batch ticket to nearest gallon.

I. Adding air entraining admixtures to concrete batch at site will be allowed only once when approved by COR:

1. After air entraining admixture is added, concrete shall be mixed for minimum of 30 revolutions of mixer drum at mixing speed.
2. Take slump and air content after air-entraining admixture addition and additional revolutions.
3. Record added air entraining admixture on batch ticket to nearest ounce.

J. Do not use concrete which has become so stiff that concrete cannot be properly placed.

K. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20-inches in depth of layers.

L. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.

M. Hot Weather:

1. Place concrete in accordance with ACI 305.1.
2. Protect reinforcing steel so that steel temperature does not exceed ambient air temperature immediately before placing concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

N. Cold weather:

1. Place concrete in accordance with ACI 306.1.
2. Do not place concrete on frozen subgrade or subgrade containing frozen materials.

3.03 FINISHING

A. Notify COR before finishing concrete.

B. Finish concrete in presence of Government inspector unless inspection is waived in each specific case:

1. Perform placement finishing under the direct supervision of a qualified flatwork foreman.

C. Finish surfaces as specified in Table 03 30 00F - Formed Surfaces and Table 03 30 00G - Unformed Surfaces.

D. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.

E. Formed surfaces:

1. Finish class is designated by symbols F1, F2.

2. Finish F1:

a. Applies to formed surfaces to be covered by fill material, grout, or concrete, and construction joint surfaces as specified in Table 03 30 00F - Formed Surfaces.

b. Protect form tie rod ends on surfaces in contact with fill material from moisture where they will be below water table or waterline:

1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.

c. Cut off flush with formed surface form tie rod ends on surfaces in contact with concrete or fill material and above maximum water table or waterline elevation.

3. Finish F2:

a. Applies to exposed formed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish F4, and to contraction joint surfaces and expansion joint surfaces as specified in Table 03 30 00F - Formed Surfaces:

1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.

F. Unformed surfaces:

1. Do not use dry Portland cement or additional water during finishing.

2. Do not use “jitterbugs” or other tools to force coarse aggregate away from surface.

3. Finish class is designated by symbols U1, U2, or broom finish.

4. Finish U1 (Screeded Finish):
    a. Applies to unformed surfaces to be covered by fill material, grout, or concrete as specified in Table 03 30 00G - Unformed Surfaces.
    b. Use as first stage of finish U2.
    c. After concrete is placed and consolidated, strike off and level concrete to produce even uniform surface.
5. Finish U2 (Floated Finish):
    a. Applies to unformed surfaces not permanently concealed by fill material, grout, or concrete, as specified in Table 03 30 00G - Unformed Surfaces.
    b. Begin floating as soon as screeded surface has sufficiently stiffened and bleed water sheen has disappeared.
    c. Use hand- or power-driven equipment.
    d. Finish surface with minimum floating necessary to produce surface that is free of screed marks and is uniform in texture.
6. Broomed finish:
    a. Apply broom finish immediately after concrete receives U2 finish.
    b. Edge transverse joints before brooming.
    c. Produce a scored surface by brooming with fiber-bristle brush in direction transverse to that of traffic with adjacent strokes slightly overlapping.
    d. Finished surface shall have uniform appearance and be free of abrupt corrugation exceeding 1/8-inch in depth.
    e. Brooming shall eliminate flat surface left by the surface face of the edger.
7. Slope interior surfaces for drainage where shown on drawings or as directed by COR. Slope surfaces exposed to weather for drainage as directed by COR.
8. Slope narrow surfaces, such as tops of walls and curbs, approximately 3/8-inch per foot of width, unless use of other slopes or level surface is indicated on drawings or is directed by COR.
9. Slope broader surfaces; such as walks, platform, and decks; approximately 1/4-inch per foot unless use of other slopes or level surfaces is indicated on drawings or is directed by COR

3.04 JOINTS AND EDGES

A. Construction joints (CJ):
1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.

2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.

3. Locate construction joints where shown on drawings. Relocation, addition, or elimination of construction joints will be subject to approval by COR.

4. Clean, roughen, and surface dry surfaces of construction joints to be covered with fresh concrete. See Preparation article.

5. Do not use a mortar layer on construction joints.

B. Control joints (Ct.J):

1. Control joints are joints placed in concrete to provide for control of initial shrinkage stresses and cracks of monolithic units.

2. Construct control joints so no bond exists between concrete surfaces forming the joint:

a. Construct control joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.

b. Coat surface of concrete first placed at control joint with curing compound that prevents bond before placing concrete on other side of joint.

3. Reinforcement is continuous across tooled or saw cut control joints.

C. Partial Contraction Joints, (Partial Cr. J):

1. Construct partial contraction joints so no bond exists between concrete surfaces forming the joint:

a. Construct partial contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.

b. Coat surface of concrete first placed at partial contraction joint with curing compound that prevents bond before placing concrete on other side of joint.

2. At partial contraction joints, discontinue every other reinforcement bar perpendicular to the joint; i.e. 1/2 of perpendicular reinforcement shall cross the joint. End discontinued bars 2-inches from face of joint.

D. Contraction joints (Cr.J):

1. Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units.

2. Construct contraction joints so no bond exists between concrete surfaces forming the joint:

a. Construct contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.

b. Coat surface of concrete first placed at contraction joint with curing compound that prevents bond before placing concrete on other side of joint.

3. Except as provided for dowels, reinforcement is not continuous across a contraction joint.

E. Expansion joints (EJ):

1. Cut sponge rubber joint filler to size and shape of joint surface to receive filler.

2. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.

3. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

F. Expansion joints (EJ):

1. Form joint in concrete.

2. Fill joint with bituminous joint filler.

3. Butt sections of filler with tight-fitting butt joints.

G. Preformed joints consisting of plastic or metal strips not allowed.

3.05 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effects that permissible variations may have upon a structure. COR reserves the right to diminish specified structural deviations and surface tolerances where such variations impair structural action, operational function, or architectural appearance of a structure or portion of structure.

D. Construct concrete within stated variations even though more than one may be specified:

1. Specified variation for one element of a structure will not apply when it will permit another element of same structure to exceed its allowable variation.

2. Where variations are not specified or shown on drawings for a particular structure, variations shall be those specified for similar work. As an exception to clause at FAR 52.236-21 “Specifications and Drawings for Construction”, specific tolerances shown on drawings in connection with dimension shall govern.

E. Structural Deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions.

2. Variation is distance between actual position of structure or element of structure and specified position in plan for structure or particular element:

   a. Plus or minus variations indicate a permitted actual position up or down and in or out from specified position in plan.

   b. Variations not designated as plus or minus indicate maximum deviation permitted between designated successive points on completed element of construction.

3. Specified position in plan is defined as lines, grades, and dimensions described in this section, shown on drawings, or prescribed by COR.

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

A. PIPELINE STRUCTURES			
1.	Thrust Blocks, Collars, Anchor Blocks and Miscellaneous Slabs:		
	(a)	Departure from established alignment	plus or minus 2-inches
	(b)	Departure from established profile grade	plus or minus 2-inches
	(c)	Variation from specified thickness	minus 2.5 percent of specified thickness or minus 1/4-inch, whichever is greater; or plus 5 percent of specified thickness or plus 1/2-inch, whichever is greater
	(d)	Variation from specified inside dimensions	plus or minus 0.5 percent of inside dimensions

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

2.	Pre-Cast Manholes:		
	(a)	Departure from established alignment	
	(b)	Departure from established profile grade	plus or minus 1-inch
	(c)	Variation from plumb or specified batter for lines and surfaces:	plus or minus 1-inch
	(d)	Variation from specified inside dimensions	

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

2.	Precast Manholes:	
	(a) Departure from established alignment	plus or minus 1-inch
	(b) Departure from established grade	plus or minus 1-inch
	(c) Variation from plumb or specified batter for lines and surfaces:	
	(1) When overall length of line or surface is:	
	Less than 10-feet	Exposed: plus or minus 3/8-inch Buried: plus or minus 3/4-inch
	10-feet or more	Exposed: plus or minus 1/2-inch Buried: plus or minus 1-inch
	(2) For any 2 successive intermediate points on the line or surface separated by:	
	10- to 20-feet, inclusive	Exposed: 3/8-inch Buried: 3/4-inch
	More than 20-feet	Exposed: 1/2-inch Buried: 1-inch
3.	Variation from plumb of pipe erected vertically in any length of 10-feet.....	plus or minus 1/2-inch

F. Surface irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.

2. Surface irregularities are classified as “abrupt” or “gradual” and allowable tolerances are specified in Table 03 30 00D - Surface Tolerances:

   a. A surface tolerance is designated by a capital “T” followed by a number 1 through 5.

   b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt surface irregularities:

   a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

   b. Abrupt surface irregularities include isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual surface irregularities:

   a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

   b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Surface tolerances:

Table 03 30 00D - Surface Tolerances

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

H. Repair of hardened concrete not within specified tolerances:

1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.

2. Perform repair after consultation with Government inspector regarding method of repair. Notify COR as to time when repair will be performed.

3. Repair concrete which will be exposed to view in manner which will result in concrete surface with uniform appearance:

   a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16-inch in cross section at finished surface.

b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16-inch in cross section at finished surface, repair concrete by excavating and replacing concrete.

I. Field verification of surface tolerances:

1. Determine compliance of surface with specified surface tolerances.

2. Evaluate surface roughness:

a. Measure roughness height or depth and check for compliance with values specified in Table 03 30 00D - Surface Tolerances and Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions.

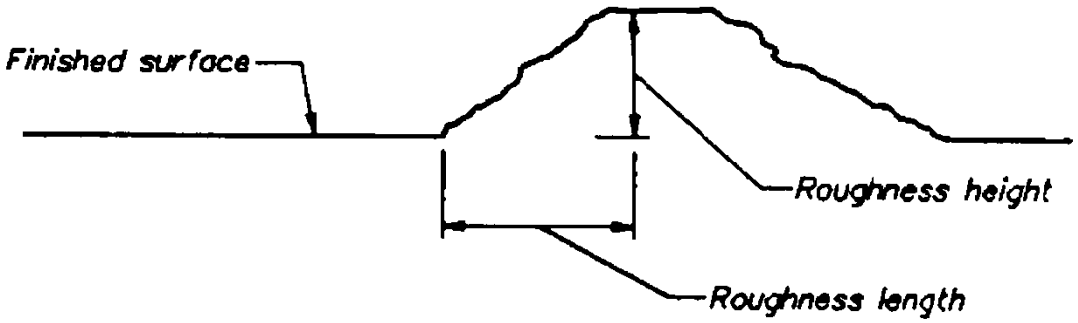
b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed applicable value specified in Table 03 30 00C - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification:

1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

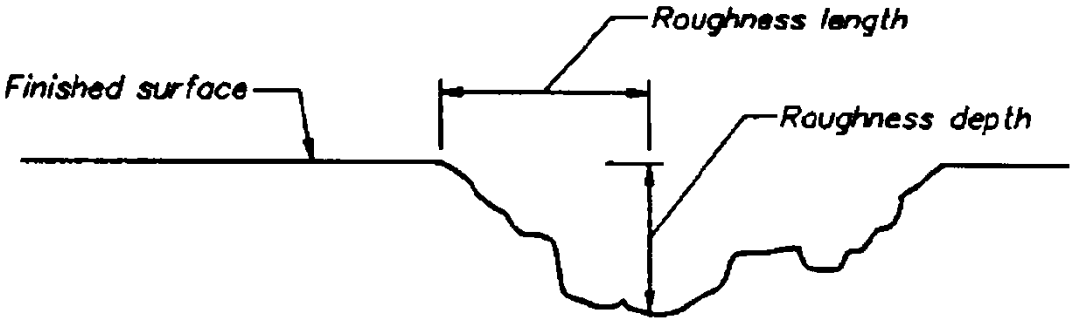
2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



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

CASE 1 = Offset on the Surface



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

CASE 2 = Offset into the Surface

FIGURE 1

J. Measuring surface roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. Measure roughness protruding above surface with straightedge that is at least 20 times longer than roughness height being measured.

   b. Position straightedge with one end resting on top of roughness, as shown in Figure 2 (case 1).

   c. Determine roughness height by measuring maximum gap that occurs normal to straight edge.

   d. Note position on the straightedge from which normal distance is measured.

   e. To determine roughness length, measure distance along straightedge from point where the height was measured to point of contact between straightedge and top of roughness.

   f. Roughness slope is defined as ratio of roughness height to roughness length.

   g. As roughness is seldom symmetric, moving position of straightedge about roughness may be necessary to locate point where maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

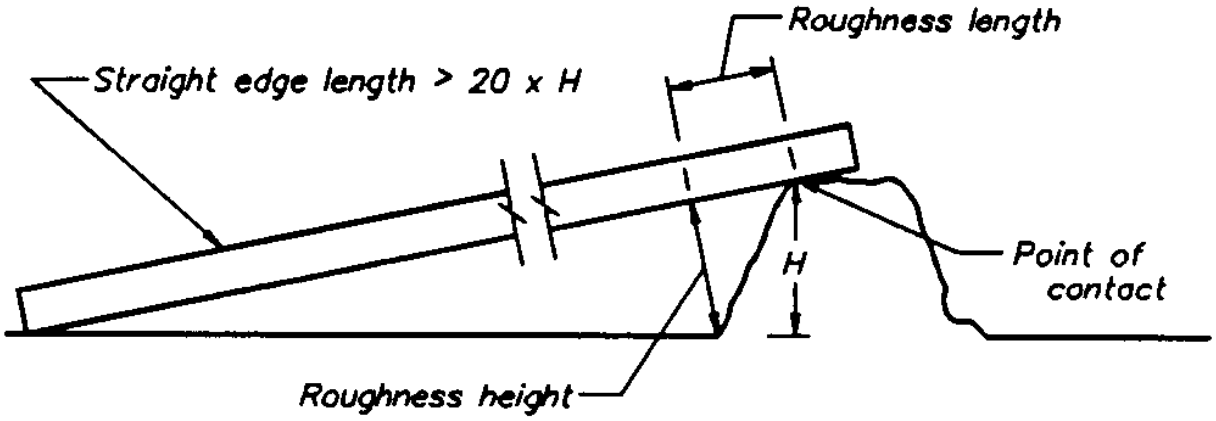
   a. A roughness occurring as an indentation to surface is measured by placing straightedge across indentation, as shown in Figure 2 (case 2).

   b. Measure maximum gap between straightedge and surface and note location of measurement on straightedge.

   c. From point of depth measurement, measure along straightedge in both directions to point of contact with surface.

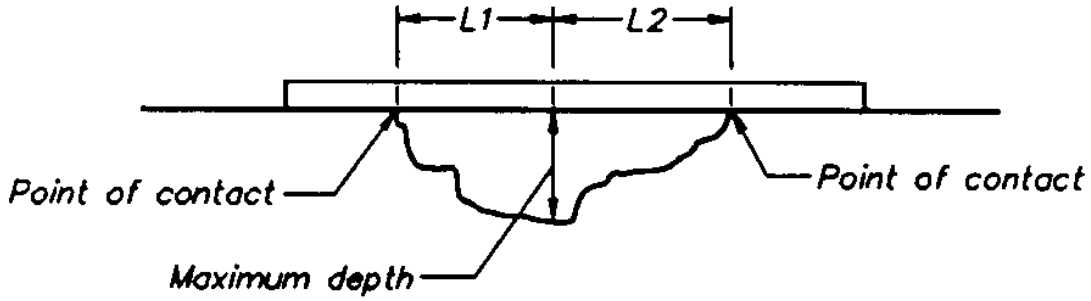
   d. Use shortest length measured as roughness length.

   e. Divide roughness depth by roughness length to determine roughness slope.



CASE 1

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



CASE 2

FIGURE 2

K. Prevention of repeated failure to meet tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.06 CURING

A. Water Curing:

1. Keep concrete surface wet for 14-days, minimum, from time concrete has attained sufficient set to prevent detrimental effects to surface.

2. Cure methods:

a. Water-saturated material.

b. System of perforated pipes, mechanical sprinklers, or porous hose.

c. Other methods which will keep surfaces wet.

d. Subject to approval by COR.

B. Curing with Curing Compound:

1. Apply to concrete surface to provide water-retaining film. Reapply as necessary to maintain continuous, water-retaining film on surface for 28-days.

2. Thoroughly mix compound and spray apply in one coat to provide continuous, uniform film over surface.

3. Do not exceed coverage rate recommended by curing compound manufacturer. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.

4. Ensure ample coverage on edges, corners, and rough surfaces.

5. Use spray equipment recommended by curing compound manufacturer.

C. Sheet Material Curing:

1. Thoroughly moisten concrete surface by lightly spraying with water as soon as concrete has hardened sufficiently to prevent damage.

2. Completely cover concrete surface with sheet material to provide airtight, water-retaining film over entire surface.

3. Lap edges of sheet material to seal adjacent sheets.

4. Place tightly against concrete surface at extreme edge of curing area.

5. Secure sheet material to withstand wind and prevent circulation of air inside sheet material.

6. Keep surface covered for 14-days, minimum.

3.07 CONTRACTOR FIELD QUALITY TESTING

A. Perform sampling, testing, and reporting as required in Table 03 30 00E - Field Testing:

1. Independent testing agency shall meet requirements specified in Section 01 46 20 - Testing Agency Services.

2. Personnel conducting plastic concrete field tests: Qualified as ACI Concrete Field Testing Technician, Grade 1; or equal.

3. Personnel conducting concrete specimen tests: Qualified as ACI Concrete Strength Testing Technician; or equal.

B. Perform tests at least as often as frequencies specified in Table 03 30 00E - Field Testing.

C. Notify COR immediately of test results showing failure of materials to meet specifications. Notify COR within 2-hours of test results showing materials meet specifications. Submit reports of test results as specified.

3.08 FIELD QUALITY ASSURANCE

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

Table 03 30 00E- Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Fresh Concrete Properties - tests performed at site	ASTM C143	Slump of Hydraulic-Cement Concrete	1 set of tests per load for first 2 loads. When tested concrete meets specifications, 1 set of tests each day of placement for each mixture for first 50 or less cubic yards, and 1 set of tests for each additional 100 cubic yards of concrete. Minimum of 1 set of tests per hour during placements. When concrete does not meet specifications, test each load until 2 consecutive loads meet specifications, then resume testing frequency specified above.
	ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method (alternative to ASTM C138 gravimetric method)	
	ASTM C1064	Temperature of Freshly Mixed Hydraulic-Cement Concrete	
	ASTM C138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete	

Table 03 30 00E- Field Testing

TESTS OF	TEST STANDARD	STANDARD TITLE	TESTING FREQUENCY
Compressive Strength,	ASTM C31 ASTM C39	Making and Curing Concrete Test Specimens in the Field Compressive Strength of Cylindrical Concrete Specimens	1 set of samples (6-inch by 12-inch for each day of placement for each mixture for the first 50 or less cubic yards, and 1 set of samples for each additional 100 cubic yards of concrete. A minimum of 5 samples for strength testing shall be made each time strength samples are collected. 2 additional field cured test cylinders during placement in adverse (hot or cold) weather. Cure these samples on jobsite under same conditions as concrete the cylinders represent for minimum of 7 days, then transfer to testing laboratory until testing at strength design days. Test 2 cylinders each at 7 days age and 2 cylinders at strength design age. Maintain last cylinder for testing in event that the strength design age test results fall below the required strength.
Concrete Cores	ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	At discretion of the Government when cylinder strengths fail to meet minimum requirements. The Contractor shall obtain core specimens in accordance with ASTM C42 at locations directed by COR, at no additional cost to the Government. The Contractor shall repair the core holes in accordance with USBR M-47 as directed by COR

B. Acceptance criteria:

1. Cylinder compressive strength:

a. In accordance with ASTM C94, except as follows:

1) 90 percent of test cylinders exceed specified compressive strength at design age.

2) Average compressive strength of six consecutive test cylinders exceeds specified compressive strength at design age.

3) No individual strength test falls below specified compressive strength by more than 500 pounds per square inch.

2. Drilled concrete cores:

   a. Concrete in placement represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 85 percent of specified compressive strength and no single core has a compressive strength of less than 75 percent of specified compressive strength.

3.09 PROTECTION

A. Protect concrete from damage until final acceptance by Government:

1. Do not load, remove forms or shoring, or backfill against concrete until concrete has gained sufficient strength to safely support its weight and imposed loads.

2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.

3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

B. Protect concrete when freezing temperatures are imminent:

1. Maintain concrete at a temperature of 50 degrees F (10 degrees C) or greater for 72-hours, minimum, after placement. Vent heater and prevent concrete from drying where artificial heat is employed.

2. Protect concrete from freezing during water curing. After discontinuance of water curing, maintain at a temperature of 50 degrees F (10 degrees C) or greater for next 72-hours.

3. Discontinue protection against cold weather such that the drop in temperature of the concrete will be gradual and will not exceed 5 degrees F per hour and 40 degrees F in 24-hours [for thin sections and 5 degrees F per hour and 20 degrees F in 24-hours for massive sections greater than 36-inches.

3.10 REPAIR

A. Repair concrete in accordance with USBR M-47.

B. Use repair or replacement method directed by COR.

3.11 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03 30 00F - Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	Water, White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces.
Pedestals and equipment foundations	F2	T5	ASTM C1315 Class A Clear curing compounds, water-emulsified resin-base if outdoors, Polyethylene film

Table 03 30 00G - Unformed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by fill material or concrete	U1	T1	White ASTM C309 Class A or B curing compound for horizontal surfaces, and White ASTM C309, Class B curing compound for vertical or sloped surfaces
Outdoor equipment slabs and foundations	U2	T3	White ASTM C309 Class A or B curing compound, Polyethylene film or White Burlap-polyethylene sheet

END OF SECTION

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SECTION 03 48 10

PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for Six-Inch Diameter Air Valve Assemblies, Six-Inch Diameter Air Valve with Manhole Assemblies, and Six-Inch Blowoff with Manhole Assemblies.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C478-15a	Precast Reinforced Concrete Manhole Sections
2.	ASTM C923-08(2013)	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
3.	ASTM C990-09(2014)	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

1.03 SUBMITTALS

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

B. RSN 03 48 10-1, Approval Data:

1. Manufacturer’s product data for precast reinforced concrete manhole sections, precast lid, and joint sealant.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE MANHOLE

A. Precast Reinforced Concrete Manhole Sections: ASTM C478.

B. Joints and Joint Sealant: ASTM C990.

2.02 MANHOLE COVER AND MANHOLE STEPS

A. Precast Concrete Lid: ASTM C478.

B. Twenty four inch hinged, lockable, metal lid.

C. Manhole steps shall be made of 1/2-inch steel rod encapsulated with copolymer polypropylene or approved equal and shall conform to ASTM C478.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumb in accordance with manufacturer's recommendations.

B. Seal joints between manhole sections.

C. Place and compact backfill materials uniformly about manhole structure to prevent unequal loading and displacement of structure in accordance with Section 31 23 02 – Compacting Earth Materials.

END OF SECTION

SECTION 03 63 00
EPOXY GROUT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items requiring epoxy grout.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C579-01(2012)	Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
2.	ASTM C580-02(2012)	Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
3.	ASTM D638-14	Tensile Properties of Plastics
4.	ASTM D696-11	Coefficient of Linear Thermal Expansion of Plastic Between -30 degree C and 30 degree C with a Vitreous Silica Dilatometer

1.03 SUBMITTALS

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

B. RSN 03 63 00-1, Approval Data:

1. Grout manufacturer’s product data.
2. Grout manufacturer’s environmental, product storage, preparation, mixing, installation and curing instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver epoxy materials to jobsite in manufacturer’s original unopened packaging with labels and seals intact.

B. Store epoxy materials in protected area in accordance with manufacturer’s instructions.

PART 2 PRODUCTS

2.01 EPOXY GROUT

A. Three part flowable epoxy grout; resin, hardener, and aggregate filler.

1. CHOCKFAST RED manufactured by ITW Polymer Technologies, 130 Commerce Drive, Montgomery PA; or equal, having following essential characteristics:
    a. ASTM C579 Compressive Strength: Minimum of 15,000 psi.
    b. ASTM C579 Compressive Modulus: 2,000,000 psi.
    c. ASTM D696 Coefficient of Linear Thermal Expansion:
        1) 11.2×10^{6} degrees F.
    d. ASTM C580 Flexural Strength: Minimum 4,000 psi.
    e. ASTM D638 Tensile Strength: Minimum 1,800 psi.
    f. Service temperature: Up to 140 degrees F.
    g. Pot life: Approximately 3 hours at 70 degrees F.
    h. Shelf life: 2-years in dry storage.

B. Aggregate filler as recommended by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mix and install grout in accordance with manufacturer's instructions to fill space to be grouted.

1. Concrete shall be a minimum of 28-days old.
2. Clean and roughen concrete surfaces.
3. Remove dirt, dust, oil, grease, debris, paint, curing compounds, sealers, and unsound concrete.
4. Mechanically prepare concrete surfaces in accordance with manufacturer's instructions to give surface profile of a minimum of 1/8-inch and expose coarse aggregate of concrete.
5. Concrete shall have an open surface texture.

B. Placement:

1. Place grout at air temperature recommended by manufacturer.
2. Bring materials to be epoxied as close to 70 degrees F as possible.
3. Do not place grout over frozen concrete.

4. Hold grout in place with forms. Prepare forms to prevent sticking of grout.
5. Minimum 3/4-inch by 3/4-inch, 45 degree chamfer.
6. Mix grout components in accordance with manufacturer's instructions and technical data sheet.
7. Place grout in accordance with manufacturer's instructions.
8. Finish surface of grout in accordance with manufacturer's instructions.
9. Smooth sharp edges.

C. Protection:

1. Protect placed grout from damage during construction.
2. Maintain grout at 50 degrees F or greater for 72-hours, minimum, after placement unless otherwise recommended by manufacturer.
    a. After protection period, discontinue protection against cold weather such that the drop in temperature of the grout will be gradual and will not exceed 5 degree F per hour and 40 degree F in 24-hours.
3. The more stringent of grout manufacturer's recommendation or section shall apply.
4. Initial Loading:
    a. Do not apply loads to epoxy grout sooner than 72-hours after placement.
        1) Apply load after epoxy grout has attained a compressive strength of 3000 psi, minimum.
    b. Time required for epoxy grout used to attain this strength will be determined by COR.
    c. Take care when applying loads on hardened epoxy grout.
    d. Contractor shall be responsible for damage resulting from impact loads when positioning equipment or metalwork.

D. Protect from movement until grout has fully cured.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for various other items.

a. Includes:

1) Anchors for installation of metal fabrications.

B. Cost:

1. Include in prices offered in Price Schedules for Buried Galvanic Anode Cathodic Protection and Corrosion Monitoring Systems:

a. Includes:

1) Guard Posts

2) Assemblies (Blowoffs, Air Valves)

1.02 DEFINITIONS

A. Miscellaneous metalwork: Where either shown on drawings or specified elsewhere in this Section, "miscellaneous metalwork" means metal fabrications.

1.03 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)

1.	AISC 325-2011	Steel Construction Manual – 14th Edition

B. American Welding Society, Inc. (AWS)

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

C. ASTM International (ASTM)

1.	ASTM A123/A123M-15	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2.	ASTM A36/A36M-14	Carbon Structural Steel
3.	ASTM A385/A385M-15	Providing High-Quality Zinc Coatings (Hot-Dip)
4.	ASTM A48/A48M-03(2016)	Gray Iron Castings

5.	ASTM A53/A53M-12	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
6.	ASTM A615/A615M-16	Plain and Deformed Carbon-Steel Bars for Concrete Reinforcement
7.	ASTM C578/C578M-07(2012)	Rigid, Cellular Polystyrene Thermal Insulation

D. Commercial Item Description (CID)

1.	CID A-A-1923A	Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

E. National Association of Architectural Metal Manufacturers (NAAMM)

1.	NAAMM MBG 531-15	Metal Bar Grating Manual

1.04 QUALIFICATIONS

A. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.01 MATERIALS

A. Arc-Welding Electrodes:

1. Use filler metal and shielding gases suitable for base materials, positions, and other conditions.
2. Filler metal and required shielding gases or fluxes: AWS D1.1.
3. Use filler metal with a minimum tensile strength of 70,000 pounds per square inch for steel.

B. Grating: NAAMM MBG 531 galvanized steel.

1. Welded grating.
2. Where safety grating is required, provide serrated-edge grating.
3. Banding bar: Unless otherwise shown on the drawings, provide same size as bearing bars, where required.

C. Rigid Insulation:

1. ASTM C578, Type IV.

D. Steel Pipe: ASTM A53, type E or S, grade B.

1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.
2. Government inspection at mill and hydrostatic tests will not be required.

E. Structural Steel:

1. Shapes: ASTM A36.
2. Bars and Plates: ASTM A36.

2.02 GUARD POSTS

A. Steel Pipe: ASTM A53, type E or S, grade B.

B. Concrete:

1. In accordance with the applicable requirements of Section 03 30 00 - Cast-in-Place Concrete.
2. Aggregate: 3/4 inch, maximum.
3. Compressive strength: 2,500 psi at 28 days, minimum.

C. Reinforcing Bars:

1. ASTM A615, Grade 60.
2. Deformed steel bar.

D. Coating: In accordance with Section 09 96 20 - Coatings.

2.03 CAST IRON FOUNDRY RING AND COVER

A. Foundry Ring and Cover:

1. ASTM A48, class 358.
2. Size: As indicated on the drawings.

2.04 ANCHORS

A. Expansion Anchors: Kwik Bolt 3 torque controlled expansion anchor body, wedge, nut, and washer as manufactured by HILTI, P.O. Box 21148, Tulsa OK 74121; or equal, having the following essential characteristics:

1. Meets requirements of CID A-A-1923A, Type 4.
2. Anchor Body and Wedge: Carbon steel.
3. Nuts and Washers: As recommended by anchor manufacturer.

4. Bolt Length: As shown on drawings. If not shown, provide bolt length with 3 1/2-inch minimum embedment.

2.05 FABRICATION

A. Fabricate metalwork in accordance with AISC 325.

1. Perform welding and related work in accordance with AWS D1.1.
2. Grind welds on ladders smooth.

B. If straightening is necessary, use methods that will not injure the metal.

C. After shop work completion and before galvanizing, clean material of rust, loose scale, dirt, oil, grease, and slag from welded areas, and other foreign substances.

D. Ladders:

1. Fabricate from standard weight pipe with diameter shown on drawings, or round HSS of the same outside diameter and minimum wall thickness of 0.132-inches.

E. Galvanizing:

1. Galvanize items of metalwork as specified or shown on drawings. Use hot-dip galvanizing, where required after fabrication, in accordance with ASTM A123 and ASTM A385.
2. Fabricator's Galvanizing Repair:
   a. Redip material with damaged galvanizing unless damage is local and can be repaired by 2 component epoxy zinc primer as approved by COR.
   b. If galvanized coating becomes damaged after being dipped twice, material will be rejected.
   c. Where local repair is authorized:
      1) Repair damage to galvanizing in accordance with Section 09 96 20 - Coatings.

PART 3 EXECUTION

3.01 PREPARATION

A. Where locations and dimensions of miscellaneous metalwork shown on drawings are dependent upon existing equipment and/or equipment furnished, confirm locations and dimensions prior to fabrication of miscellaneous metalwork.

3.02 INSTALLATION

A. Embedded Metalwork:

1. Locate metalwork to be embedded in concrete. Hold metalwork in correct position and alignment and protect metalwork from damage and displacement during placing and setting of concrete.
2. Unless otherwise specified, use metal braces, supports, and other items to position and align embedded metalwork, which will be embedded in concrete.
    a. Do not use wooden braces, supports, or other items to position and align embedded metalwork if they will also be embedded in concrete.

B. Holes in Metalwork: Drill, or drill and tap as required, holes in metalwork required for installation.

C. Anchors:
1. Drill holes for anchors straight and true and of diameter recommended by anchor manufacturer.
2. Install anchors in accordance with manufacturer's recommendations.
3. Follow manufacturer’s recommendations when embedded steel or reinforcement is encountered during drilling for anchors.
4. When drilling water is used, clean surfaces of concrete to remain exposed immediately to prevent discoloration.
5. Following drilling, clean holes with water to remove cuttings, followed by air to ensure holes are dry.

D. Guard Posts:
1. Install posts plumb in concrete footings and as shown on drawings.
2. Fill posts with concrete and trowel top of post round for water drainage. Posts may be capped in lieu of filling posts with concrete.

E. Installer’s Galvanizing Repair:
1. Repair damage to galvanizing in accordance with Section 09 96 20 - Coatings.

3.03 COATINGS

A. Coat surfaces of miscellaneous metalwork exposed after installation, except galvanized steel in accordance with Section 09 96 20 - Coatings.

END OF SECTION

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SECTION 07 21 20
SPRAY-ON INSULATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

1. Include in prices offered in Price Schedules for air valve and blowoff assemblies.

1.02 SUBMITTALS

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

B. RSN 07 21 20-1, Approval data:

1. Manufacturer's certification that material meets specified requirements.

1.03 DELIVERY STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original unopened packaging.

B. Protect from weather and sunlight.

PART 2 PRODUCTS

2.01 INSULATION

A. Spray on appropriate for use, or equivalent approved by COR.

B. Equivalent R value of 4-inches to rigid Type 4 insulation.

PART 3 EXECUTION

3.01 RIGID INSTALLATION

A. Install in blowoff and air valve precast concrete manholes as shown on drawings.

B. Vertical installation: Spot apply adhesive as recommended by insulation manufacturer.

3.02 INSULATION COVER

A. Apply/install per manufacturer’s recommendations.

END OF SECTION

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SECTION 07 21 60

INSULATION JACKET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in applicable prices offered in Price Schedules for blowoffs with manholes, and air valves with and without manholes.

1.02 SUBMITTALS

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

B. RSN 07 21 60-1, Approval Data:

1. Manufacturer's product data.

C. RSN 07 21 60-2, Instructions:

1. Manufacturer's product storage, surface preparation, environmental, and application instructions.

a. Include manufacturer's recommendations for cleaning and preparing each substrate material to be covered by insulation.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 INSULATION JACKET

A. Removable Box Jacket, manufactured by ThermaXX Jackets, LLC, 16 Hamilton Street, West Haven, CT 06516, Website: www.thermaxxjackets.com or equal with the following essential characteristics:

1. Equivalent R value of 20.
2. Accommodate operation of valve.
3. Removable and replaceable.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare clean, dry substrate surfaces in accordance with manufacturer's instructions.

1. Remove dirt, petroleum products, corrosion, loose materials, and other substances which could affect proper adhesion of insulation.

B. Obtain approval of surface preparation from COR before proceeding with application of insulation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 96 20
COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered Price Schedules for other items of work.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A380-13	Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
2.	ASTM A780-09(2015)	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
3.	ASTM C920-14	Elastomeric Joint Sealants
4.	ASTM D870-15	Testing Water Resistance of Coatings Using Water Immersion
5.	ASTM D2244-16	Calculation of Color Differences from Instrumentally Measured Color Coordinates
6.	ASTM D2794-93(2010)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
7.	ASTM D4060-14	Abrasion Resistance of Organic Coatings by the Taber Abraser
8.	ASTM D4285-83(2012)	Indicating Oil or Water in Compressed Air
9.	ASTM D4541-09e1	Pull-Off Strength of Coatings Using Portable Adhesion Testers
10.	ASTM D4587-11	Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus
11.	ASTM D5894-16	Cyclic Salt Fog/UV Exposure of painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
12.	ASTM G8-96(2010)	Cathodic Dis-bonding of Pipeline Coatings

B. American Water Works Associations (AWWA)

1.	AWWA C104-13	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4In. (100mm) and Larger – Shop Applied
3.	AWWA C222-08	Polyurethane Coatings for the Interior and Exterior of Steel Pipe and Fittings
4.	AWWA C602-11	Cement Mortar Lining of Water Pipelines in Place – 4In. (100mm) and Larger

C. International Organization For Standardization (ISO)

1.	ISO 8502-3-2017	Assessment of dust on Steel Surface Prepared for Painting (Pressure-Sensitive Tape Method)

D. National Association of Pipe Fabricators (NAPF)

1.	NAPF 500-03-04-06	Abrasive Blast Cleaning of Ductile Iron Pipe
2.	NAPF 500-03-05-06	Abrasive Blast Cleaning of Cast Ductile Iron Fittings

E. NSF International (NSF)

1.	NSF 61-2016	Drinking Water System Components

F. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-AB1-17	Mineral and Slag Abrasives
2.	SSPC-AB2-16	Cleanliness of Recycled Ferrous Metallic Abrasives
3.	SSPC-AB3-04	Newly Manufactured or Re-Manufactured Steel Abrasives
4.	SSPC-Guide 15-13	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates and Other Nonporous Substrates
5.	SSPC-PA1-16	Shop, Field, and Maintenance Painting of Steel
6.	SSPC-PA2-17	Measurement of Dry Paint Thickness with Magnetic Gages
7.	SSPC-SP1-16	Solvent Cleaning
8.	SSPC-SP5/NACE 1-07	White Metal Blast Cleaning
9.	SSPC-SP6/NACE 3-07	Commercial Blast Cleaning

10.	SSPC-SP10/NACE 2-07	Near-White Blast Cleaning
11.	SSPC-SP11-13	Power Tool Cleaning to Bare Metal
12.	SSPC-VIS1-02	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
13.	SSPC-VIS3-04	Visual Standard for Power- and Hand-Tool Cleaned Steel
14.	SSPC Paint Manual	Volume 1, Good Painting Practices, Fourth Edition 2002
15.	NACE RP 0287-16	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
16.	NACE SP 0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
17.	NACE SP 0274-11	High Voltage Electrical Inspection of Pipeline Coatings

1.03 SUBMITTALS

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

B. RSN 09 96 20-1, Approval Data:

1. For each coating material:
    a. Manufacturer’s product data, application, and SDS sheets.
    b. Supplier’s name, address, and phone number.
    c. Identification of “Items to be coated” including sub-letter and sub-number listed in Coating Tabulations.
    d. National Sanitation Foundation (NSF) 61 certificate for use in potable water.
2. For each caulk and filler:
    a. Manufacturer’s product data, application, and SDS sheets.
    b. Supplier’s name, address, and phone number.
    c. Identification of areas of use including sub-letter and sub-number listed in Coating Tabulations.
3. For each substituted coating material “equal” to specified product in Coating Tabulation:
    a. List of not less than 3 similar successful material applications:
        1) Project name, location, type of structure, and application dates.

2) Owner's name, address, and telephone number.

b. Certification that material meets or exceeds specified requirements:

1) Manufacturer's certification including technical representative's signature and date of signature.

2) Independent laboratory's certified test reports.

C. RSN 09 96 20-2, Final Approval Data:

1. For each coating material:

a. Purchase orders including order number, date, manufacturer's designated product name, batch number(s), and quantity purchased.

D. RSN 09 96 20-3, Paint Chip Samples:

1. Color chip samples approximately 4- by 6-inch.

2. Label each sample to include manufacturer's designated product name, color, and gloss.

3. Color samples are to be provided to COR for approval.

E. RSN 09 96 20-4, Qualifications:

1. Coating applicator:

a. Current Coating Application Specialist (CAS) or Plural Component Application Certification (PCAC).

b. List of not less than 3 comparable jobs for each coating type including owner's name, address, and telephone number.

2. Coating inspector:

a. Current Level 2 or 3 certification for NACE Certified Coatings Inspector (CIP) or SSPC Protective Coatings Inspector (PCI).

b. List of not less than 5 years of comparable jobs including project description, location, and owner's name, address, and telephone number.

F. RSN 09 96 20-5, Quality Control Plan:

1. Quality Control Manager:

a. Name and title.

2. Quality Control Procedure:

a. Quality control plan.

b. Procedure for addressing identified non-conformities.

G. RSN 09 96 20-6, Contractor Quality Testing Report:

1. Comprehensive report of daily quality control test reports.

1.04 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store coating materials and thinners in accordance with manufacturer's recommendations, and as a minimum, store off the ground, under cover, and at 50 to 95 degrees F.

D. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.05 AMBIENT CONDITIONS

A. Maintain environmental conditions to meet coating manufacturer's requirements during surface preparation, coating application, and curing period. Provide heating or cooling, and dehumidification as needed. Complete curing before placing coating systems into service.

B. Coatings shall be applied when substrate surface temperature is 5 degrees F or more above dew point temperature and for at least 8-hours after application.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Surface preparation and spray application equipment:

1. Sized in accordance with coating manufacturer's recommendations.
2. Provide:
    a. Pressure gauges and pressure regulators.
    b. Air supply lines free from oil and moisture.

2.02 ABRASIVES

A. Mineral and slag abrasives: Meets SSPC-AB1, type I (natural minerals) and type II (slags), class A.

B. SSPC-AB2 for recycled cleanliness.

C. SSPC-AB3 Class I (steel) or II (iron) for angular shaped grit. Shot abrasives are not acceptable.

D. Commercially available products or processes to render hazardous waste stream non-hazardous and not exceeding toxicity threshold limits.

2.03 COATINGS

A. Specified in Coating Tabulations:

1. Apply only one coating system per option in Coating Tabulations.
2. Apply compatible products of same manufacturer for coating system components.

B. Volatile Organic Compounds (VOC): Do not exceed maximum permitted by Federal, State, Tribal and local air pollution control regulations as supplied in container or by addition of thinner material.

C. Factory color or tint only. Do not color or tint at jobsite.

D. Use manufacturer's recommended thinners for coating materials.

E. Do not use accelerator products unless approved by COR.

2.04 FILLERS AND CAULKS

A. Caulks:

1. Coating manufacturer's standard or compatible caulk material.
2. Polyurethane, silicone, or silicone acrylic caulk material: Meets or exceeds ASTM C920 type S or M, grade NS, class 25, suitable for water immersion service.

B. Fillers:

1. Carboguard 501, as manufactured by Carboline, www.carboline.com.
2. Devmat 142HB, as manufactured by International Paint, www.international-pc.com.
3. PPG Amercoat 114 A, as manufactured by PPG, www.ppgpmc.com.
4. Steel Seam FT910, as manufactured by Sherwin Williams, www.sherwin-williams.com.
5. Surfacing Epoxy Series 215, was manufactured by Tnemec, www.tnemec.com.
6. Provide one of above fillers, or equal with following essential characteristics:
   a. Coating manufacturer's standard filler material.
   b. Approved use by manufacturer.

PART 3 EXECUTION

3.01 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

A. Remove, mask, or otherwise protect items or surfaces not coated from contamination and damage during cleaning and coating operations.

B. Examples include protecting mating and machined surfaces, mechanical and electrical equipment (open or enclosed), instruction and similar plates, and wet and newly coated surfaces.

3.02 COATING OF METALWORK EMBEDDED IN CONCRETE

A. For ferrous surfaces embedded in concrete:

1. Do not coat steel that is in contact or encased with grout or concrete. Exceptions:

a. For atmospheric exposure on both sides of embedded concrete or when mechanical bond is needed:

1) For penetrations through concrete extend prime coat on steel six inches minimum into concrete embedment measured from face of concrete and along surface of embedded. Caulk gap after coating applications.

2) Examples include: Above ground thrust or anchor blocks, floors, and walls with pipe or metal passing through concrete.

b. For burial or immersion service exposure on either side of concrete faces:

1) Extend primer coat continuously through solid concrete structure.

2) Examples include: Sill plates, anchor plates.

B. Caulk concrete/steel interface to seal gaps at exposed faces in accordance with manufacturer's instructions with maximum thickness of 1/2-inch.

3.03 SURFACE PREPARATION

A. Remove or repair surface irregularities and impart profile as specified:

1. Welds:

a. Welds: Smooth and continuous.

b. Weld spatter, slag, buckshot, laminations, and slivers: Remove and grind smooth.

c. Undercuts and porosity: Fill with weld material and grind smooth.

d. Projections, sharp edges, high points, fillets, and corners: Grind smooth to a radius of at least 1/16-inch.

2. Substrate defects:

a. Pitting, gouges, scratches, porosity, and similar:

1) Grind smooth.

2) Defects exceeding 20 percent reduction in wall thickness require weld repairs.

3. Grind full length of edges and corners smooth to a radius of at least 1/16-inch.

B. Surface preparation method:

1. See Coating Tabulations.

a. SSPC-SP1 followed by one or more of the following:

b. SSPC-SP5/NACE 1.

c. SSPC SP6/NACE 3.

d. SSPC-SP10/NACE 2.

1) Repair of defective or damaged coated areas.

a) For metal substrate:

i. SSPC-SP10/NACE 2.

ii. SSPC-SP11 where abrasive blasting is impractical.

b) For surrounding intact coating (nominal 2- to 4-inch margin):

i. SSPC-SP1.

ii. Feather abrupt edges and around repair area by hand or power tool with non-woven pad into adjacent tightly bonded coatings.

iii. Roughen or abrade surface in accordance with manufacturer's recommendations to achieve matted or lusterless finish.

iv. SSPC-SP1

e. SSPC-SP11.

2. Assessment of dust contaminants:

a. Perform clear tape test method in accordance with ISO 8502-3.

b. Perform three tests per shift.

c. Acceptance Criteria: Degree of cleanliness shall meet Class 3.

C. Surface profile:

1. Prepare as specified in Coating Tabulations.

2. Where not specified, prepare in accordance with manufacturer's instructions for metallic substrates or existing coating surfaces and service environment.

3. Where manufacturer's instructions do not specify a surface profile, prepare blasted surfaces to following profile:

a. Atmospheric Service Environments: 1 mil or greater angular profile and less than specified millage of first applied coat.

b. Burial and Immersion Service Environments: Angular profile 2 mil or greater and less than specified millage of first applied coat.

4. Inspect surface profile in accordance with NACE RP 0287:

a. Use replica tape suitable for surface profile depth range.

b. Perform at least two tests per 1,000 square feet.

D. Re-clean or perform additional surface preparation of contaminated surfaces before coatings application.

E. Heat cast iron components to between 140 and 180 degrees F to evaporate moisture for 2-hour minimum.

3.04 COMPRESSED AIR EQUIPMENT

A. Keep air compressor and spray application equipment lines free of oil and moisture during work.

B. Compressed air quality:

1. Perform tests in accordance with ASTM D4285.

2. Perform test at beginning of every shift.

3.05 FILLERS AND CAULK APPLICATION

A. Caulk areas including crevices, gaps, plate seams, skip welds, and conduit penetrations.

B. Fill areas including prepared pits, cavitation, and/or porosity, plate seams, and gaps at bolts and rivets.

C. Apply in a uniform texture, neatness, and color matched appearance.

D. Apply in accordance with manufacturer’s instructions and achieve tight bond to substrate or previous coats.

3.06 COATING APPLICATION

A. Stripe coat:

1. Brush apply stripe coat.

2. Apply stripe coat prior to spray application of primer, when practical.

3. Apply to edges, corners, interior angles, pits, plate seams, crevices, rivets, nuts, threads, bolts, washers, welds, and similar features.

B. Apply number of coats and coating thickness specified in Coating Tabulations.

1. Alternate coat colors to differentiate between coats.

2. Apply in accordance with manufacturer's instructions.

3. Apply in accordance with SSPC PA1.

C. Prevent overspray or dry spray. When such conditions occur, clean surfaces prior to application of subsequent coats.

D. Re-clean contaminated surfaces between coats.

E. Dry Film Thickness (DFT):

1. After each coat, inspect hardened coating system for DFT compliance in accordance with SSPC PA2.

2. Acceptance Criteria: No single spot measurement less than 80 percent of specified minimum.

F. Discontinuity (Holiday) Testing:

1. Inspect in accordance with NACE SP 0188:

a. Use maximum test voltage for DFT as recommended by coating manufacturer to prevent coating damage.

2. Inspect pipeline coatings in accordance with NACE SP 0274:

a. Use maximum test voltage for any DFT as recommended by coating manufacturer to prevent coating damage.

G. Coating Adhesion:

1. Test in accordance with ASTM D4541 at direction of COR.

3.07 CONTRACTOR FIELD QUALITY TESTING

A. Inspection Equipment:

1. Calibrate inspection devices and equipment in accordance with manufacturer's instructions.

2. Verify calibration prior to every use.

B. Qualified personnel shall conduct tests and sign reports.

1. Perform tests in presence of COR:

2. Provide rigging for COR to observe inspections.

C. Make daily reports for review by COR, including:

1. Date of work.

2. Description of areas and work performed.

3. Environmental conditions.

4. Results from the following quality control tests:

a. Surface profile.

b. Visual comparison of prepared surfaces.

c. Assessment of dust contaminants.

d. Compressed air quality.

e. Dry film thickness (DFT).

f. Discontinuity (Holiday) testing.

g. Coating adhesion testing (when directed by COR).

D. Final inspection will take place after repairs, but before placing into service.

3.08 REPAIR AND REMEDIAL WORK

A. Repair defective or damaged areas of coatings in accordance with coating manufacturer's recommendations.

3.09 COATING TABULATIONS

Tabulation No. 01

Items to be coated - Commercial or manufactured items with factory or shop applied coating system using coating manufacturer's standard coating material:

a. Air valve assemblies
b. Electrical cabinets, enclosures, and junction boxes

Coating materials	Number and thickness of coats	Surface preparation method

Factory or Shop applied permanent coating system:

1. Factory or shop standard surface preparation and permanent coating system.
2. Items subject to sunlight shall be topcoated with ultraviolet (UV) stable materials.
3. Permanent coating system shall have 10-year corrosion-free protection without significant defects stored in atmospheric exposure.
4. Color and gloss: Manufacturer's standard color unless specific color is otherwise specified in color schedule.
5. Unless otherwise specified, unexposed surfaces that require coatings, such as interior of cabinets, enclosures, and equipment, shall be given manufacturer's standard permanent coated finish.

Field Repair: Repair damaged areas of coated surfaces with compatible materials to equal thickness and color match of undamaged areas, unless otherwise tabulated herein.

Tab AE-05.DOC

Tabulation No. 02		
Items to coated: a. Guard posts b. Manhole hatch covers c. Cathodic protection test platform posts		
Coating materials – Option 1 Alkyd/Silicone Alkyd	Number and thickness of coats	Surface preparation method
Prime or spot repair coats - Carboline: Carbocoat 115 VOC International Paint: Devguard 4160 Sherwin Williams: Kem Kromik Universal Primer Tnemec: Chem-Prime HS Series 37H	1 or more prime coats for uncoated or repair of damaged surfaces. Apply at 2 to 3 mils DFT, per coat, plus stripe coats.	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: SSPC-SP6
Topcoat - Carboline: Carbocoat 30R International Paint: Devshield 877 Sherwin Williams: Steel Master 9500 Tnemec: Versatone Series 82HS Color and gloss: See Schedule 09 96 20A	2 or more compatible manufacturer's finish coats. Apply at 2 to 3 mils DFT, per coat. Total system, excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Follow manufacturer's surface preparation instructions and application instructions to apply subsequent coats.

Coating materials - Option 2 Water-borne acrylic	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces - Carboline: Carbocrylic 3358 International Paint: Devflex 4020PF DTM Sherwin Williams: Pro Industrial Pro-Cryl Tnemec: Uni-Bond DF Series 115	1 or more prime coats for uncoated or repair of damaged surfaces. Apply at 2 to 3 mils DFT, per coat, plus stripe coats.	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: SSPC-SP6
Topcoat - Carboline: Carbocrylic 3359 International Paint: Devflex 4216HP Sherwin Williams: Pro Industrial Multi Surface Acrylic Tnemec: Enduraton Series 1028 Color and gloss: See Schedule 09 96 20A	2 or more compatible manufacturer's finish coats. Apply at 2 to 3 mils DFT, per coat. Total system, excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Alkyd/silicone alkyd: 240 milligram loss or less, Acrylics: 110 milligram loss or less.
Direct impact, ASTM D2794	Alkyd/silicone alkyd: 40 inch-pounds, Acrylics: 60 inch-pounds.
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Alkyd/silicone alkyd: 260 psi or greater, Acrylics 500 psi or greater.

Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.
QUV accelerated weathering test, ASTM D4587:	Passes 3,000 hour test with no blisters evident on either scribed or un-scribed sides, or color difference ASTM D2244.

Tab AE-04.DOC

Tabulation No. 03

Items to coated:

a. Exterior ferrous surfaces of exposed piping, valves, fittings, and appurtenances
b. Exterior surfaces of exposed air vent piping and blow off piping
c. Coat all associated fasteners to include nuts, bolts, washers, and anchors

Notes:

1. Do not coat stainless steel, bronze, or non-metallic surfaces.
2. Do not coat mating surfaces, machine surfaces, seals, and surfaces that would be functionally impaired by coating.
3. Coat exposed machined surfaces after assembly.

Coating materials – Option 1 Zinc rich primer/epoxy/ polyurethane	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces - Carboline: Carbozinc 859 PPG: Amercoat 68HS or Amercoat 68HS VOC Sherwin Williams: Zinc Clad III HS or Zinc Clad III HS 100 Tnemec: Tneme-zinc 90-97	1 or more prime coats. Apply at 3 to 5 mils DFT, per coat, plus stripe coats.	SSPC-SP1 followed by: For steel: SP10/NACE 2 For ductile-iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05
Intermediate epoxy coat for ferrous surfaces - Carboline: Carboguard 691	1 or more intermediate coats. Apply at 6 to 8 mils DFT, per coat, plus stripe coats.	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PPG: Amerlock 400 or Amerlock 2 Sherwin Williams: Duraplate 235 or Macropoxy 646 Tnemec: Epoxoline Series N69 or Epoxoline Series V69		
Finish coats - Carboline: Carbothane 134 HB, HG, or VOC PPG: Amercoat 450H or Amershield VOC Sherwin Williams: Hi solids polyurethane or Hi solids polyurethane 250 Tnemec: Endura-shield 175 Color and gloss: see Schedule 09 96 20A	1 or more compatible manufacturer's finish coats, apply at 3 to 5 mils DFT, per coat. Total system, excluding stripe coats: 12-mil DFT, minimum 18-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials – Option 2 Moisture-cured urethanes	Number and thickness of coats	Surface preparation method
Prime coat for ferrous surfaces - Sherwin Williams: Corothane I Mio-zinc Wasser: MC-Miozinc 2.8 or 100	1 or more prime coats. Apply at 3 to 5 mils DFT, per coat, plus stripe coats.	SSPC-SP1 followed by: For steel: SP10/NACE 2 For ductile-iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05
Intermediate coat - Sherwin Williams:	1 or more compatible manufacturer's finish coats,	Follow manufacturer's surface preparation and

Corothane I Ironox B Wasser: MC Ferrox B 2.8 or 100	apply at 3 to 5 mils DFT, per coat.	application instructions to apply subsequent coats.
Finish coats: Semi-gloss - Sherwin Williams: Corothane II Satin Polyurethane Wasser: MC Luster 2.8 or 100 Color and gloss: See Schedule 09 96 20A	1 or more compatible manufacturer's finish coats, apply at 2 to 4 mils DFT, per coat. Total system, excluding stripe coats: 8-mil DFT, minimum 14-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Finish coats: Gloss - Sherwin Williams: Corothane I Aliphatic Finish Coat Wasser: MC Shieldcoat 2.8 or 100 Color and gloss: See Schedule 09 96 20A	2 or more compatible manufacturer's finish coats, apply at 1 to 3 mils DFT, per coat. Total system, excluding stripe coats: 8-mil DFT, minimum 16-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy/polyurethane: 100 milligram loss or less. MC urethanes: 100 milligram loss or less.
Direct impact, ASTM D2794	Epoxy/polyurethane: 30 inch-pounds MC Urethanes: 100 inch-pounds.
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Epoxy polyurethane, and MC urethane: 800 psi or greater.
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.
QUV accelerated weathering test, ASTM D4587:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244.

Tabulation No. 04

Items to be coated:

a. Interior ferrous surfaces of buried line pipe and fittings
b. Interior ferrous surfaces of field welded joints of buried line pipe and fittings
c. Interior ferrous surfaces of buried piping and fittings not tabulated herein

Notes:

1. Steel pipe shall have a minimum holdback of 3-inches from welding areas.
2. Do not paint aluminum-brass, bronze, and stainless steel metalwork.
3. Do not coat seals, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit.

Coating materials - Cement-mortar lining	Surface preparation method
For ferrous surfaces: Apply in accordance with following standards: AWWA C104 or C205, shop applied.	In accordance with AWWA C104 or C205
For girth welds and damaged areas: Apply in accordance with AWWA C602, in-place method.	In accordance with AWWA C602

Tabulation No. 05

Items to be coated:

a. Exterior ferrous surfaces of buried line pipe and fittings
b. Exterior ferrous surfaces of buried field welded joints
c. Interior and exterior fittings for Fiberglass, PVC, and HDPE piping. May be fusion bonded epoxied at no additional expense to Government
d. Exterior ferrous surfaces of buried piping and fittings not tabulated herein. Coat all associated fasteners to include nuts, bolts, washers, and anchors

Notes:

1. Steel pipe shall have a minimum holdback of 3-inches from welding areas.
2. Do not paint aluminum-brass, bronze, and stainless steel metalwork.
3. Do not coat seals, mating surfaces, and machined surfaces where paint could interfere with proper operation or fit.
4. Coat exposed machined surfaces after installation.
5. Pipe bedding and trench backfill will be installed so as to avoid abrasion or other damage to the coatings.

Coating materials – Polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Material: EC-120 or Corropipe II TX-15; as manufactured by: Madison Chemical Industries Inc. 490 McGeachie Drive Milton, Ontario, Canada L9T 3Y5 905-878-8863 www.madisonchemical.com Protec II; as manufactured by: ITW Futura Coatings 1685 Galt Industrial Blvd. St. Louis, MO 314-733-1110 www.futuracoatings.com Standard: Meets or exceeds requirements of AWWA C222 Thickness: 25-mil DFT, minimum Color: Manufacturer's standard color		SSPC-SP1 followed by - For steel: SP10/NACE 2 For ductile-iron: NAPF 500-03-04 For cast-iron: NAPF 500-03-05 2-4 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

<table>
<tr><td colspan="2">Tabulation No. 05</td></tr>
<tr><td>For repair of damaged and defective polyurethane areas:

Material: Use coating manufactures recommended repair materials.

Thickness: Achieve thickness equal to surrounding undamaged polyurethane.</td><td>For damaged coated surfaces:

SSPC SP-1 followed by SP-10 and/or SSPC SP-11 where abrasive blasting is impractical

Follow manufacturer’s surface preparation and application instructions to apply subsequent coats.</td></tr>
<tr><td>For girth weld area - Option 1:

Materials: Aqua-Shield AQW; as manufactured by:
Canusa-CPS
2408 Timberloch Place, Building C-8
The Woodlands TX 77380
281-367-8866
www.canusacps.com

Application: Follow manufacturer’s recommendations and instructions to apply heat shrink sleeve.

Repair: Repair damage or defective sleeve areas per manufacturer’s instructions. Replace sleeve for areas exceeding six square inches.</td><td>Follow manufacturer’s surface preparation and application instructions to apply sleeve and any subsequent repairs.</td></tr>
<tr><td>For girth weld area - Option 2:

Category: Liquid applied girth weld coating, compatible and approved by the polyurethane pipe coating manufacture.

Application: Follow manufacturer’s recommendations and instructions to apply girth weld coating.

Repair: Repair damage or defective areas per manufacturer’s instructions.</td><td>Follow manufacturer’s surface preparation and application instructions to apply girth weld coating and any subsequent repairs.</td></tr>
</table>

Tabulation No. 06

Items to be coated:

1. For potable water service, NSF 61 approved coating:

a. Interior and exterior of ferrous pipe and fittings (not mortar lined or polyurethane coated).
b. Interior and exterior of cast iron or ductile iron pipe and fittings (not mortar lined or polyurethane coated).
c. Interior and exterior of steel or cast iron valves. May be fusion bonded epoxied at no additional expense to the Government.
d. Coat all associated fasteners to include nuts, bolts, washers, and anchors.

Notes:

1. Materials listed below require certified NSF 61 approval for contact with potable water.
2. Do not coat stainless steel, bronze, or non-metallic surfaces.
3. Do not coat mating surfaces, machine surfaces, seals, and surfaces where the coating could interfere with proper operation or fit.
4. Coat exposed machined surfaces after assembly.

Coating materials – Option 1 Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base Coats - Carboline: Carboguard 691(pw) PPG (Ameron): Amerlock 2(pw) Sherwin Williams: Duraplate 235 NSF(pw) Tnemec: Pota-Pox Series 20(pw) Color: manufacturer's standard light grey and gloss or other light colors	3 or more base coats, apply at 8 to 10 mils DFT, per coat, plus stripe coats. Total base coat system, excluding stripe coats: 24-mil DFT, minimum 30-mil DFT, maximum	SSPC-SP1 followed by: For cast-iron: NAPF 500-03-05 Blast Clean No. 4 For steel: SSPC-SP5/NACE 1 or SP10/NACE 2 2-4 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Coating materials – Option 2 High Solids Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base Coats - Sherwin Williams: Sherplate PW Epoxy Color: manufacturer's standard light grey and gloss or other light colors	1 or more base coats, apply at 30 to 50 mils DFT, per coat, plus stripe coats. Total base coat system, excluding stripe coats: 30-mil DFT, minimum 50-mil DFT, maximum	SSPC-SP1 followed by: For cast-iron: NAPF 500-03-05 Blast Clean No. 4 For steel: SSPC-SP5/NACE 1 or SP10/NACE 2 2-3 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials – Option 3 100% Solids Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: International (Enviroline): Enviroline 230(pw) Raven Lining Systems: Aquata-Pox A-6(pw) Color: manufacturer's standard light grey and gloss or other light colors	1 or more base coats, apply at 30 to 50 mils DFT, per coat, plus stripe coats. Total coat system, excluding stripe coats: 30-mil DFT, minimum 50-mil DFT, maximum	SSPC-SP1 followed by: For cast-iron: NAPF 500-03-05 Blast Clean No. 4 For steel: SSPC-SP5/NACE 1 or SP10/NACE 2 2-4 mil surface profile Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Coating materials – Option 4 100% Solids Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base Coats: Carboline: Plasite 4500 S(pw) NSP Products: NSP 120(pw) Sherwin Williams: Dura-Plate UHS(pw) Color: manufacturer's standard light grey and gloss or other light colors.	2 or more base coats, apply at 10 to 16 mils DFT, per coat. Total coating system, excluding stripe coats: 20-mil DFT, minimum 32-mil DFT, maximum	SSPC-SP1 followed by: For cast-iron: NAPF 500-03-05 Blast Clean No. 4 For steel: SSPC-SP5/NACE 1 or SP10/NACE 2 2-4 mil surface profile Material amine blushes, multiple coat systems need to be prepared in accordance with manufacturer's instructions to apply subsequent coats. Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

PERFORMANCE REQUIREMENTS:

Testing Protocol	Acceptance Criteria
Fresh/deionized water immersion test, ASTM D870:	Passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Dilute Harrison immersion test, Modified ASTM D870:	Passes, 2 years test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy: 100 milligram loss or less
Direct impact, ASTM D2794	30 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 3000 hrs.
Cathodic disbondment, ASTM G8:	No disbondment at 120 day test

Tab IE-03.DOC

Tabulation No. 07		
Damaged galvanized items to be repaired: a. Damaged galvanized surfaces not otherwise tabulated		
Coating materials	Number and thickness of coats	Surface preparation method
Repair damaged galvanized surfaces in accordance with ASTM A780, except repair materials containing cadmium and lead are not permitted.		

Tab AE-11.DOC

Tabulation No. 08		
Damaged stainless steel items not to be coated and receive a uniform passivation layer: a. Stainless steel clad surfaces not otherwise tabulated herein		
Note: Do not coat stainless steel items listed above. New stainless steel surfaces to receive uniform passivation at point of manufacture. Clean and restored uniform passivation layer of damaged, contaminated, or depassivated stainless steel surfaces by methods listed below.		
Coating materials	Number and thickness of coats	Surface testing method
Do not coat unless specifically listed elsewhere in these tabulations.		ASTM A380
Repassivation Methods and Inspection Procedures of Contaminated Stainless Steel Surfaces		
Degree of surface contamination	ASTM A 380* Surface preparation methods**	ASTM A 380* Surface testing methods**
Locally heavy surface contaminated areas: Contaminated by free iron, oxide scale, or rust related contaminates caused by field welding or cutting.	Method 5. - "Descaling", General Method 5.3 - "Mechanical Descaling" by grinding and/or Method 6.3 - "Cleaning of Welds and Weld-Joint Areas"	Method 7.2 - "Gross Inspection" Methods 7.2.5 - "Tests for Free Iron: Gross Indications"

Tabulation No. 07		
General surface contaminated areas: Contaminated by free iron, oxide scale, or rust related contaminates.	Method 5. - "Descaling," General Method 5.2 - "Chemical Descaling" Method 5.2.2.(1) – "Chemical Descaling" by swab or spray wetting the surfaces and/or Method 5.3 - "Mechanical Descaling" by grinding	Method 7.2 – "Gross Inspection" Method 7.2.5 – Tests for Free Iron: Gross Indication
General surface contaminated areas: Contaminated by grease, oil, residual chemical films, or other non-free iron related contaminates.	Method 6.2.10 – "Water Jetting" and/or Method 6.4 – "Final Cleaning, or Passivation, or Both", wiping with a clean, solvent-moistened cloth.	Method 7.2 – "Gross Inspection" Method 7.2.2 – "Wipe Tests" Where films are not detectable under white light conditions, use: Method 7.3 – "Precision Inspection" Method 7.3.2 – "Black Light Inspection"

* Other ASTM A 380 methods may be used instead of above specified surface preparation methods and inspection procedures.

** Do not damage attached parts, adjacent parts, or materials by field cleaning and passivation methods of stainless steel.

Tab AE-14.DOC

3.10 COLOR SCHEDULE

A. Colors and glosses of finished coats:

1. To be selected and approved by COR.

B. Color and gloss to meet one or more of the following:

1. Munsell Color.

2. Manufacturer's standard color.

C. Gloss abbreviations:

a. G - Full Gloss.

D. Color schedule table:

1. Numbers listed in the "Tabulation No." column correspond to "Items to be coated" listed in Coating Tabulations.

Schedule 09 96 20A. - Color Schedule.

Tabulation No.	Item Surface	Color	Color No.	Gloss
2	a. Guard posts	Safety Yellow	Mfr. Std.	G
2	a. Manhole hatch covers b. Cathodic protection test platform posts	NTUA Blue	Munsell 7.5B7/8	
3	a. Exterior ferrous surfaces of exposed piping, valves, fittings, and appurtenances. b. Exterior surfaces of exposed air vent piping and blowoff piping.	Beige	Munsell 2.5Y8/4	G

END OF SECTION

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SECTION 10 14 26
UTILITY MARKERS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Utility Marker:

1. Payment: Lump sum prices offered in Price Schedules.

1.02 SUBMITTALS

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

B. RSN 10 14 26-1, Utility Marker Plan:

1. Show proposed locations of utility markers.

PART 2 PRODUCTS

2.01 UTILITY MARKERS

A. CRM3007, Utility Marker, manufactured by Carsonite, www.carsonite.com; or equal, with the following essential characteristics:

1. Durable.
2. UV resistant.
3. T-cross section with support rubs along each edge.
4. Resistant to impact, ozone and hydrocarbons.
5. Service Temperature Range: Minus 40 degrees F to 140 degrees F.
6. Width: 3.75 inches.
7. Length: 66 inches minimum.
8. Anchor Barb.
9. Color: NTUA Blue.
10. Label: NTUA Potable Water Pipeline.

B. Concrete Anchor:

1. In accordance with Section 03 30 00 – Cast-In-Place Concrete.
2. Shown on drawing 1695-D-60323.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in locations approved by COR. At minimum install every 2,000 feet and at:

1. Fabricated horizontal pipe bends.
2. High points in existing ground.
3. Each side of road crossing.
4. Buried manholes.

END OF SECTION

SECTION 23 33 13
DRAFT CONTROL DAMPER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in applicable prices offered in Price Schedules for other items of work.

1.02 SUBMITTALS

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

B. RSN 23 33 13-1, Approval Data:

1. Installation methods.
2. Technical data.

C. RSN 23 33 13-2, Final Data:

1. Operation and Maintenance Data.
2. Bound copy of signed, stamped, previously approved data.

PART 2 PRODUCTS

2.01 DRAFT CONTROL DAMPER

A. Temperature operating range: 40 degrees Fahrenheit to 150 degrees F.

B. Draft Control Damper: The following draft control dampers are acceptable:

1. Model MG-1, size as shown on drawings. Manufactured by Field Controls, LLC, 2630 Airport Road, Kinston, NC, 28504, Website: www.fieldcontrols.com, or equal with the following essential characteristics:
   a. Construction:
      1) Material: Galvanized steel.
      2) Coating: Baked enamel.
   b. Double acting leaf opens to relieve positive or negative vent system pressures.
   c. Adjustments using weights, accurate from 0.01- to 0.1-inch water gauge static pressure.

PART 3 EXECUTION

3.01 GENERAL

A. Install draft damper per manufacturer's recommendations and as shown on drawings.

B. Initially adjust weights to positive and negative 0.05-inch water gauge static pressure.

C. Protect damper when applying foam insulation to prevent interference with damper operation.

END OF SECTION

SECTION 26 42 10

CATHODIC PROTECTION AND CORROSION MONITORING SYSTEMS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cathodic Protection and Corrosion Monitoring Systems:

1. Payment: Lump sum prices offered in Price Schedules.

1.02 REFERENCES AND STANDARDS

A. ASTM International (ASTM)

1.	ASTM B 843-13	Magnesium Alloy Anodes for Cathodic Protection
2.	ASTM C33/C33 M-11	Concrete Aggregates

B. Bureau of Reclamation (Reclamation)

1.	Reclamation M-47	Standard Specification for Repair of Concrete, August 1996

C. National Association of Corrosion Engineers (NACE)

1.	NACE SP0169-13	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2.	NACE TM0497-12	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

D. Peabody A.W., (2001), Peabody's Control of Pipeline Corrosion, 2nd Edition.

E. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2008	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 DEFINITIONS

A. Structure: Metallic pipe and fittings or other metalwork being protected and monitored.

B. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to underlying structure and for the most part physically and electrically isolating metal from electrolyte.

C. Electrolyte: An electrically conductive solution, such as soil. Terms for these specific conductive solutions may be substituted for the word "electrolyte" in these definitions.

D. Cathodic Protection:

1. Sacrificial Protection: Reduction of corrosion of a metal in an electrolyte by galvanically coupling it to a more anodic metal. This form of cathodic protection is also sometimes called galvanic anode cathodic protection.

2. Impressed Current Protection: Reduction of corrosion of a metal in an electrolyte by supplying a DC current through an external power source and employing an impressed current anode.

E. Structure-to-Electrolyte Potential:

1. Also referred to as structure-to-soil, pipe-to-soil, and fitting-to-soil potentials.

2. Potential of structure in electrolyte as compared to potential of a reference electrode making contact with same electrolyte.

3. Static structure-to-electrolyte potential: Structure-to-electrolyte potential determined prior to energizing cathodic protection system or after cathodic protection system has been de-energized for an extended time period. Also referred to as native structure-to-electrolyte potential.

4. Uncorrected structure-to-electrolyte potential: Structure-to-electrolyte potential determined with cathodic protection system energized and cathodic protection current flowing. This potential is sometimes called protective potential and may contain significant IR drop error.

5. Polarized structure-to-electrolyte potential: Structure-to-electrolyte potential determined after cathodic protection system has been energized, but immediately after cathodic protection current is interrupted. Also referred to as "instant off" structure-to-electrolyte potential.

6. Polarization: Change from static or native potential as a result of current flow across electrode/electrolyte interface. Also considered the difference between polarized and native potentials.

1.04 QUALITY

A. Installation and testing conducted by or under direction of Cathodic Protection Specialist certified by NACE International. Other qualified individuals may assist installation and testing personnel.

B. NACE SP-0169 and NACE TM0497 shall apply to issues not specifically addressed by this specification.

C. Manufacturer's Standards: Comply with manufacturer's recommendations and standards unless otherwise specified.

1.05 QUALIFICATIONS

A. Cathodic Protection Specialist: Certified by NACE International.

1.06 SYSTEM DESCRIPTION

A. Provide cathodic protection systems for buried portions of the following features and pipe choices:

1. Steel and Ductile Iron Pipe: Impressed current cathodic protection for pipe, fittings, and other associated metalwork, which is electrically continuous.

2. PVC Pipe: Galvanic cathodic protection systems for metal fittings, butt welded steel pipe, and associated metalwork.

3. Casings: Galvanic cathodic protection systems for casings.

B. Provide corrosion-engineering services to furnish, install, energize, adjust, and test cathodic protection systems:

1. Materials, installation and testing shall be consistent with sound corrosion engineering principles and practice, in accordance with this specification, NACE SP0169, NACE TM0497, and Peabody's Control of Pipeline Corrosion.

2. Include electrical isolation, electrical continuity joint bonds, test stations, junction box, anodes, and accessory equipment and features as directed in this specification or as otherwise indicated.

C. Cathodic protection systems shall have capacity to:

1. Provide a minimum service life of 20 years (system and components).

2. Maintain locations of protected structure(s), with reference to a copper/copper sulfate electrode placed close to structure:

a. Polarized structure-to-electrolyte potential of at least -0.850 volts on structure having a high quality bonded dielectric coating.

b. Alternately, at discretion of Reclamation, -0.100 volts of polarization if -0.850 volt criterion cannot be obtained due to extenuating circumstances (e.g. on bare or poorly coated structures or localized locations with high soil resistivity).

c. Polarized potential at any point on a dielectrically coated structure not exceeding -1.100 volts.

D. Placement and Current Output of Anodes:

1. Shall be such as to provide adequate distribution of cathodic protection current, as indicated by polarized potential readings.

E. Electrical Continuity Bonds:

1. Metallurgical type bonds shall assure electrical continuity of buried metalwork.

2. Bond cable designed such that resistance does not detrimentally affect performance of cathodic protection system.

1.07 SUBMITTALS

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

B. RSN 26 42 10-1, Certification and Data:

1. Copy of Cathodic Protection Specialists' NACE International certification for personnel performing or directing installation and testing of cathodic protection systems.

2. Manufacturer’s data including catalog data sheets when available.

a. Include:

1) Impressed current anodes.

2) Galvanic anodes (if required)

3) Cables.

4) Metallurgical bonding system.

5) Dielectric coating system for bonds.

6) Junction box.

7) Test stations.

8) Shunts.

9) Variable resistors.

10) Rectifier.

11) Isolation joint flange kit (between Reach 11 and Reach 12A)

12) Carbonaceous backfill material.

13) Vent pipe.

14) $Cu/CuSO_4$ permanent reference electrode(s).

b. Preliminary drawings, including:

1) Proposed location of test stations.

2) Proposed location of rectifiers and anode beds.

C. RSN 26 42 10-2, Interference Mitigation Method:

1. Proposed mitigation method for AC and DC cathodic interference submitted for approval by foreign pipeline or powerline owner and Reclamation.

D. RSN 26 42 10-3, Final Data:

1. Testing data:

a. Test equipment and methods utilized.

b. Placement of reference electrode during each test.

c. Results of tests conducted.

2. As-built information and drawings, including:

a. Location of test stations and cable runs:

1) Location shall be given using unique identifier and GPS coordinates.

2) Location shall include type of test station (drawings 1695-D-60361 and 1695-D-60362).

b. Electrical continuity bond details.

c. List of anode cable identifications in test station and anode junction box.

PART 2 PRODUCTS

2.01 GENERAL

A. Installation details indicated on drawings 1695-D-60360, 1695-D-60361, 1695-D-60362, 1695-D-60363 and 1695-D-60364.

2.02 CABLES

A. Manufactured no more than 24 months prior to notice to proceed.

B. Cathodic Protection:

1. Single-conductor: Stranded, plain, annealed copper cable.

2. Cable Insulation:

a. Rated for 600 volts and direct burial or immersion.

b. High molecular weight polyethylene (HMWPE) outer jacket with minimum thickness of 0.100-inch.

3. Unspliced lengths to permit installation from terminus to terminus (e.g., anode to junction box) free of splices and without stress.

4. Gauge:

a. No. 2 AWG or larger for electrical continuity joint (jumper) bonds (black insulation).

b. No. 6 AWG or larger for structure to rectifier cables (black insulation).

c. No. 6 AWG or larger for structure (bond) cables at foreign structure locations (black insulation).

d. No. 12 AWG or larger for structure (bond) cables (black insulation).

e. No. 12 AWG or larger for determining structure-to-electrolyte potentials (black insulation).

f. No. 10 AWG or larger for deep well impressed current anodes (red insulation if available).

g. No. 12 AWG or larger for galvanic anodes (red insulation if available).

h. No. 14 AWG or larger for permanent reference electrodes (yellow insulation).

i. No. 6 AWG or larger for foreign structure (bond) cables (blue or white insulation if available).

j. No. 12 AWG or larger for foreign structure cables for determining structure-to-electrolyte potentials (blue or white insulation if available).

2.03 ELECTRICAL CONTINITY JOINT BONDS

A. Insulated copper cable in accordance with cable requirements above.

2.04 EXOTHERMIC METALLURGICAL BONDS

A. Exothermic metallurgical bond system by ThermOweld, 4102 South 74th East Avenue, Tulsa, OK 74145-4700; or equal, having the following essential characteristics:

1. Designed for:

   a. Cathodic protection systems.

   b. Metallic substrate material.

2. Exothermic reaction produces molten copper, which produces a permanent, high conductivity connection.

3. Uses a special alloy to provide minimum heat effect on substrate material.

4. Current carrying capacity equal or better than that of the conductor.

2.05 DIELECTRIC COATING FOR METALLURGICAL BONDS

A. Dielectric Material: Royston Handy Cap, manufactured by Royston Laboratories, Incorporated, 128 First Street, Pittsburgh, PA, 15238; or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.

2. Applied with primer coat, as needed.

3. Approved dielectric coating material.

4. Suitable for the intended environment.

2.06 JUNCTION BOX

A. Specifically constructed for cathodic protection system installations.

B. Enclosed within a NEMA 250, Type 3-R, lockable cabinet constructed of No. 16-gauge or thicker galvanized steel that is weatherproof, lockable, and vented for heat dissipation.

C. Equip with 0.01-ohm calibrated shunt for each anode.

D. Equip with variable resistors of adequate electrical rating for each anode such that current flow of each anode can be adjusted as required within 125 percent of one another, without overheating variable resistor.

E. Engraved 1/4-inch minimum NEMA grade C phenolic panel.

F. Solderless, pressure-type terminals.

G. Identified terminals.

H. Equip with combination bracket for pole or wall mounting.

2.07 RECTIFIER

A. Constant voltage type.

B. Air cooled.

C. Capable of continuous operation at 120 percent of rated output in ambient temperature of 50 degrees C.

D. Fitted with a heavy-duty transformer.

E. Silicon diode type.

F. Fitted with individual meters for determining output voltage and current, and which are:

1. Accurate within 2 percent of full scale.
2. Marked with red lines designating rated capacities.

G. Output voltage is adjustable in 20 or more equal increments or continuously from 0 to 100 percent rated output.

H. Energized by 120-volts, single phase AC.

I. Equipped with AC and DC lightning arrestors and protective fuses or relays.

J. Equipped with solderless, pressure-type terminals for anode and cathode cables.

K. NEMA 250 type 3-R, weatherproof, lockable, vented for heat dissipation cabinet constructed of No. 16-gauge or thicker galvanized steel.

L. Equipped with a single slide out rack for easy access to internal components during maintenance. Rack shall slide out the front of cabinet.

M. Equipped with an accessible shunt on front panel for determining current output. Shunt shall be stamped with amperage per millivolt rating.

N. Equipped with 115-volts AC convenience outlet.

O. Fitted with combination bracket for wall or pole mounting.

P. Screened against entry of bees, hornets, or wasps.

Q. External circuit breaker preceding and mounted on same pole as rectifier with shut-off switch and lockout/tagout capability.

2.08 IMPRESSED CURRENT ANODES

A. Anodes: center connected graphite anodes as supplied by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248, or equal, with the following essential characteristics:

1. Number of anodes:
    a. Dependent on pipe option.
    b. Specified in Table 26 42 10A - Impressed Current.
2. Anode size:
    a. 4-inch diameter.
    b. 80-inch length.
3. Minimum weight:
    a. 64 pound.
4. Wax or resin treated graphite anode material specifically designed for cathodic protection systems and intended environment.
5. Low resistance center cable connection having waterproof seal on both sides of anode-to-cable connection.

B. Anode cable in accordance with cable requirements of this section. In addition, anode cable insulation shall be of dual insulation construction, inner layer of Halar or Kynar and outer layer of high molecular weight polyethylene.

C. Factory anode-to-anode cable connection shall, in addition to an internal moisture seal, be protected by epoxy encapsulation and an external anode cap.

2.09 GALVANIC ANODES

A. Galvanic anodes: 20D2 or larger UltraMag High Potential Magnesium Anode manufactured by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248; or equal, with the following essential characteristics:

1. Minimum of 20-pounds magnesium anode material per anode.

2. High potential magnesium anode material specifically designed for cathodic protection systems and intended environment.

3. Anode material meeting or exceeding requirements of ASTM B 843 and a minimum potential of -1.700 volts referenced to a copper/copper sulfate reference electrode (CSE).

4. Contain mild steel core that extends essentially entire length of anode. Mild steel core shall be centered within anode material and exposed on one end of anode for factory made anode-to-cable connection.

B. Silver-solder connection between anode cable and mild steel core.

C. Anode-to-cable connection, exposed mild steel core, and exposed copper cable potted in epoxy.

D. Anode cable No. 12 AWG or larger in accordance with cable requirements of this section.

E. Anode pre-packaged in a chemical backfill specifically intended for type of buried anode used.

1. Chemical backfill: Approximately 75 percent ground hydrated gypsum, 20 percent powdered bentonite, and 5 percent anhydrous sodium sulfate.

2.10 TEST STATION ENCLOSURE

A. Test stations: TESTOX Series 100 or Series 700, manufactured by Gerome Electric Supply Co., 336 E. Main St., Uniontown, PA 15401; or equal, having the following essential characteristics:

1. Above-ground, cast aluminum, pipe-mounted type.

2. Specifically constructed for cathodic protection system installations.

3. Protected as required for permanency.

4. Secured to pipe with setscrew or threaded.

5. Sufficient number of terminals (5 terminals minimum) with associated hardware for number and size of cables and required accessories.

6. Equip with 0.01-ohm calibrated shunt for each anode such that current output of each anode can be determined.

7. Equip with variable resistors for each anode (if necessary) such that current output of each anode can be adjusted.

8. Test station cables in accordance with cable requirements of this Section.

2.11 TEST STATION PIPE AND BOLLARDS

A. Steel Pipe:

1. In accordance with Section 05 50 00 - Metal Fabrications.
    a. Pipe size indicated on drawing 1695-D-60361 and 1695-D-60362.

B. Painting:
1. Test station support post coated or galvanized in accordance with Section 09 96 20 – Coatings.
2. Protective post coated NTUA blue in accordance with Section 09 96 20 – Coatings.

C. Concrete:
1. In accordance with applicable requirements of Section 03 30 00 – Cast-in-Place Concrete.

2.12 SAND BACKFILL

A. Sand Backfill: ASTM C33, fine aggregate.

2.13 WARNING TAPE

A. Polyethylene Warning Tape for Anode Cables:
1. Minimum: 3-inches wide.
2. Red or yellow with black lettering.
3. Suitable for direct burial.
4. “Caution – Cathodic Protection Cable Buried Below” printed on tape its full length.

2.14 ELECTRICAL CONDUIT

A. Minimum 1.5-inch diameter Schedule 80 PVC conduit and fittings for deep well anode cables.

2.15 DEEP WELL VENT PIPE

A. Deep Anode Venting System Pipe: AllVent, manufactured by Loresco® International, 421 J.M. Tatum Industrial Park drive, Hattiesburg, MS, 39401; or equal, having the following essential characteristics:
1. Nominal 1-inch inside diameter.
2. Vent pipe shall be slotted within coke backfill column and non-slotted outside limits of coke backfill column. Slots shall conform to either of the following requirements while maintaining maximum pipe strength.
    a. Vertical slits 1.5-inches in length with a width of 0.006-inches parallel to longitudinal centerline of pipe. Center-to-center spacing of 6-inches

placed 1-inch in circumferential distance from preceding slot, allowing for 360-degree venting ability.

b. 1/8-inch holes drilled on 6-inch centers in area of anodes for plastic vent pipe. Do not drill holes in vent pipe above anodes.

2.16 IMPRESSED CURRENT ANODE BACKFILL

A. Coke Backfill: Use SC3 calcined fluid petroleum coke as manufactured by Loresco® Inc., 421 J.M. Tatum Industrial Park drive, Hattiesburg, MS, 39401; or equal, having the following essential characteristics:

1. Typical Chemical Analysis:

Component	Percent Composition
Carbon (fixed)	99.35 minimum
Ash	0.6 maximum
Volatiles	0 (950 degrees C)
Moisture	0.05

2. Particle Analysis: Dust free with a maximum particle size of 1-mm.

2.17 PEA GRAVEL

A. 1/8-inch to 3/8-inch smooth (no rough edges) pea gravel.

2.18 PERMANENT REFERENCE ELECTRODE

A. Copper/Copper Sulfate permanent reference electrode: Permacell Plus, manufactured by CorrPro Canada, 103, 221 - 18th Street SE, Calgary, AB, T2E UJ5; or equal, having the following essential characteristics:

1. Double membrane, ceramic cell in a geomembrane package.

2. Electrode cable in accordance with cable requirements of this section.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Installation and testing shall be performed or directed by Cathodic Protection Specialist certified by NACE International.

B. Installation details indicated on drawings 1695-D-60360, 1695-D-60361, 1695-D-60362, 1695-D-60363, and 1695-D-60364.

C. Electrical isolation:

1. All structures to be cathodically protected shall be electrically isolated from other extraneous metal (e.g. casings, foreign structures, and rebar in concrete).

2. Dielectric materials, other than non-metallic carrier pipe, that might cause shielding of cathodic protection current (e.g. plastic debris) shall not be left in excavation with structure.

D. Cable:

1. Inspect for insulation defects prior to backfilling.
   a. Replace cable if insulation is damaged.
2. Install without kinks, stresses, and/or splices.
3. Buried applications:
   a. For horizontal segments of cable meet the following requirements in accordance with drawings 1695-D-60360, 1695-D-60361, and Section 31 23 02 – Compacting Earth materials:
      1) Minimum burial depth of cables: 30-inches.
         a) Cables shall be buried a minimum of 42-inches in agricultural fields.
      2) Surround cable with minimum 6-inches of sand backfill.
      3) Place warning tape approximately 12-inches above cable for entire length of cable segments.
   b. Run cable through rigid galvanized conduit, test station pipe, or similar protection once cable emerges from ground.
4. Connect to test station, junction box, and rectifier with crimped, ring-tongue connectors.
5. Identify origin of cables terminating in enclosure:
   a. Cable identification to distinguish originating structure or anode in accordance with drawing 1695-D-60363.
   b. Printed letters on a shrinkable label attached to cables clearly visible within enclosure.
   c. Encase printed labels in clear heat shrink tubing.

E. Structure Cables:

1. One test cable and one bond cable per structure at each test station.
2. Connect cables and jumper bonds to structures by exothermic metallurgical bond as shown in drawing 1695-D-60363.
   a. Make exothermic metallurgical bond in accordance with bonding supply manufacturer's instructions.
   b. Bonds shall not damage linings inside pipes or fittings.
   c. Test metallurgical bond integrity by striking side of weld nugget with 16-ounce hammer, in presence of COR.

d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with approved dielectric metallurgical bond coating.

e. Allow dielectric material to cure before repair of damaged structure coating or lining.

1) Repair dielectric coatings/linings in accordance with Section 09 96 20 – Coatings.

2) Repair mortar/concrete coating and lining in accordance with Reclamation M-47.

F. Electrical Continuity Joint (Jumper) Bonds:

1. Provide metallurgical bonds at mechanical type joints (e.g., non-welded joints) between ferrous parts included in a particular cathodic protection system as indicated in this section or as necessary to ensure electrical continuity.

2. Minimum of four cables per bond joint for long metallic pipe sections.

3. Minimum of two cables per bond joint for fittings on non-metallic pipe.

4. Bond cable installed with sufficient slack to prevent stress or tugging.

a. Allow for minimum 1/2-inch of joint movement.

5. Jumper Bond Locations:

a. Between non-welded ferrous pipe sections and ferrous pipe and fittings.

b. Between stargrips and fittings for non-metallic pipe.

G. Test Stations:

1. Locations:

a. Each end of pipeline.

b. Foreign pipeline crossings.

c. Powerline crossings.

d. Upstream side of metallic casings.

e. Locations requiring galvanic anodes such as metallic fittings and structures on non-metallic pipe.

f. Locate test stations and junction boxes to make readily accessible.

g. Do not locate test stations inside agricultural fields.

h. Where test stations will not likely be damaged or interfere with personnel and/or equipment (e.g., adjacent to above ground structures). Exact location is subject to approval of COR.

i. As close to each current carrying structure connection as possible.

2. Details for each type of test station are shown in drawings 1695-D-60361 and 1695-D-60362.

3. Permanently, uniquely, and clearly identify each test station with station number. Hand lettering inside of test station cap with permanent marker is acceptable.
4. Terminate cables for a given location within same test station enclosure.
5. Contain two cables, at minimum:
    a. Bond cable from protected structure.
    b. Test cable from protected structure for determining structure-to-soil potentials.
6. Protect test stations using steel Bollards in accordance with drawings 1695-D-60361and 1695-D-60362.
    a. Secure test station support pipe to steel Bollard with metal straps or pipe clamps.

H. Pipeline Casings:

1. Metallic pipe shall be electrically isolated from casing using non-metallic spacers and non-metallic sleeves when necessary.
2. Test station or anode junction box on upstream side shall include two cables from casing (if metallic), two cables from pipe (if metallic), and one cable from each anode required for casing and pipe.
    a. Anode cables connected through a 0.01-ohm calibrated shunt for each in test station.
    b. Variable resistor for each anode (as necessary).
3. Anodes are not required on non-metallic casings.
4. Anodes are not required on non-metallic carrier pipes.
5. Anodes are not required on carrier pipe if protected by an impressed current cathodic protection system at said location.

I. Foreign Pipeline Crossings:

1. Test station shall include two cables from each pipe and permanent reference electrode.
    a. Obtain permission from foreign line owner 30 days prior to attaching cables on foreign line.
    b. Cables shall be attached to foreign pipeline by pipeline owner or by Contractor at discretion of foreign line owner.
2. Place permanent $Cu/CuSO_4$ reference electrode between foreign pipe and Reclamation pipe.
3. Place reference electrode approximately 12-inches from Reclamation pipe.
4. Permanent reference electrode installed in accordance with manufacturer’s instructions.

5. Test stations are only required if both Reclamation line and foreign line are metallic and an impressed current system is installed on one or both pipes.

J. Powerline Crossings:

1. Test station shall include two cables from Reclamation pipe and permanent reference electrode:

a. Obtain permission from foreign structure owner 30-days prior to attaching cables on foreign structure.

b. Cables shall be attached to foreign structure by structure owner or by Contractor at discretion of foreign line owner.

2. Place permanent $Cu/CuSO_4$ reference electrode between foreign structure and Reclamation pipe.

3. Place reference electrode approximately 12-inches from Reclamation pipe.

4. Permanent reference electrode installed in accordance with manufacturer's instructions.

5. Test stations are only required if Reclamation line is metallic.

3.02 INSTALLATION OF IMPRESSED CURRENT CATHODIC PROTECTION SYSTEMS FOR METALLIC PIPE OPTION

A. Installation details indicated on drawings 1695-D-60360 to 1695-D-60364.

B. Specifications for system based on pipe options, shown in Table 26 42 10A – Impressed Current.

C. Rectifier:

1. Rectifier, field circuit breaker, junction box, and electrical usage meter (if required) shall be mounted on power pole or pole imbedded in concrete footing and located as indicated in Table 26 42 10A – Impressed Current and as directed by COR.

2. Rectifier and field circuit breaker shall meet governing electrical codes to include sufficient grounding.

3. Ground rectifier on AC side in accordance with local electrical codes.

D. Junction Box:

1. Mount directly under rectifier.

2. Terminate cables through junction box.

a. Connect individual anodes through individual calibrated shunts within junction box for current measurements.

b. Connect individual anodes to structure through variable resistors within junction box to allow for equalizing current output from individual anodes.

3. Single cable from anodes and single cable from structures shall be installed for connection from junction box to rectifier terminals.

4. Identify originating anodes and structures connected to terminals on both cables and panel.

E. Test Station:

1. Locations:

a. Approximately every 1,200 feet along an electrically continuous segment of pipeline.

2. Permanently, uniquely, and clearly identify each test station.

3. Terminate all cables for given location within same test station enclosure. Identify all cables to distinguish originating structure.

4. Contain two cables, at minimum:

a. No. 12 AWG bond cable from protected structure.

b. No. 12 AWG test cable from protected structure for determining structure-to-soil potentials.

F. Deep Well Anode Ground Bed:

1. Smaller pilot hole may be drilled to confirm suitability of deep well anode bed site. Hole may be widened as needed.

a. Log soil resistivity every 25-feet to ensure suitability for deep well anode bed site.

2. Install graphite anodes vertically in 10-inch diameter bed as indicated on drawing 1695-D-60360.

3. Number of anodes, anode spacing, number of anode beds, length of beds, and depth of beds shown in Table 26 42 10A - Impressed Current for each pipe option.

4. Each anode cable shall be continuous (without splices) from anode to anode junction box and shall be permanently identified with location of originating anode.

5. Anodes shall be fitted with centralizers to maintain orientation of anode in center of drill hole.

a. At no time shall anodes be supported by their cables.

b. Anodes shall be lowered into drill hole using rope.

6. Anodes shall be equally spaced length of anode bed.

7. Anode cables shall be installed in PVC conduit from sand backfill to rectifier.

a. Horizontal segments of conduit must meet the following requirements in accordance with drawing 1695-D-60360:

1) Minimum burial depth: 24-inches.

2) Surround cable with minimum 6-inches of sand backfill.

3) Place warning tape approximately 12-inches above conduit for entire length of segments.

8. A nonmetallic vent pipe shall be installed from bottom of deep anode bed to rectifier installation.

a. Vent pipe is buried except at rectifier installation where it shall be terminated above ground, protected, goose necked, and fitted with perforated cap.

b. Goose necked portion of pipe shall be installed such that it can be removed for manually introducing water into deep anode ground bed with 3/4-inch garden hose.

c. Vent pipe shall be slotted within coke backfill column and non-slotted outside limits of coke backfill column.

d. Terminate vent pipe close to but not directly beneath rectifier.

e. Install vent pipe in hole with first anode. Cap bottom of vent pipe. Cap top of vent pipe throughout anode and coke backfill installation procedure to prevent intrusion of foreign material.

f. Do not allow drilling mud to enter vent pipe.

9. Coke backfill material, either presoaked metallurgical coke breeze or calcined petroleum coke, shall be introduced into bottom of drill hole and by pumping action. Fill drill hole in such a manner as to prevent bridging and to completely encase anodes.

   a. Anode bed filled with carbonaceous backfill with a 200-foot minimum distance between top of coke backfill column and surface grade.

   b. Coke backfill column, as minimum, shall extend 5-feet below lower most anode and 10-feet above uppermost anode (drawing 1695-D-60360).

   c. Pump coke from bottom of hole up using pipe that is length of anode hole. Do not use vent pipe to pump coke. Raise pipe as anode column is filled with coke.

   d. Coke backfill shall be allowed to settle as recommended by coke backfill manufacturer. After settlement period, level of coke backfill column shall be determined and if required, additional coke backfill shall be added to drill hole.

10. Five feet (minimum) of sand backfill shall be placed on top of coke backfill and remainder of drill hole shall be backfilled with smooth (no rough edges) pea gravel and introduced into well bore in such a manner to prevent damage to anode cables and bridging.

11. Do not attach main anode cable or structure cable to rectifier or energize rectifier. Energize system only at time of testing.

Table 26 42 10A - Impressed Current Anode Beds

Pipe Option	No. of Beds	Rectifier Rating (Volts/ Amp)	Approximate Anode Bed Location (Miles from Reach BOL)				
			#1	#2	#3	#4	#5
Reach 9 – Steel	5	25/18	2.5	7.5	12.5	17.5	22.5
Reach 9 – Coated DIP	5	25/18	2.5	7.5	12.5	17.5	22.5
Reach 9 – Steel/Non-Metallic	4	25/18	2.5	7.5	12.5	17.0	
Reach 9 – Coated DIP/Non-Metallic	4	25/18	2.5	7.5	12.5	17.0	
Reach 10 – Steel	0						
Reach 10 – Non-Metallic	0						
Reach 11 – Steel	1	25/18	Middle of Reach				
Reach 11 – Coated DIP	1	25/18	Middle of Reach				

Note: Install 7 impressed current graphite anodes per bed equally spaced.

3.03 INSTALLATION OF GALVANIC ANODE CATHODIC PROTECTION SYSTEMS

A. Galvanic Anodes:

1. Installation details indicated on drawings 1695-D-60361 to 1695 -D-60364.
2. Install horizontally or vertically as follows and as directed by COR:
    a. Location:
        1) Metallic casings and metallic fittings or structures on non-metallic pipeline.
        2) Minimum 30-feet from nearest part of structures to be protected.
        3) Minimum 10-feet from one another.
        4) Minimum 10-feet from non-metallic piping.
        5) Bond all metalwork within 60-feet.
        6) Install minimum of one anode on metallic fittings and structures unless otherwise noted in Table 26 42 10B – Pipeline Fittings and Casing Anodes.
    b. Depth:
        1) At or below invert of pipe fitting,
        2) Minimum 7-feet below final grade.
3. Remove outer water resistant covering on pre-packaged anodes before installation, taking care not to damage wettable covering containing backfill and magnesium.
4. At no time shall anodes be supported by their cables.
5. Do not wet pre-packaged anodes until in ground, surrounded with compacted earth, and covered by at least 1-foot compacted backfill.
6. Do not connect anodes to structures at test stations; energize systems only at time of testing.
7. Connect individual galvanic anodes to structures through individual calibrated 0.01-ohm shunts within test station or junction box for current measurement.
8. Where multiple anodes are involved, a calibrated shunt shall be included for each individual anode.
9. Connect individual anodes to structure through variable resistors within test station or junction box to allow for equalizing current from individual anodes (if necessary).

B. Test Stations:

1. Locate at metallic casings, fittings, and structures where galvanic anodes are required.

2. Contain three cables, at minimum:
    a. Current carrying cable from protected structure (bond cable).
    b. Current carrying cable from anodes.
    c. Cable from protected structure for determining structure-to-soil potentials.

C. Pipeline Casings:
1. Metallic pipe shall be electrically isolated from casing using non-metallic spacers and non-metallic sleeves when necessary.
2. Test station or anode junction box on upstream side shall include two cables from casing (if metallic), two cables from pipe (if metallic), and one cable from each anode required for casing and pipe.
    a. Anode cables connected through 0.01 ohm calibrated shunt for each in the test station.
    b. Variable resistor for each anode (as necessary).
3. Anodes are not required on non-metallic casings.
4. Anodes are not required on non-metallic carrier pipe.
5. Anodes are not required on carrier pipe if protected by an impressed current cathodic protection system at said location.

Table 26 42 10B – Pipeline Fittings and Casing Anodes

Feature	No. of Anodes	Distance Between Anodes (ft.)	Anode Distance from Structure (ft.)
60-inch diameter casing pipe	3	10	30
54-inch diameter casing pipe	3	10	30
Fittings less than 100 ft. long	1	--	30
Fittings greater than 100 ft. long	2	10	30

3.04 CONTRACTOR FIELD QUALITY TESTING

A. Testing shall include energizing, adjusting, and testing cathodic protection systems.

B. Testing shall be performed in presence of COR.

C. COR shall be informed of date, time, and tests to be performed at least 15 working days prior to testing.

D. Testing Equipment:

1. Portable Voltmeter: Minimum input impedance of 10-megohms and capable of measuring DC voltages between plus or minus 0.1-millivolt to plus or minus 100-volts.

2. Portable $Cu/CuSO_4$ reference electrode.

E. Testing shall be conducted in at least two testing cycles.

1. Check isolation flanges before backfilling to ensure adequate electrical isolation using appropriate equipment.

2. First Testing Cycle:

a. Prior to energizing system.

1) Test structure electrical continuity.

2) Test station integrity.

a) Determine voltage difference between cables within each test station enclosure.

3) Measure static structure-to-soil potentials of buried metalwork.

a) At each individual test station location.

b) Portable reference electrode placed as close to buried metalwork as possible for structure-to-soil potential measurements.

c) Ground shall be saturated with water to reduce reference cell contact resistance.

4) Measure static anode-to-soil potentials of galvanic anodes.

a) At each individual test station location.

b) Ground shall be saturated with water to reduce reference cell contact resistance.

b. After energizing system.

1) Determine protective (uncorrected) and polarized structure-to-soil potentials in accordance with capacity requirements of this Section.

a) At each individual test station location.

b) Place portable reference electrode as close to buried metalwork as possible for structure-to-soil potential measurements.

c) Ground shall be saturated with water to reduce reference cell contact resistance.

2) Determine current output of each individual anode in test stations and junction box.

3) Adjust variable resistor setting for each anode to obtain required balance of current output.

4) Determination of rectifier outputs in volts and amperes and associated tap settings.

5) Test for cathodic interference (DC) if system installed is impressed current.

a) Notify foreign pipeline owner 30 days prior to interference testing.

6) Test for cathodic interference (AC) if system crosses under powerlines:

a) Notify foreign structure owner 30-days prior to interference testing.

3. Second and Subsequent Testing Cycles:

a. Time between testing cycles shall be 30- to 60-days.

b. Cathodic protection system shall not be adjusted between testing cycles.

c. Repeat testing required after energizing system during first testing cycle.

d. If testing cycle data indicates that cathodic protection system requires adjustment to meet specifications requirements, adjust cathodic protection system and conduct subsequent testing cycles within a 30 to 60 day window.

F. Submit final data after last testing cycle when performance criteria have been met and no further adjustments are needed.

G. Submit proposed method for AC and DC cathodic interference mitigation to Reclamation and foreign pipeline and structure owner for approval.

H. After reviewing submittal, Government may require additional testing cycles, adjustments, and re-submittal to determine if cathodic protection system conforms to specification requirements.

END OF SECTION

SECTION 31 02 10
WATER FOR DUST ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Water for Dust Abatement:

1. Measurement: Volume of water applied for dust abatement as directed by COR.
    a. Only water used for dust abatement as directed by COR will be included.
    b. Quantity will be measured in tanks or tank trucks of predetermined capacity or by means of water meters.
2. Payment: M (1,000) Gallons (MGal) prices offered in Price Schedules.

1.02 SUBMITTALS

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

B. RSN 31 02 10-1, Meter Calibration.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 APPLYING WATER FOR DUST ABATEMENT

A. Furnish calibrated water meter for use in measuring water usage.

B. Provide water in accordance with Section 01 51 00 - Temporary Utilities.

C. Provide means of conveying water to point of use and applying water.

D. Install water meter at source.

E. Use pressure spray or distributor bar to apply water evenly.

F. Do not use water for dust abatement on temporary equipment roads, completed backfill areas, and other construction activities unless directed by COR.

G. Apply water for dust abatement as directed by COR.

END OF SECTION

SECTION 31 02 30
DUST PALLIATIVE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Dust Palliative:

1. Payment: Lump sum prices offered in Price Schedules for Dust Palliative.

1.02 SUBMITTALS

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

B. RSN 31 02 30-1, Proposed Application Area for Dust Palliative:

1. Include dust palliative composition, equipment and application.
2. Certification that dust palliative does not inhibit revegetation.

PART 2 PRODUCTS

2.01 DUST PALLIATIVE FOR RESEEDED AREAS

A. Dirtglue, as manufactured by Dirtglue Enterprises, www.dirtglue.com; or equal, with the following essential characteristics:

1. Biodegradeable.
2. Water based.
3. Will not inhibit revegetation.

2.02 WATER

A. Required for mixing and application.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface preparation:

1. Shape and grade surface.
2. Loosen surface with rock rake or blade grader to depth of 1 to 2 inches.
3. Water loose surface so it is visibly moist.

4. In areas without surfacing materials: Do not disturb subgrade, moisten only.

3.02 APPLICATION

A. Apply in areas approved by COR immediately after clearing, grubbing and top soil stockpiling have been completed:

1. Apply palliative to cleared and grubbed areas not disturbed by excavation, stockpiled top soil materials, roads, access ramps.
2. Do not apply to areas to be excavated unless directed by COR.
3. After backfill and top soil has been replaced.
4. Other areas directed by COR where application of water for dust abatement is ineffective as determined by COR.
5. Perform maintenance applications to control dust for the duration of contract as recommended by manufacturer and as directed by COR.

B. Equipment: Designed for uniform application on variable widths at predetermined rates.

C. Location: Access road, stockpiles and ROW as directed by COR.

D. Area: Surface width as necessary within designated ROW.

E. Limitations:

1. Not during rain.
2. Not if rain is anticipated within 4 hours following treatment.
3. Not on frozen ground.

F. Application rate:

1. Reseeded area: Suitable for reseeding, as recommended by manufacturer.
2. If material runs off during application, make repeated passes at lesser rates.

G. Compaction:

1. By equipment travel.
2. Keep traffic off treated surface until dust palliative has penetrated and cured enough to prevent excessive pickup under traffic.

END OF SECTION

SECTION 31 03 33
REMOVAL OF WATER FROM EXCAVATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in applicable prices offered in Price Schedules for items of work requiring removal of water from excavations.

1.02 DEFINITIONS

A. Dewatering: Removal and control of groundwater from pores or other open spaces in soil or rock formations to allow construction activities to proceed as intended, and includes relief of groundwater pressure, control and discharge of effluent water.

B. Unwatering: Control and removal of ponded, seeping, or flowing surface water or emerging subsurface water from excavated surfaces and from precipitation within and adjacent to excavations and construction zones using channels, ditches, gravel drains, grave blankets, pipe, sumps, and discharge lines. Includes control and discharge of effluent water.

1.03 SUBMITTALS

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

B. RSN 31 03 33-1, Removal of Water Plan:

1. Showing proposed method for removal of water from foundations.
2. For payment purposes, prepare the plan with not more than 3 major divisions.
3. The plan may be placed in operation upon approval, but nothing in this paragraph shall relieve Contractor from full responsibility for adequacy of water removal installation.

1.04 SYSTEM DESCRIPTION

A. Design, install, operate, maintain, and monitor water removal facilities.

B. Design and layout facilities to collect discharge water from water removal systems and convey water to designated approved discharge points.

C. Locate water removal facilities to maximize water removal and minimize construction interference.

D. Select pump types and design discharge systems and settling ponds.

E. Provide required equipment and monitor as required by permit.

1.05 PROJECT CONDITIONS

A. Conditions which may influence dewatering and unwatering include:

1. Frequency and rate of precipitation at site.
2. Subsurface conditions including natural layering, thickness, permeability, and storativity of materials, and groundwater levels.
3. Efficiency of pumps, collectors, and discharge systems.

B. Water content and water levels in subsurface materials vary with location, depth, and material.

C. Refer to Section 53 20 00 - Records of Geologic and Subsurface Investigations.

1.06 REGULATORY REQUIREMENTS

A. Obtain required Federal, State, Tribal and local permits for water discharge and other activities associated with removal and control of water.

B. Refer to Section 01 57 30 - Water Pollution Control.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL OF WATER

A. Provide, maintain, and operate necessary facilities for removal of water from various parts of work and for maintaining foundations and other parts of work free from water as required for constructing each part.

B. Where excavation for pipe trenches and excavation for structures extends below ground-water level, dewater portion below water level in advance of excavation.

3.02 UNWATERING

A. Use ditches or sumps to lower and control water levels in advance of excavation, as approved by COR.

B. Construct ditches and sumps to collect seepage and runoff in work areas. Use sandbags, sand and gravel filter bedding, and other materials and techniques to control localized seepage.

3.03 DEWATERING

A. Accomplish dewatering by use of sufficient number of properly screened wells or other equivalent methods.

B. Dewater to prevent loss of fines from foundation, maintain stability of excavated slopes and bottom of excavations, and to result in construction operations being performed in the dry.

END OF SECTION

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SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Clearing and Grubbing:

1. Measurement: Area along width of ROW.
2. Payment: Lump sum prices offered in Price Schedules for Clearing and Grubbing.
    a. Includes costs of disposing of cleared and grubbed material.

1.02 DEFINITIONS

A. Vegetation: Trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Obtain permits before clearing and grubbing.

B. Obtain COR approval before clearing and grubbing.

3.02 CLEARING

A. Clear only areas to be stripped of topsoil, including areas outside of trench excavation.

B. Obtain COR approval before removing trees.

C. Remove vegetation, rubbish, and objectionable material as determined by COR.

1. Where tree cutting is required:
    a. Usable trees:
        1) Size: 3-inches diameter or larger.
        2) Remove, limb, and leave on roadside for local residents to collect and use as firewood.

b. Smaller woody plants and limbs:

1) Size: 3-inches diameter or less.

2) Chip and spread on ROW during revegetation process.

D. Clear areas in accordance with Section 01 57 50 - Tree and Plant Protection and Section 01 57 60 - Protected Species.

3.03 DISPOSAL OF CLEARED MATERIAL

A. Dispose of material in accordance with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

SECTION 31 14 10
STRIPPING, STOCKPILING, AND PLACEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Stripping, Stockpiling, and Placement:

1. Payment: Lump sum prices offered in Price Schedules.

a. Stripping will not be paid under other pay items.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Strip portions inside ROW required for construction.

1. To allow cultural monitoring.

2. Refer to Section 01 57 90 - Preservation of Historical and Archeological Data if cultural resources are discovered.

3.02 STRIPPING

A. Remove topsoil to a depth of 6-inches and to additional depths where directed by COR.

1. If a true topsoil structure does not exist, consider surface soils removed to be topsoil for the purpose of this section.

2. If surface is rock, stripping not required.

3.03 STOCKPILE

A. Transport and stockpile topsoil as necessary prior to final hauling and placing.

B. Do not compact topsoil in stockpile.

C. Cover stockpile with a non-permeable tarp or dust palliative as approved by COR.

3.04 PLACEMENT

A. Remove trash, refuse, weeds, stones larger than 3-inches, and large pieces of vegetative materials.

1. Tree removal in accordance with Section 31 11 00 - Clearing and Grubbing.

B. Place topsoil in areas of earthen surface disturbed by construction.

C. Place topsoil to a minimum thickness of 6-inches.

D. Limit equipment travel over topsoil to avoid compaction.

END OF SECTION

SECTION 31 23 02
COMPACTING EARTH MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of compacting earth materials in prices offered in Price Schedules for compacting backfill, and for other items of work where earth materials are required to be compacted.

    a. Includes furnishing water and moistening materials

    b. Includes Contractor Quality Testing.

1.02 DEFINITIONS

A. Use definitions from ASTM D653.

B. Control Fraction: The portion of a soil sample consisting of particles smaller than a designated sieve size. The fraction is used to compare in-place unit weight with standard laboratory unit weight. Control sieve size depends on laboratory test used to determine laboratory maximum density.

C. C-Value: Ratio expressed as a percentage of (1) in-place unit weight at fill moisture content to (2) wet unit weight of a laboratory-compacted specimen prepared at fill moisture content as determined by rapid method of construction control in accordance with ASTM D5080. C-Value is a comparison of compactive effort of field compaction equipment to standard laboratory compactive effort.

D. D-value: Ratio expressed as a percentage of (1) in-place wet unit weight at fill moisture content to (2) laboratory maximum wet unit weight as determined from a compaction curve constructed at fill moisture content as determined by rapid method of construction control ASTM D5080. D-value is the equivalent of percent compaction in accordance with ASTM D698.

E. Percent Compaction: Ratio expressed as a percentage of in-place unit dry unit weight to laboratory maximum dry unit weight.

F. Special compaction: Compaction close to structures or in spaces not accessible by standard width rollers.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D422-63(2007)	Particle-Size Analysis of Soils
2.	ASTM D653-14	Terminology Relating to Soil, Rock, and Contained Fluids
3.	ASTM D698-12e2	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4.	ASTM D1140-17	Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5.	ASTM D1556/D1556M-15e1	Density and Unit Weight of Soil in Place by the Sand-Cone Method
6.	ASTM D2216-10	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7.	ASTM D2487-11	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8.	ASTM D2488-09a	Description and Identification of Soils (Visual-Manual Procedure)
9.	ASTM D4318-10e1	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
10.	ASTM D4546-14	One-Dimensional Swell or Collapse of Cohesive Soils
11.	ASTM D4647/D4647M-13	Identification and Classification of Dispersive Clay Soils by the Pinhole Test
12.	ASTM D4718-15	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
13.	ASTM D4914-16	Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit
14.	ASTM D5030/D5030M-13a	Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit
15.	ASTM D5080-17	Rapid Determination of Percent Compaction
16.	ASTM D6572-13e2	Determining Dispersive Characteristics of Clayey Soils by the Crumb Test

17.	ASTM D6938-17	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depths)
18.	ASTM D7382-08	Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer

B. Bureau of Reclamation (Reclamation)

1. Reclamation Guidelines for Earthwork Construction Control Testing of Gravelly Soils, Earth Sciences and Research Laboratory, Technical Service Center, Bureau of Reclamation, Denver, Colorado, September 2006.

1.04 SUBMITTALS

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

B. RSN 31 23 02-1, Test Results:

1. Results of tests listed in Table 31 23 02A - Contractor Materials Testing Requirements and Frequency.
2. Include test date, time, location and person performing tests.
3. Notify COR within 2 hours if testing does not meet specified requirements.

1.05 AMBIENT CONDITIONS

A. Do not place and compact soil under following conditions:

1. Rain that creates puddles in clayey or silty materials.
2. Heat or wind or both that dries material below specified moisture conditions.
3. Ice, frost, or snow pockets are visible in soil being placed or in underlying materials.

B. Ambient air temperature below freezing may make placement and compaction operations difficult.

1. Obtain COR approval, before performing operations when ambient air temperatures are below freezing.
2. Cease operations when placed materials are freezing or below freezing.
   a. Minimize interruptions of operations.
   b. Continuous operations may be required to eliminate freezing of materials.

PART 2 PRODUCTS

2.01 CLASSIFICATION

A. When required, classify earth materials using the Unified Soil Classification System (USCS) according to ASTM D2487 or ASTM D2488.

1. Gradation tests for classification: ASTM D422 or ASTM D1140.
2. Atterberg limits testing for classification: ASTM D4318.

2.02 SOIL TYPES

A. Clean Fill:

1. Any soil except soils with classifications Peat (PT), Organic Silts and Organic Clays (OL and OH), or Elastic Silt (MH) per ASTM D2487.
2. Do not use soils that exhibit expansive or dispersive characteristics in accordance with ASTM D4546, ASTM D4647, or ASTM D6572.
3. Free of roots, stumps, limbs, vegetation, organic matter, and ice.
4. Does not contain construction debris, scrap materials, refuse, man-made wastes, or chemical or hydro-carbon contamination.

B. Do not use frozen soils.

C. Special Gradations and Plasticity.

1. In some cases, such as embankment materials, embedment for buried pipe, special gradations and/or plasticity characteristics may be required. These requirements are in applicable Section.

2.03 DESIGNATION OF SOILS FOR COMPACTION

A. Requirements for lift thickness, method of compaction, and method of determining degree of compaction depends on whether soil is considered to be silty or clayey, cohesionless, or cohesionless containing some silt and clay.

B. Silty or Clayey Soils:

1. Contains appreciable amounts of fines (more than 15 percent plastic fines or 30 percent non-plastic fines).

C. Cohesionless Soils:

1. Contains few fines (less than 5 percent fines).

D. Cohesionless Soils Containing Some Clay and Silt:

1. Contains some clay and silt (between 5 percent fines and 15 percent plastic fines or 30 percent non-plastic fines).

2.04 MAXIMUM PARTICLE SIZE

A. Soil for compacted backfill and embankment:

1. Maximum particle size limitations described in appropriate Sections for backfill against specific structures and zoned embankment materials.

2. Otherwise, no cobbles larger than 3-inches.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Clear, grub, and strip.

B. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified compaction, if necessary.

C. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing layer of material to be compacted.

3.02 SOIL MOISTURE CONTENT

A. Moisten or aerate material, as necessary, to provide moisture content that will readily facilitate obtaining specified compaction. Add water to soil only in increments that will permit moisture content to be uniform and homogenous throughout each layer after mixing.

B. Silty and Clayey Soils and Cohesionless Soils Containing Some Silt and Clay:

1. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.

   a. If clayey borrow soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in the clods.

   b. Use of disks, harrows, or rakes may be required to blend moisture in borrow area.

2. Moisture content during compaction:

   a. Soils controlled by impact compaction

      1) Minimum 95 percent with moisture content plus or minus 2 percent of optimum moisture content.

   b. Soils controlled by vibrating hammer.

      1) Within water content range for effective compaction as determined by ASTM D7382.

C. Cohesionless Soils:

1. Add water during compaction, as necessary, since soils are free-draining.

D. Determine moisture with one of the following:

1. ASTM D1556.
2. ASTM D4914.
3. ASTM D5030.
4. ASTM D5080.
5. ASTM D2216.
6. ASTM D6938.
    a. Correct moisture from the nuclear gage for gauge error for the specific soils tested and the moisture content of the total material may require adjustment for the control fraction (ASTM D4718).

3.03 PLACEMENT

A. Place soils to be compacted in horizontal layers.

B. If necessary, blend materials so that compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations, or other imperfections.

3.04 COMPACTION

A. Compact material with following methods and techniques appropriate to type of soil.

B. Silty or clayey material:

1. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers, other suitable compaction equipment, or equipment travel.
    a. Uniformly distribute equipment passes.
    b. Compact in horizontal layers to compacted thickness of 6-inches or less.
2. Special compaction: Compact with hand held impact tampers, or small tamping equipment.
    a. Uniformly distribute effort.
    b. Compact in horizontal layers to compacted thickness of 4-inches.
3. Density:
    a. Percent Compaction, minimum: 95 percent, or
    b. D-value:
        1) Minimum 95 percent with moisture content plus or minus 2 percent of optimum moisture content.

C. Cohesionless free-draining material:

1. Compact with crawler-type tractors, vibrating drum rollers, surface plate vibrator, or similar equipment

a. Uniformly distribute equipment passes.

b. Compact in horizontal layers to compacted thickness of 12-inches or less.

2. Special compaction: Compact with hand held impact tampers, vibrating plate tampers, or small tamping equipment.

a. Uniformly distribute effort.

b. Compact in horizontal layers to compacted thickness of 6-inches.

3. Density:

a. Percent Compaction, minimum: 95 percent.

D. Cohesionless Soils Containing Some Silt and Clay:

1. Compact in accordance with either procedure above.

2. Density:

a. Percent Compaction, minimum: 95 percent.

E. Demonstration:

1. Lift thicknesses may vary depending on equipment and methods. Before changing requirements in this Section, demonstrate that required density will be obtained.

F. Wash Crossing Compaction:

1. Minimum compaction 85 percent.

3.05 MEASURE OF COMPACTION

A. Determine unit weight of soils in-place using one of the following methods:

1. Silty or Clayey and Cohesionless Soils:

a. ASTM D1556.

b. ASTM D4914.

c. ASTM D5030.

d. ASTM D6938.

B. Determine soil compaction by one of the following.

1. Silty or clayey soils:

a. Percent Compaction:

1) Rapid Method: ASTM D5080.

2) Laboratory Compaction Test: Comparison of in-place dry unit weight of minus No. 4 sieve size control fraction to laboratory maximum dry unit weight as determined by ASTM D698, Procedure A.

2. Cohesionless soils:

a. Percent Compaction: In place dry unit weight of minus 2-inch control fraction compared to the maximum dry unit weight determined by ASTM D7382.

3. Cohesionless Soils Containing Some Silt and Clay:

a. Use whichever testing procedure result requires higher in-place dry density.

C. Adjustment:

1. Soils with 5 to 30 percent oversized particles: In-place unit weight of minus No. 4 size control fraction determined by screening gravel, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D4718.

2. Soils containing greater than 30 percent oversized particles: Required D ratio or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 3 in Reclamation Guidelines for Earthwork Construction Control Testing of Gravelly Soils.

3.06 CONTRACTOR FIELD QUALITY TESTING

A. Testing:

1. Independent testing laboratory shall perform sampling, testing, and reporting as required in Table 31 23 02A - Contractor Materials Testing Requirements and Frequency.

a. Independent testing laboratory shall meet requirements specified in Section 01 46 20 - Testing Agency Services.

2. Notify independent testing laboratory and Government 24 hours before compaction work begins and 24 hours before significant change in compaction operations (major change in equipment or procedure used).

3. Notify independent testing laboratory and Government immediately of equipment change due to breakdown, or re-deployment.

4. Testing Frequency:

a. At minimum, perform test at frequencies specified in Table 31 23 02A - Contractor Materials Testing Requirements and Frequency.

b. Greater frequency of testing is normally performed at beginning of new work, new work crew, or new equipment.

c. After successful work operation pattern is established, testing frequency may be performed at minimum guidelines.

d. Perform additional tests at sites considered questionable by Government; such as suspected incomplete compaction, surfaces that may have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances. Frequency of additional testing is at discretion of Government.

e. At minimum perform compaction test at every road crossing to verify compaction.

Table 31 23 02A - Contractor Materials Testing and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	MINIMUM FREQUENCY OF TESTING
Soil Classification	ASTM D2487	Classification of Soils for Engineering Purposes	As necessary to classify material to meet specification requirements or to index material for determining density by nuclear method.
	ASTM D2488	Description and Identification of Soils	
Moisture Content	ASTM D2216	Laboratory Determination of Water (Moisture Content of Soil and Rock by Mass.	With in-place density or as required to index material for determining density by nuclear method.
Laboratory Compaction (Standard Effort)	ASTM D698, Procedure A.	Laboratory Compaction Characteristics of Soil Using Standard Effort	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation, regardless of amount of material placed.
Laboratory Compaction (Vibratory Hammer)	ASTM D7382	Standard Test Methods for Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation, regardless of amount of material placed.
Oversized Correction	ASTM D4718	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles	When oversize material is between 5 to 30 percent

Table 31 23 02A - Contractor Materials Testing and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	MINIMUM FREQUENCY OF TESTING
Rock Factor		USBR Guidelines for Earthwork Construction Control Testing of Gravelly Soils	When oversize material is greater than 30 percent
Sand Cone	ASTM D1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation, regardless of amount of material placed
Rapid Construction Control	ASTM D5080	Rapid Determination of Percent Compaction	One test every 500 yd^3 Minimum 1 test per day per compacted backfill operation, regardless of amount of material placed.
Nuclear Method	ASTM D6938	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	One test every 100 yd^3 Minimum 1 test per day per compacted backfill operation, regardless of amount of material placed. Minimum 1 test per foundation prior to concrete placement.

B. Contractor Support:

1. Provide timely access to areas for density testing and excavate and level an area in compacted material to provide surface for testing.
   a. Test fills compacted by sheepsfoot rollers 1 or 2 lifts below surface.
2. Government may select location of testing.
3. When density is being measured by sand cone device in accordance with ASTM D1556, cease construction activity in immediate vicinity of testing.
4. Dig test pits as requested to examine compacted soil against structures or pipe.
5. Backfill test pits to original requirements.
6. Provide warning lights, flags, or other safety devices as needed by testing personnel.
7. Provide adequate lighting for performing test if required because of darkness.

3.07 FIELD QUALITY ASSURANCE

A. Government may perform test as required to verify contractor quality testing. If Government performs quality assurance testing, provide support as required for Contractor quality testing.

END OF SECTION

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SECTION 31 23 22
PIPE TRENCH EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Price Schedule 1 (Reach 9): Diameter change from 48-inches to 42-inches is assumed at Station 90879+00. Location of diameter change may vary based on pipe material type used and quantities adjusted accordingly.

B. Excavation for Pipe Trenches:

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

   a. Regardless of actual widths, bottoms, and side slopes excavated, measurement will be made to paylines shown on drawings.

   b. Measurement for payment for additional excavation will be made to trench widths (Wp) shown on drawings and to depth directed by COR.

   c. Measurement for payment will be continuous through pipe fittings.

   d. Measurement for payment for excavation for concrete for pipe fittings that is outside the trench excavation paylines will be made to lines and dimensions shown on the drawings or to the neatlines of the concrete.

2. Payment: Cubic yard prices offered in Price Schedules.

   a. Includes cost of labor and materials for:

      1) Shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction;

      2) Pumping and unwatering;

      3) Removing such temporary construction where required;

      4) Stockpiling excavated material for backfill;

      5) Disposal of unused or wasted excavated materials.

   b. No direct payment will be made for excavation of pipe trenches outside paylines shown on drawings.

   c. Include cost of excavation for pipe trenches required outside paylines in prices offered in Price Schedules for various sizes and classes of line pipe.

   d. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at expense of Contractor.

e. Where excavation is performed in backfill, no payment will be made for resulting excavation, backfill, and compacting backfill.

C. Rock Excavation for Pipe Trenches:

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

a. Regardless of actual widths, bottoms, and side slopes excavated, measurement will be made to paylines shown on drawings and to original ground or rock surface.

b. Measurement for payment for additional excavation will be made to Wp and trench bottom shown on drawings and to depth directed by COR.

c. Measurement for payment will be continuous through pipe fittings.

d. Measurement for payment of excavation for concrete for pipe fittings that is outside trench excavation paylines will be made to lines and dimensions shown on drawings or to neatlines of the concrete.

2. Payment: Cubic yard prices offered in Price Schedules.

a. Includes cost of labor and materials for:

1) Mechanical breaking, shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction;

2) Pumping and unwatering;

3) Removing such temporary construction where required;

4) Stockpiling excavated material for backfill;

5) Disposal of unused or wasted excavated materials.

b. No direct payment will be made for rock excavation of pipe trenches outside Wp, depth and length listed above.

c. Include cost of rock excavation for pipe trenches required outside paylines prices offered in Price Schedules for Rock Excavation of Pipe Trenches.

d. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at expense of Contractor.

D. Embedment in Pipe Trenches:

1. Measurement:

a. Made to paylines for pipe trenches, to lengths shown on drawings, or as directed based on diameters Dp shown on drawings, regardless of actual diameters of pipe furnished.

b. Measurement for payment for the embedment zone in pipe trenches for additional excavation of pipe trenches will be made to trench widths Wp shown on drawing 1695-D-60314.

1) Embedment zone; between 0.25 Dp to 0.7 Dp.

c. Controlled Low Strength Material is required in embedment zone for road and utility crossings.

2. Payment: Cubic yard prices offered in Price Schedules.

a. Includes cost of work associated with procuring, processing, and hauling of necessary material.

b. Where embedment material is obtained from other sources, payment will be made for embedment only. Include cost of excavating or procuring, hauling, and processing of such material in unit prices offered in Price Schedules for embedment in pipe trenches.

c. Native material when used from required excavation for embedment in pipe trenches will be paid for both as excavation when removed from original position and as embedment when placed.

d. No direct payment will be made for embedment in pipe trenches for pipe outside paylines shown on drawings. Include cost of embedment outside these paylines in prices offered in Price Schedules for various sizes and classes of line pipe.

e. No payment will be made for embedment required to fill overexcavation performed by Contractor.

f. No payment will be made for removal and reconstruction of defective and nonconforming embedment compacted to an insufficient density.

E. Backfill for Pipe Trenches:

1. Measurement:

a. Made to paylines for pipe trenches, to lengths shown on drawings, or as directed based on diameters Dp shown on drawings, regardless of actual diameters of pipe furnished.

b. Measurement for payment of backfill in pipe trenches for additional excavation of pipe trenches will be made to trench widths Wp shown on drawings and to depth directed by COR.

1) Backfill; Between 0.7 Dp to bottom of stripping or original ground surface in rock.

c. Backfill material mounded or spread over trench above original ground surface will not be measured for payment as backfill in pipe trenches.

d. Controlled Low Strength Material is required in backfill for road and utility crossings.

2. Payment: Cubic yard prices offered in Price Schedules.

a. Includes cost of work associated with excavation or procuring, processing, and hauling of necessary material.

b. Material from required excavation used for backfill in pipe trenches will be paid for both as excavation when removed from original position and as backfill when placed.

c. Where backfill material is obtained from other sources, payment will be made for backfill only. Include cost of excavating or procuring, hauling, and processing of such material in unit prices offered in Price Schedules for backfill in pipe trenches.

d. No direct payment will be made for backfill in pipe trenches for pipe outside paylines shown on drawings. Include cost of backfill outside these paylines in prices offered in Price Schedules for various sizes and classes of line pipe or valve assemblies.

e. No direct payment will be made for furnishing and placing gravel around air valves, and blowoffs. Include cost in prices offered in Price Schedules for backfill in pipe trenches.

f. No payment will be made for backfill required to fill overexcavation performed by Contractor.

g. No payment will be made for removal and reconstruction of defective and nonconforming backfill compacted to an insufficient density.

F. Cost:

1. Include cost of bedding in pipe trenches in Line Pipe.

a. Bedding Zone; bottom of trench to 0.25 Dp.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for convenience, fault, or operation of Contractor beyond specified or directed additional excavation lines.

C. Rock Excavation:

1. Material that cannot be ripped with 400 horsepower or larger crawler tractor equipped with ripper rated for hard rock with a rock tooth.

2. Material that cannot be excavated with 300 horsepower or larger hydraulic excavator, with rock teeth, in areas where it is not feasible for ripping with crawler tractor.

1.03 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO SSHB-02 Standard Specifications for Highway Bridges, 17th Edition

1.04 PROJECT CONDITIONS

A. Soil conditions are described in Section 53 10 00 - Geologic Investigations.

B. Tables 31 23 22A - Reach 9, Reach 10 and Reach 11 summarize Government's interpretation of geological investigations to predict native material properties. Conditions in field may vary. Bidders are encouraged to come to their own conclusions relating to excavation characteristics of site materials.

C. Material Types presented in these tables do not reflect potential for encountering bedrock during excavation. If bedrock is encountered, trench excavation should match what is shown on drawing 1695-D-60314 for Material Type 1. Bedrock surface has been inferred from geologic investigations, and is presented on drawings 1695-D-60281 through 1695-D-60313.

Table 31 23 22A – Reach 9

Station	Expected Native Material Properties*
90010+00 to 90019+50	3
90019+50 to 90104+00	2
90104+00 to 90151+00	3
90151+00 to 90187+00	2
90187+00 to 90237+00	3
90237+00 to 90432+00	2
90432+00 to 90483+00	3
90483+00 to 90545+00	2
90545+00 to 90634+00	3
90634+00 to 91100+00	2
91100+00 to 91150+00	3
91150+00 to 91195+00	2
91195+00 to 91226+00	3

Table 31 23 22A – Reach 10

Station	Expected Native Material Properties*
10010+00 to 10050+00	3

Table 31 23 22A – Reach 11

Station	Expected Native Material Properties*
11058+00 to 11100+00	2
11100+00 to 11179+50	3
11179+50 to 11280+00	2

*Refer to Drawing 1695-D-60314 for explanation of Native Material Properties.

PART 2 PRODUCTS

2.01 BEDDING

A. Bedding:

1. Controlled low strength materials in accordance with Section 31 23 70 - Controlled Low Strength Material (CLSM).

2.02 EMBEDMENT

A. Embedment:

1. Select material in accordance with drawings.
2. CLSM in accordance with Section 31 23 70 – Controlled Low Strength Material (CLSM).
3. Select Material from commercial sources meeting requirements of this specification.
4. Native material removed from pipe trench excavation or from other sources arranged for by Contractor.

2.03 MATERIALS FOR BACKFILL

A. Use materials removed in excavating for pipe trenches or from other sources arranged for by Contractor.

1. Government makes no guarantee that specified backfill materials are contained in or can be processed from materials excavated from pipe trenches.
2. All reasonable effort shall be expended to obtain suitable backfill material from required excavation prior to obtaining commercial sources.

B. Do not use unprocessed expansive clays in compacted backfill.

C. Provide processing equipment and perform work necessary to process excavated materials to produce materials meeting requirements of these specifications.

D. Maximum backfill particle size within 1-foot of the outside of pipe: Conform to requirements of Table 31 23 22B - Maximum Backfill Particle Size

Table 31 23 22B - Maximum Backfill Particle Size

Type of Pipe	Maximum Particle Size, inches
PVC, metallic pipe with dielectric coating, or metallic pipe encased in polyethylene	3/4
Polyethylene Pipe: Diameter 10-inch to 16-inch Diameter greater than 16-inch	 1 1 1/2
Fiberglass Pipe	1 1/4
Other pipe	3

E. Maximum backfill particle size beyond 1-foot of outside of pipe: 1/2 lift height.

F. Particle size of material placed in compacted backfill, maximum: 3-inches.

G. Particle size of material placed in uncompacted backfill, maximum: 5-inches.

H. Backfill placed where pipelines cross under open irrigation ditches and other watercourses: Silty or clayey material with a plasticity index of 8 or more.

PART 3 EXECUTION

3.01 GENERAL

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

3.02 EXCAVATION

A. Do not excavate or keep pipe trench open more than 300-feet ahead or 100-feet when groundwater is present of pipelaying, backfilling, or compacting backfill operations, unless approved by COR.

1. Backfill and Compacting Operations:

   a. Shall not fall behind pipelaying and excavation operations,

   b. Allow CLSM to obtain required strength in accordance with Section 31 23 70 - Controlled Low Strength Material (CLSM) prior to placing backfill above 10-feet of cover.

   c. At the end of each shift:

      1) 100-feet of pipe trench, maximum, is open ahead of pipelaying and,

2) Backfill is within 100-feet of pipelaying.

3) For trenches left open overnight,

a) Install inflatable watertight plug.

b) Fence open trench with temporary safety fence in accordance with Section 01 56 32 - Temporary Safety Fence.

2. If backfilling and compacting fall behind pipelaying operations, stop excavation and pipelaying operations. Do not proceed until directed by COR.

B. Excavate pipe trenches for pipelines, delivery installations, and pipeline accessories to lines, grades, and dimensions shown on drawings.

C. Finish bottom of trench accurately to lines and grades shown on drawings.

D. Perform excavation in the dry.

E. Do not excavate in frozen materials without written approval of COR.

3.03 ADDITIONAL EXCAVATION

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

3.04 OVEREXCAVATION

A. When foundation material is overexcavated beyond specified or directed lines, fill overexcavation with backfill materials and compact in accordance with Section 31 23 02 - Compacting Earth Materials.

B. If foundation material is overexcavated by being disturbed or loosened during excavation, compact material in place or remove and replace with backfill material and compact in accordance with Section 31 23 02 - Compacting Earth Materials.

3.05 STOCKPILING

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

3.06 DISPOSAL

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

1. Excess excavated materials: Materials which are not used or processed for use as backfill material and waste materials from such processing.

3.07 PIPE INSTALLATION

A. Install pipe in accordance with Section 33 11 10 – Pipeline General Requirements.

3.08 BEDDING PLACEMENT

A. Place to lines shown on drawings or as directed by COR.

B. Do not drop directly on pipe.

C. Place CLSM in accordance with Section 31 23 70 – Controlled Low Strength Material (CLSM) and as shown on drawings.

D. Place to widths and depths shown on drawings.

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

3.09 EMBEDMENT PLACEMENT

A. Place to lines shown on drawings or as directed by COR.

B. Do not drop directly on pipe.

C. Place CLSM, Select or Native Material in accordance with drawings.

D. Place to widths and depths shown on drawings.

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

F. Place CLSM, select or native material in accordance with drawing 1695-D-60314.

3.10 BACKFILL PLACEMENT

A. Install warning tape over center of pipe at least 18-inches below ground and at least 18-inches above pipe. See Section 33 11 10 – Pipeline General Requirements, Pipe Accessories; Warning Tape for details.

B. Place backfill in pipe trenches to lines shown on drawings, or as directed by COR.

C. Do not place material in backfill when either material or surfaces on which backfill is to be placed are frozen.

D. Place backfill for overexcavation performed outside specified or directed paylines for excavation for pipe trenches in same manner as specified for adjacent backfill or embedment.

E. Do not drop backfill directly on pipe.

F. Place backfill carefully and spread in uniform layers so that spaces about rocks and clods will be filled.

G. Place backfill in lifts:

1. Backfill to be compacted: In accordance with Section 31 23 02 - Compacting Earth Materials.

2. Maximum lift height of other backfill: 1-foot.

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

I. Backfill above compacted backfill may be placed as soon as compacting of backfill is completed.

1. Placing of this backfill shall be delayed at locations designated by COR for the procurement of compacted backfill sample collections for testing.

J. Place backfill over pipe as approved by COR, if backfilling operations are interrupted for more than 24 hours.

K. For Wash Crossing backfill: See Section 35 42 35 – Bank Protection.

3.11 COMPACTING BACKFILL

A. Compact backfill in pipe trenches in layers having about the same top elevation on both sides of pipe to prevent unequal loading and displacement of pipe.

B. Compact backfill as specified in Section 31 23 02 - Compacting Earth Materials.

C. Location of Compacted Backfill:

1. As shown on drawings.

2. Backfill for foundation.

3. Backfill on outside of horizontal curves for a minimum of restrained pipe length.

4. Backfill where pipeline cross under roadways and driveways.

5. Backfill where utility pipelines cross pipeline:

a. To horizontal centerline of pipeline crossing lateral pipeline and to dimensions and slopes as shown on drawings.

6. Backfill at tees with horizontal outlets, pipe bends, encasements, collars including collar-type blocking, and pipe plugs as shown on drawings.

7. Backfill around valve boxes and manholes as shown on drawings.

8. Where additional excavation for pipe trenches is directed by COR to remove foundation material or other material, compact backfill within paylines for this additional excavation.

D. When tests indicate insufficient density of compacted backfill about pipe:

1. Remove backfill above compacted backfill.
2. Compact backfill until proper density is obtained.
3. Replace backfill above compacted backfill.
4. This work shall be at Contractor's expense.

3.12 PROTECTION

A. Government reserves the right to direct Contractor to place a sufficient amount of backfill material over compacted backfill within 72 hours after compacting of backfill has been completed.

B. Place uncompacted backfill to a minimum depth of 3-feet or compact backfill to a minimum depth of 2-feet above top of pipe before allowing construction equipment to travel over pipe.

1. After these minimum earth covers are in place, maximum live equipment loading allowed over pipe shall be HS-20 loading (16,000-pound wheel load) in accordance with AASHTO SSHB.
2. If construction equipment that exerts a larger wheel load is proposed to be used, submit construction equipment loadings to COR for analysis and determination of required backfill depths or other protective measures.

END OF SECTION

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SECTION 31 23 39
DISPOSAL OF EXCAVATED MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in appropriate Price Schedules for Excavation for Pipe Trenches.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DISPOSAL OF EXCAVATED MATERIALS

A. Waste material from required excavation which is not suitable or required for backfill, embedment, bedding, or topsoil.

B. Place waste excavated material as directed by COR.

C. Waste areas for excavated materials, 6-inches or smaller, as directed by COR.

D. Dispose waste material within ROW unless prior approvals of cultural and environmental clearance have been obtained outside of ROW.

E. Do not place waste material in wetlands, within 12-feet of drainage channels, within 12-feet of edge of prescribed or actual cuts for laterals, wasteways, or drains.

F. Do not waste material by dumping from top of slope.

G. Grade waste banks to reasonably even and uniform surfaces that blend with natural terrain.

1. Minimum slope: 2 percent.
2. Maximum slope: 4H:1V.

END OF SECTION

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SECTION 31 23 70

CONTROLLED LOW STRENGTH MATERIALS (CLSM)

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the prices offered in Price Schedules for Line Pipe.
   a. Bedding Zone – Line Pipe
   b. Embedment Zone – Embedment Item.
   c. All other including road and utility crossing requirements – Line Pipe.

B. Cost:

1. Include in prices offered in Price Schedules for Backfill for Pipe Trenches at utility crossing and other locations as shown on drawings.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 318-14	Building Code Requirements for Structural Concrete

B. ASTM International (ASTM)

1.	ASTM C33/C33M-16e1	Concrete Aggregate
2.	ASTM C94/C94M-17	Ready-Mixed Concrete
3.	ASTM C114-15	Chemical Analysis of Hydraulic Cement
4.	ASTM C143/C143M-15a	Slump of Hydraulic-Cement Concrete
5.	ASTM C150/C150M-17	Portland Cement
6.	ASTM C618-15	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
7.	ASTM C1602/C1602M-12	Mixing Water Used in the Production of Hydraulic Cement Concrete
8.	ASTM D1558-10	Moisture Content Penetration Resistance of Fine Grained Soils
9.	ASTM D4832-16	Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

10.	ASTM D6024-16	Ball Drop on Control Low Strength material (CLSM) to determine Suitability for Load Application

1.03 SUBMITTALS

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

B. RSN 31 23 70-1, Approval Data for CLSM Produced Without Native Soil:

1. Mix Design: For each CLSM mix.
    a. Mixture proportions.
    b. Material sources.
        1) Name and manufacturer of each cementitious material.
        2) Name of aggregate sources.
        3) Product name and manufacturer of admixtures to be used in mix.
        4) Government reserves right to require submission of samples of CLSM materials for testing before or during use in concrete.
    c. If proposed material has more than 30 percent passing the 200 sieve, provide mix designs for:
        1) 10 to 30 passing 200 sieve.
        2) 30 to 50 passing 200 sieve.
    d. Physical properties:
        1) Trial mixtures:
            a) Results from trial batches made within past 6 months.
            b) Trial mix test results, three 6-inch diameter cylinders each at 7 and 28 days.
            c) Average compressive strength of trial batch cylinders at specified design age.
    e. Resubmit mix design for change in material source or type.
    f. Cementitious materials manufacturer’s certifications and test reports within last 6 months.
    g. Aggregate test reports for gradation and plasticity, less than 6 months old.
    h. Method to determine moisture and consistency of materials to maintain specified strengths. Provide testing frequency.
2. NRMCA Certification of Production Facilities:
    a. Automatic digital recording of cementitious materials, aggregate, water, and chemical admixtures.

b. Verification that facility meets requirements for furnishing concrete in subfreezing weather.

c. ACI Personnel Certification(s):

1) Aggregate Testing Technician.

2) Concrete Field Testing Technician.

3) Concrete Strength Testing Technician.

3. Current calibration of scales, water meters, and admixture dispensers.

4. If Quality control test results show CLSM does not meet requirements, submit revised mix design.

C. RSN 31 23 70-2, Approval Data for CLSM Produced With Native Soil:

1. Submit Mix design for each material type.

a. If proposed material has more than 30 percent passing the 200 sieve, provide mix designs for:

1) 10 to 30 percent passing 200 sieve.

2) 30 to 50 percent passing 200 sieve.

b. Physical properties:

1) Trial mixtures:

a) Results from trial batches made within past 6 months.

b) Trial mix test results, three 6-inch diameter cylinders each at 7- and 28-days.

c) Average compressive strength of trial batch cylinders at specified design age.

c. Resubmit mix design for change in material source or type.

d. Cementitious materials manufacturer’s certifications and test reports within the last 6 months:

e. Material test reports for gradation and plasticity, less than 6 months old:

2. Soil processing and mixing equipment.

3. Foreman references.

4. Method to maintain specified strengths using native soils.

5. If quality control test results show CLSM does not meet specified requirements, submit revised mix design.

D. RSN 31 23 70-3, Quality Control Test Results:

1. Notify COR within 2 hours if testing does not meet specified requirements.

2. If Quality Control Test Results show CLSM does not meet specified requirements, submit a revised mix design.

1.04 DELIVERY, STORAGE, AND HANDLING

A. CLSM delivered from ready mix plants, furnish complete and legible batch ticket with each batch of CLSM in accordance with ASTM C94. Deliver ticket to COR at jobsite during batch delivery.

1.05 QUALIFICATIONS

A. References for foreman in charge of CLSM placement, if CLSM is produced with native soils: Three projects within last 3 years.

PART 2 PRODUCTS

2.01 BACKFILL FOR PIPE TRENCHES

A. See Section 31 23 22 – Pipe Trench Earthwork.

2.02 STEEL PIPE

A. See Section 33 21 95 – Metal Piping for Line Pipe Installations.

2.03 CEMENTITIOUS MATERIALS

A. Cement and pozzolan shipments shall be accompanied by shipping documents containing:

1. Manufactures Certification that material meets requirements.
2. Type or class of material shipped.
3. Manufacturing locations and dates.
4. Lot (bin) number.
5. Date of shipment.
6. Quantity of material shipped.
7. Provide to COR.

B. Cementitious Materials Options:

1. Specified portland cement plus 20 to 80 percent by weight of total cementitious (cement plus pozzolan) specified pozzolan, in accordance with ACI 318.

C. Portland Cement:

1. ASTM C150, Type V.
2. Meet equivalent alkalies requirements of ASTM C150, Table 2.

3. Meet false-set requirements of ASTM C150, Table 4.

D. Pozzolan:

1. ASTM C618, Class F, except,

a. Sulfur trioxide for Class F, maximum: 4.0 percent.

b. Loss on ignition, maximum: 2.5 percent.

c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C618. Use low-alkali cement for test.

d. Does not decrease sulfate resistance of CLSM by use of pozzolan.

1) Demonstrate pozzolan will have an "R" factor less than 2.5.

2) R = (C-5)/F.

3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C114.

4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C114.

2.04 WATER

A. ASTM C1602.

2.05 AGGREGATE OR SOIL

A. Aggregate:

1. ASTM C33.

2. Maximum particle size: 3/8-inch.

B. Soil:

1. PI: Less than 10. LL: Maximum of 30.

2. Gradation:

a. Passing U.S. Standard No. 200 sieve, by weight, maximum: 50 percent.

b. Passing U.S. Standard No. 100 sieve, by weigh, maximum: 70 percent.

c. Maximum particle size: 3/8-inch.

3. Select or process soil so that particles remain in suspension, i.e., no segregation occurs, when CLSM is placed.

4. Clay balls:

a. Maximum percent, by weight of soil: 10 percent.

b. Maximum size: 3/8-inch.

2.06 MIX

A. Mixture of Aggregate or Soil, Cementitious Materials, Water, and Admixtures:

1. Cementitious material content: Percent by dry weight of aggregate or soil to obtain specified compressive strength.

2. Make trial mixes prior to placing CLSM to determine mixture adequacy.

a. Determine compressive strength in accordance with ASTM D4832.

b. Determine slump in accordance with ASTM C143.

B. Water Content: Not to exceed that required to provide a mix that will flow and can be pumped.

C. Seven-day Compressive Strength, ASTM D4832: Not less than 50 pounds per square inch (lb/in^2) and not more than 150 lb/in^2.

D. Consistency:

1. Except, when a stiffer mix required to prevent CLSM from flowing down trenches on a steep slope:

a. Slump, ASTM C143: 8- to 10-inches.

2.07 CLSM TEMPERATURE

A. CLSM Temperature at time of placement: 50 degrees F to 85 degrees F (10 to 30 degrees C).

PART 3 EXECUTION

3.01 BATCHING EQUIPMENT

A. Design and Operation of Mixers: Discharged CLSM shall be uniform in composition and consistency throughout each batch.

1. Adjust amount of water and aggregates batched for CLSM to compensate for variations in moisture content or grading of aggregates as they enter mixer.

2. Inform COR prior to and after adjustments in batching equipment and control instrumentation.

3. Equip truck mixer with dial or digital water meter accurate to within 1 percent of total mix water located between water supply and mixer.

4. Provide revolution counter which indicates total number of revolutions of drum per batch.

a. Visible from outside truck.

b. Reset to zero for each batch.

5. Attach metal plate attached in a prominent place on mixer listing:
    a. Manufacturer's recommended drum capacity.
    b. Mixing and agitating speeds in accordance with ASTM C94.
6. Initial Mixing: Not less than 70 revolutions and not more than 100 revolutions after ingredients are in the drum.
7. Mix 30 revolutions after addition of tempering water.
8. Mix 10 to 12 revolutions after a prolonged period of agitation.
9. Discharge CLSM before 300 drum revolutions.

B. Manufacture and deliver in accordance with ASTM C94.
1. In addition to requirements of ASTM C94, use water meter approved by COR to measure and record mix water for each batch.

C. Provide following information to COR:
1. Copy of current calibration of scales and water meters.
2. Mix water information.

3.02 TRIAL BATCH

A. Perform trial run with proposed equipment and material prior to placing CLSM.
1. Obtain Representative Sample of Material:
    a. If native soil materials are used, mix material from top of trench to proposed invert.
        1) Discard material not meeting requirements.
    b. Test material for gradation, plasticity.
2. Test CLSM for slump and compressive strength.
    a. Prepare and test three 6- by 12-inch cylinders for both 7- and 28-day according to ASTM D4832.

3.03 PREPARATION

A. Place pipe on soil pads or other approved compressible material such as extruded polystyrene foam insulation. Soil pads shall maintain horizontal and vertical alignment during backfilling operations.
1. Do not create point loads on pipe:
    a. Soil pads shall have a lower compressible strength than surrounding CLSM.

3.04 PLACING

A. Notify COR at least 24 hours before batching CLSM. Include quantity of CLSM required for each daily placement. Unless inspection is waived, perform batching in presence of a Government inspector.

B. Do not place CLSM during rain.

C. Do not mix or place CLSM when ambient temperature is below 40 degrees F. Except when, ambient temperature is 35 degrees F and rising and daily high is predicted to be above 40 degrees F, CLSM may be placed, if approved by COR.

D. Place CLSM to lines, grade, and dimensions shown on drawings.

1. Initially, place CLSM from 1 side of pipe. Where necessary, rod or vibrate CLSM so that CLSM flows under pipe and appears on other side.
2. Add CLSM to both sides of pipe and rod or vibrate until CLSM completely fills space between pipe and trench.
3. Do not disturb pipe trench or allow foreign material to become mixed with CLSM.

E. Restrain pipe to prevent flotation during placement of CLSM.

1. Do not point load pipe.

F. Do not place backfill material over CLSM until CLSM has reached initial set.

1. As determined by ASTM D6024 (ball drop test) or ASTM D1558 in the presence of COR.
2. Do not place greater than 10 feet of backfill over pipe until CLSM has a compressive strength of 50 pounds per square inch (lb/in^2) or greater.

3.05 CONTRACTOR FIELD QUALITY TESTING

A. Testing:

1. Independent testing laboratory shall perform sampling, testing, and reporting.
    a. Independent testing laboratory shall meet requirements specified in Section 01 46 20 - Testing Laboratory Services.
    b. Government may inspect testing laboratory facilities. COR will notify testing facilities 72 hours before inspection. Periodic inspection may be required by COR.
2. If CLSM Contains Native Soils:
    a. Obtain and test soil samples for gradation and plasticity daily while batching and placing CLSM or if a change in soil is visually noted.

1) Test material 14 days ahead of placement from top of trench to proposed invert.

b. During CLSM batching, provide an inspector from testing laboratory to monitor soil characteristics and operations.

1) Modify material and or batching operations as recommended by testing laboratory.

2) Notify COR within 24 hours of modifications.

3. Obtain samples and test to determine compressive strength in accordance with ASTM D4832 and slump in accordance with ASTM C143.

a. Testing frequency:

1) At least once for each shift when placing CLSM.

2) Once every 100 cubic yards or,

3) If consistency of materials change.

b. Acceptance Criteria:

1) 7-day compressive strength, ASTM D4832:

a) Not less than 50 pounds per square inch and not more than 150 pounds per square inch (lb/in^2).

b) 70 percent of test cylinders shall exceed 75 pounds per square inch (lb/in^2).

c. Make adjustments to mixture to comply with strength requirements.

d. Stop work if specified requirements are not met.

3.06 FIELD QUALITY ASSURANCE

A. Government will obtain samples and test for compressive strength in accordance with ASTM D4832 and slump in accordance with ASTM C143.

3.07 PROTECTION

A. When subsequent lifts of CLSM are to be placed, maintain surface of CLSM in a moist condition by use of tarps or water mist until subsequent lift of CLSM is placed.

B. If backfill will not be placed over CLSM within 8 hours, place 6-inch minimum cover of moist backfill over CLSM. Maintain moisture in 6-inch soil cover until additional backfill is placed.

C. If ambient temperature is forecast to be 50 degrees F or less within 8 hours of placing CLSM, place 12-inch minimum additional cover of loose backfill over 6-inch moist backfill cover before end of work day. Do not allow CLSM to freeze.

END OF SECTION

SECTION 31 31 30

SOIL-APPLIED HERBICIDE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Soil-Applied Herbicide:

1. Cost: Include in prices offered in Price Schedules for gravel surfacing.

1.02 SUBMITTALS

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

B. RSN 31 31 30-1, Use Plan.

C. RSN 31 31 30-2, Applier Certification.

1.03 QUALIFICATIONS

A. Applicators: Certified by appropriate Federal, State, Tribal or local agencies, as required.

1.04 REGULATORY REQUIREMENTS

A. Comply with label directions, and applicable EPA, Federal, State, Tribal and local laws and regulations.

PART 2 PRODUCTS

2.01 HERBICIDES

A. Label: EPA (Environmental Protection Agency) pesticide registration number.

B. Provide soil-applied herbicide conforming to one of the following:

1. Atrazine:

   a. Composed of a finely divided, wettable powder containing a minimum of 80 percent chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine and related compounds.

   b. Mix: Minimum 2 gallons of water per pound of dry product.

2. Bromacil:

   a. Composed of a finely divided, wettable powder containing a minimum of 80 percent bromo-3-sec-butyl-6-methyluracil.

   b. Mix: Minimum 2 gallons of water per pound of dry product.

3. Prometone:

   a. Composed of a liquid emulsifiable solution containing a minimum of 25 percent 2-methoxy-4, 6-bis isopropylamino-s-triazine.

   b. Mix with water:

      1) For small areas, add sufficient water to provide thorough and uniform coverage.

      2) For large areas, add concentrate to 100 gallons of water per acre.

C. Commercial mixtures meeting requirements may be used.

PART 3 EXECUTION

3.01 PREPARATION

A. Apply herbicide after gravel surfacing has been placed.

3.02 APPLICATION

A. Apply herbicide to gravel surfacing placed under this section as directed by COR.

1. Select 1 herbicide from those specified.
2. Apply soil-applied herbicide at following rate:

   a. Atrazine: Equivalent of 0.035-pound of dry product per 100 square feet (about 15 pounds per acre).

   b. Bromacil: Equivalent of 0.035-pound of dry product per 100 square feet (about 15 pounds per acre).

   c. Prometone: Equivalent of 0.017-gallon of herbicide concentrate per 100 square feet (about 7-1/2 gallons per acre).

B. Apply herbicide only with approval of COR.

C. Apply uniformly.

D. During application, continuously agitate suspension.

END OF SECTION

SECTION 32 15 10
GRAVEL SURFACING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

1. Gravel Surfacing:
   a. Measurement: Price per Ton.
   b. Payment: Include in prices offered in Price Schedules for Gravel Surfacing.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D1241-15	Materials for Soil-Aggregate Subbase, Base, and Surface Courses
2.	ASTM D4632-15a	Grab Breaking Load and Elongation of Geotextiles
3.	ASTM D4751-16	Determining Apparent Opening Size of a Geotextile
4.	ASTM D6241-14	Static Puncture Strength of Geotextiles and Geotextile-related Products Using a 50 mm Probe

1.03 SUBMITTALS

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

B. RSN 32 15 10-1, Gravel Certification:
   1. Aggregate meets ASTM D1241 abrasion loss criteria.

C. RSN 32 15 10-2, Geofabric Installation:
   1. Manufacturer’s recommendation.

D. RSN 32 15 10-3, Geofabric Certification:
   1. Geofabric meets specified chemical, physical, and manufacturing requirements.

PART 2 PRODUCTS

2.01 GRAVEL

A. Gravel: ASTM D1241, Type I, Gradation C, surface-course materials, except,

1. Fine aggregate:

a. Minimum passing No. 200 sieve: 8 Percent.

b. Fraction passing No. 40 sieve:

1) Liquid limit, maximum: 35.

2) Plasticity index range: 4 to 9.

2.02 GEOFABRIC

A. 170N non-woven geotextile, manufactured by Mirafi, www.tencate.com; or equal, with the following essential characteristics:

1. Grab Tensile Strength (ASTM D4632): 180 pounds.
2. Elongation (ASTM D4632): 50 percent.
3. Puncture Strength (ASTM D6241): 400 pounds.
4. Apparent Opening Size (ASTM D4751): 70 US Sieve size.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade and prepare subgrade free from depressions and soft spots.

B. Obtain COR approval of subgrade before placing surfacing.

3.02 PLACING GEOFABRIC

A. Place geofabric in accordance with manufacturer's recommendations.

B. Do not tear geofabric during placing of gravel surfacing.

C. Placement: Maintained Road crossings and other areas as directed by COR.

3.03 PLACING

A. Place gravel surfacing at following locations:

1. Maintained Road Crossings:

a. At locations as shown on drawings.

B. Place, moisten, and compact gravel surfacing to 95 percent compaction in accordance with Section 31 23 02 - Compacting Earth Materials.

C. Dispose of excess and unsuitable materials in accordance with Section 31 23 39 - Disposal of Excavated Materials.

3.04 CONTRACTOR FIELD QUALITY TESTING

A. Testing:

1. Have independent testing laboratory sample, test, and report in accordance with Section 01 46 20 - Testing Laboratory Services.

END OF SECTION

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SECTION 32 91 60
EROSION CONTROL BLANKET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Erosion Control Blanket:

1. Measurement: Surface area required to be covered, except no allowance will be made for overlaps, repairs, or waste.
2. Payment: Square yard prices offered in Price Schedules:
   a. Includes:
      1) Erosion Control Blanket Anchors.
      2) Coir Wattles.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO))

1.	AASHTO T310-13	Standard Method of Test for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
2.	AASHTO T99-15	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM)

3.	ASTM D698-12e2	Standard Test Methods for Laboratory compaction Characteristics of Soil Using Standard Effort (12 400 ft-.bf/ft^3)

1.03 SUBMITTALS

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

B. RSN 32 91 60-1, Manufacturer's Information:

1. Literature listing specified essential characteristics.
2. Installation instructions.
3. Excelsior color sample.

C. RSN 32 91 60-2, Installation Plan:

1. Describe sequence of placing blanket.

PART 2 PRODUCTS

2.01 EROSION CONTROL BLANKET

A. AEC Premier Coconut erosion control blanket, as manufactured by American Excelsior Company, 850 Avenue H East, Arlington TX, telephone: 800-777-7645; or equal, having the following essential characteristics:

1. Machine-assembled mat with 100 percent aspen or coconut excelsior within 2 layers of netting stitched to form a 3 dimensional matrix:

a. Netting: Jute or other natural biodegradable fiber.

2. Consistent thickness with aspen or coconut excelsior curled, interlocked, and evenly distributed over entire area of mat.

3. Excelsior Color: Sand.

4. Unit Weight: 8 ounces per square yard.

5. Thickness, Minimum: 1/2-inch.

6. Thread Pattern: 4-inch wide by 4-inch long.

B. Supply blanket in protected, rolled mat form.

2.02 EROSION CONTROL BLANKET ANCHORS

A. Biodegradable staples, 6-inch minimum length, as recommended by manufacturer.

2.03 COIR WATTLES

A. BioD-Watl 9, as manufactured by Rolanka International, 155 Andrew Drive, Stockbridge, GA 30281, telephone: 770-506-8211; or equal, having the following characteristics:

1. 100% coconut fiber filler material in cylindrical shaped rolls with 2-inch by 2-inch high strength outer netting made of 60-lbs. strength machine spun bristle coir twines.

2. Unit Weight: 1.5 lb/ft.

3. Density: 3.4 lb/cu ft.

4. Diameter: 9-inch.

5. Length: 15- and 20-feet.

PART 3 EXECUTION

3.01 EROSION CONTROL BLANKET INSTALLATION

A. Site Preparation:

1. Compact bank line excavated for pipe trench backfill beneath erosion control blanket bank protection:

   a. Compact to 85 percent of maximum density obtained using AASHTO T99 (Standard Proctor) in accordance with AASHTO T310.

   b. Compact to 85 percent of maximum density obtained using ASTM D698 (Standard Effort).

2. Remove large, sharp objects which include but are not limited to rocks, cut trees, roots, shrubs, glass that may damage erosion control blanket.

3. Grade wash crossing bank slope to the natural topography prior to pipe installation.

B. Erosion Control Blanket:

1. Install erosion control blanket on slopes steeper than 2.5:1, at locations shown on drawings or as directed by COR and in accordance with manufacturer's recommended installation procedures and approved installation plan.

2. At overlaps, shingle upstream matting over downstream matting.

3. Secure topsoil erosion control matting in a 6- by 6-inch anchor trench at top and bottom of berms and at upstream and downstream ends of mats.

4. Before backfilling anchor trenches, pin or staple erosion control blanket into anchor trench with no more than 12-inch spacing as recommended by manufacturer.

5. Outside anchor trench, anchor topsoil erosion control matting with 3 to 4 staples per square yard as recommended by manufacturer.

3.02 COIR WATTLE INSTALLATION

A. Anchoring system must be adequate to seat coir wattle securely in contact with adjacent ground:

1. Place coir wattle at bank toe and at subsequent 12-foot intervals up compacted backfill bank on top of erosion control blanket extending 5-feet beyond disturbed area.

2. Minimum 2-foot overlap between adjoining wattles.

3. A pair of 2-inch by 4-inch wood construction stakes should be placed every 4-feet along coir wattle, one on each side.

4. Piercing coir wattle with stakes should be avoided. Stakes should be driven alongside coir wattle. Coir wattle is secured by tightly sandwiching coir wattle between stakes.

B. To form a continuous unit, coir wattles must be tied together end-to-end:

1. Use strong synthetic rope to stitch ends together, with knots tied at frequent intervals to ensure reliable connection.

3.03 REPAIR

A. Repair or replace damaged during installation topsoil erosion control matting at Contractor's expense.

END OF SECTION

SECTION 33 05 21

BORED UTILITY AND ROAD CROSSINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Bored Utility Crossings:

1. Measurement: Linear foot of casing pipe.
2. Payment: Include in prices offered in Price Schedules for Bored Utility and Road Crossings.
    a. Includes:
        1) Casing pipe
        2) Installation of casing and carrier pipe.
        3) Endcaps, spacers, runners and end seals.
        4) Additional earthwork outside line pipe paylines.
    b. Does not include:
        1) Carrier pipe (line pipe).

B. Bored Road Crossing, BIA Road 9 and Gas Plant Road:

1. Measurement: Linear foot of casing pipe.
2. Payment: Include in prices offered in Price Schedules for Bored Utility and Road Crossings.
    a. Includes:
        1) Casing pipe
        2) Installation of casing and carrier pipe.
        3) Endcaps, spacers, runners and end seals.
        4) Additional earthwork outside line pipe paylines.
    b. Does not include:
        1) Carrier pipe (line pipe).

1.02 SUBMITTALS

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

B. RSN 33 05 21-1, Placement Plan:

1. Detail work including boring, casing materials and equipment used.

a. Assembly.

b. Casing geometry.

c. Cross section of installation including soil/bedrock profile.

C. RSN 33 05 21-2, Material Certification:

1. Certification, signed by material producer and Contractor that material complies specified requirements.

D. RSN 33 05 21-3, Copy of Application for Utility Permit.

1.03 SITE CONDITIONS

A. Bedrock may be encountered during boring operations. Refer to Section 53 10 00 – Geologic Investigations.

1.04 PERMITS

A. Obtain permits from appropriate authorities to install bored utility crossings.

PART 2 PRODUCTS

2.01 CASING PIPE

A. Smooth Steel Pipe:

1. In accordance with Section 33 21 95 – Metal Piping for Line Pipe or 33 11 12 – Steel Line Pipe, except:

a. Hydrostatic test not required.

b. Thickness: 0.25-inches.

c. Diameter: 60- and 54-inch.

d. Epoxy lined.

e. Welded joints.

2.02 CARRIER PIPE

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

2.03 SPACERS AND RUNNERS

A. Insulated casing spacers and runners, per manufacturer's recommendations.

2.04 END SEAL

A. Model AW Wrap Around End Seal, Manufactured by Advance Products & Systems, Incorporated, www.apsonline.com or equal with the following essential characteristics:

1. Rubber end seal with stainless steel clamps.
2. Rubber seal manufactured with butyl mastic strips.

PART 3 EXECUTION

3.01 GENERAL

A. Verify utility locations prior to excavation in accordance with Section 01 56 15 - Protection of Existing Utilities.

B. Remove and replace fence in accordance with 01 56 20 - Existing Fences.

C. Excavate suitable pits or trenches for boring operations.

1. Strip in accordance with Section 31 14 10 – Stripping, Stockpiling, and Placement.
2. Earthwork in accordance with Section 31 23 22 – Pipe Trench Earthwork.

D. Where excavation extends below ground water levels, dewater portion below water line in advance of excavation in accordance with Section 31 03 33 - Removal of Water from Excavation.

1. Conduct work in the dry.

E. Do not interfere with normal operations of highway, street, or other facilities.

1. Exception: Public safety in accordance with approved traffic plan.

F. Do not weaken or damage highway, street or facility. Repair at Contractor's expense, as determined by COR.

G. Remove and replace, without additional cost, pipe damaged during boring operations.

H. Install casing pipes to lines and grades shown on drawings.

1. Final position of pipe:
   a. Less than 1-inch in 40-feet laterally or vertically.
   b. Variation: Regular and only 1 direction.
2. Grout bored annulus, outside of casing pipe, if annulus exceeds 1-inch.

I. No pit or trench, excavated to install pipe, shall remain open longer than 5 days after installation, unless otherwise approved by COR.

J. Install safety fencing around pit or trenches in accordance with Section 01 56 32 - Temporary Safety Fence. Remove as required for construction.

3.02 BORING

A. Pilot Hole Method:

1. Bore pilot hole entire length of crossing.
2. Check line and grade of bore from exit hole, and correct.
3. Use pilot hole as centerline for larger diameter hole to be bored.

B. Auger Method:

1. Proper diameter steel pipe equipped with a cutter head to mechanically perform excavation.
2. Augers shall be of sufficient diameter to convey excavated material to work pit.

C. Gel-forming Colloidal Drilling Fluid:

1. Minimum 10 percent of high grade processed Bentonite.
    a. Consolidate cuttings of bit, seal holes in boring wall, and furnish lubrication for cuttings removal and immediate installation of line pipe.
2. Use water or other fluids in boring only to lubricate cuttings for removal.
3. Jetting not permitted.

D. Dispose of drilling fluid in accordance with Section 01 74 00 - Cleaning and Waste Management.

3.03 CARRIER PIPE

A. Install carrier pipe, spacers, runners and end seal per manufacturer's recommendations.

3.04 BACKFILL

A. If pit or trench is backfilled prior to installation of carrier pipe, install a wooden bulk head at ends of casing to keep backfill material out of casing pipe. Mark ends with of casing pipe with utility markers to allow for relocation.

B. Backfill in accordance with accordance with Section 31 23 22 – Pipe Trench Earthwork.

C. Reconstruct highway slopes and embankments with same materials excavated and to existing dimensions.

D. Dispose of excavated material in accordance with Section 31 23 39 - Disposal of Excavated Materials.

END OF SECTION

SECTION 33 05 23
MAINTAINED AND UN-MAINTAINED ROAD CROSSINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Maintained and Un-Maintained Road Crossings:

1. Cost: Include in prices offered in Price Schedules for Line Pipe and Gravel Surfacing.

a. Includes:

1) Compaction.

2) CLSM.

3) Gravel.

4) Herbicide.

1.02 REGULATORY REQUIREMENTS

A. Conform to Federal, State, Tribal, and local ordinances, rules, and regulations for operations at roadway crossings.

B. Obtain permits, at Contractor's expense, for work on State, County, or City ROW.

C. Have operations approved and inspected by permitter.

PART 2 PRODUCTS

2.01 GRAVEL SURFACING

A. In accordance with Section 32 15 30 – Gravel Surfacing.

2.02 CLSM

A. In accordance with Section 31 23 70 – Controlled Low Strength Materials (CLSM)

2.03 GEOFABRIC

A. In accordance with Section 32 15 30 – Gravel Surfacing.

2.04 HERBICIDE

A. In accordance with 31 31 30 – Soil-Applied Herbicide.

2.05 MARKERS

A. In accordance with 10 14 26 – Utility Markers.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to pipeline crossing excavation, slope ground to edge of shoulder as shown on drawings.

B. Remove and control water in accordance with Section 31 03 33 - Removal of Water from Excavation.

3.02 PIPELINE CROSSING

A. Construct pipeline crossings as shown on drawings.

1. Keep existing roadways open:
    a. Keep portion of roadway disturbed by crossing as small as practicable.
    b. Traffic control: See Section 01 55 20 - Traffic Control.
2. Provide detours: See Section 01 55 20 - Traffic Control.

END OF SECTION

SECTION 33 11 10
PIPELINE GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Line Pipe (Reach 9):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, and road crossings with no allowance for lap at joints.

    a. Diameter change from 48-inches to 42-inches is assumed to be at Station 90879+00. Location of diameter change may vary based on pipe material type used.

2. Payment: Applicable linear foot prices offered in Price Schedule 1 for various size and class of line pipe.

    a. Includes cost of furnishing materials; furnishing and laying pipe; fittings, furnishing and placing bedding and embedment; providing utility markers; furnishing and placing concrete, cement, and reinforcement steel in encasements, blocking, and collars not included elsewhere.

B. Line Pipe (Reach 10):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, end collars, thrust restraints, and road crossings with no allowance for lap at joints.

    a. Measurement for line pipe from pipe outlets will begin at downstream face of valve or flange.

2. Payment: Applicable linear foot prices offered in Price Schedule 2 for various size and class of line pipe.

    a. Includes cost of furnishing materials; furnishing and laying pipe; fittings, furnishing and placing bedding and embedment; providing utility markers; furnishing and placing concrete, cement, and reinforcement steel in encasements, blocking, and collars not included elsewhere.

C. Temporary Construction Water Line (Reach 10):

1. Payment: Lump sum price offered in Price Schedule 2 (Reach 10).

2. Includes all items shown on drawing 1695-D-60308 unless otherwise noted.

D. Line Pipe (Reach 11):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, and road crossings with no allowance for lap at joints.

   a. Measurement for line pipe from pipe outlets will begin at downstream face of valve or flange.

2. Payment: Applicable linear foot prices offered in Price Schedule 3 (Reach 11) for various size and class of line pipe.

   a. Includes cost of furnishing materials; furnishing and laying pipe; fittings, furnishing and placing bedding and embedment; providing utility markers; furnishing and placing concrete, cement, and reinforcement steel in encasements, blocking, and collars not included elsewhere.

E. Filling and Testing Pipe:

1. Measurement: Includes one pipe volume of water. More water is required for flushing and testing.

2. Payment: Lump sum prices offered in Price Schedules.

   a. Includes water used for filling and testing as approved by COR.

F. Repair Kits:

1. Payment: Lump sum prices offered in Price Schedules.

1.02 DEFINITIONS

A. Line Pipe:

1. Water transmission pipe and 6-inch temporary construction water pipe.

2. Unless otherwise specified, does not include piping in vaults or piping for appurtenances such as blowoffs, bypasses, air valves or manholes.

B. Pipe sizes and classes: Designated on plan and profile drawings by an alphanumeric symbol.

   a. Symbol identifies pipe diameter, cover class and hydraulic transient head as follows:

      1) First number in symbol indicates nominal diameter in inches.

      2) Alphabetic character represents cover class of pipe where; B < 10 feet, C < 15 feet, and D < 20 feet. Pipe with “K” designation represents pipe that has a special design.

      3) Second number in symbol is maximum hydraulic transient head measured to centerline of pipe.

4) A symbol of 42C600 means pipe is 42-inches in diameter with a cover between 10- and 15-feet and a hydraulic transient head of 600-feet at centerline of pipe.

2. Unless specific reference is made to outside or inside diameter of pipe, pipe diameters shown on drawings and used in this section are nominal pipe diameters.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C150/C150M-17	Portland Cement
2.	ASTM F2164-13	Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems using Hydrostatic Pressure.

B. American Water Works Association (AWWA)

1.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100mm) and Larger - Shop Applied
2.	AWWA C600-10	Installation of Ductile Iron Water Mains and Their Appurtenances
3.	AWWA C604-11	Installation of Steel Water Pipe 4 In. (100mm) and Larger
4.	AWWA C605-13	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
5.	AWWA M45	Fiberglass Pipe Design, Third Edition

C. International Organization for Standardization (ISO)

1.	ISO 9001-15	Quality Management

D. National Sanitation Foundation (NSF)

1.	NSF Standard 61-16	Drinking Water System Components - Health Effects

1.04 SUBMITTALS

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

B. RSN 33 11 10-1, Qualifications:

1. Certification of line pipe layers (Foreman).
2. Certification of line pipe and fitting manufacturers.

C. RSN 33 11 10-2, Pipelaying Diagrams:

1. Submit in sections, not to exceed 5-miles, after utility crossing investigation and wash crossing field information has been submitted for that section.
2. For each type of pipe furnished.
3. Show position and marking of pipe sections.
4. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe segment and fitting.
5. Include pipe thickness, Dimension Ratio (DR) or pressure class of pipe segment or fitting.
6. For alignment changes not using a miter bend (pulling joints) provide station at point of curvature and point of tangent, and deflection angle at each pulled joint.

D. RSN 33 11 10-3, Filling and Testing Plan:

1. Proposed rate, time, and procedure for:
   a. Cleaning.
   b. Filling.
   c. Field and pressure testing.
   d. Draining pipeline.
2. Method for disposing of water drained from pipeline to enable repair of leaks.

E. RSN 33 11 10-4, Flotation Prevention Plan:

1. Show location and describe method of preventing pipe from floating.
2. Provide supporting calculations.

F. RSN 33 11 10-5, Pipe Deflection Measurements.

G. RSN 33 11 10-6, Connection to Reach 12A:

1. Provide details of communications with Tohlakai Pumping Plant Operators.
2. Provide connection schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship pipe after receiving COR approval as per Section 2.03 – Source Quality Assurance.

B. Prevent damage to pipe and fittings during loading, transporting, unloading, storing, and laying.

C. Transport metallic pipe and fittings on padded bolsters curved to fit outside of pipes. Use heavy padding under ties.

D. Tightly close open ends of shop-applied, cement-mortar-lined pipe with plastic wrap for protection of cement-mortar lining during shipment.

1. Plastic Wrap:

a. At least 2 thicknesses of 6-mil sheet polyethylene plastic.

b. Remain on pipe until installation.

E. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.

F. Government will inspect pipe once it is delivered.

G. Replace or repair, as approved by COR, any pipe that is damaged during shipment, storage, or installation at Contractor's expense. Include linings and coatings.

1.06 QUALIFICATIONS

A. Pipe manufacturers shall be certified in accordance with ISO:9001 or similar nationally certified program approved by COR.

B. Line pipe and specials manufacturers:

1. 10 years successful experience producing products as specified.

2. Provide references for at least 3 completed projects with similar pipe diameters and pressures.

C. Pipe Layers: Skilled and experienced in laying pipe with joints as needed for each material type of pipe used. Minimum 2-years installing pipe with similar pipe diameters, pipe material, and pressures:

1. In the absence of specific pipe material experience, substitution of onsite pipe manufacturer training and quality control is allowed:

a. Provide manufacturer's representative certified in pipeline installation, including all applicable joints, for training pipe layers and pipe foreman prior to installation.

b. In lieu of specific pipe material installation experience, pipe layers and pipe foreman shall still have experience with installing similar pipe diameters and pressures.

D. Qualify welding procedures and welders in accordance with code under which welding is specified.

1.07 REPAIR KITS

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

B. Repair kit:

1. One standard length of pipe and 2 restrained couplings.
2. At highest loading and pressure rating for each material type and nominal size of pipe provided.

C. Place repair kits in storage within 150-miles from site, as designated by COR.

PART 2 PRODUCTS

2.01 PIPE OPTIONS

A. In accordance with the following Sections:

1. 33 11 12 – Steel Line Pipe,
2. 33 11 13 – Ductile Iron Pipe,
3. 33 11 16 – PVC Pressure Pipe,
4. 33 11 18 – HDPE Pressure Pipe.
5. 33 11 19 – Fiberglass Pipe.

B. Locations:

1. Reach 9; pipe material types and diameters allowed are shown on drawing 1695-D-60306.
2. Reach 10; pipe material and types listed in 2.01 – Pipe Options.
    a. 42-inch nominal diameter.
    b. 6-inch nominal diameter: PVC only
3. Reach 11; pipe material and types listed in 2.01 – Pipe Options:
    a. PVC and HDPE not allowed.
    b. 42-inch nominal diameter.

C. No more than one metallic line pipe type and one non-metallic line pipe type may be used, except as shown on drawings.

D. Materials and chemicals that may come into contact with drinking water shall be certified by NSF 61.

E. Rubber Gaskets:

1. Manufactured and tested in accordance with applicable AWWA standard for pipe type.
2. Petroleum-Resistant Gaskets: Use in pipe joints in accordance with Section 33 05 21 – Bored Utility and Road Crossings.
3. Lubricant: Approved for potable water use.

2.02 FITTINGS

A. Fittings should resist same loading conditions as adjacent pipe.

B. Refer to applicable line pipe section for allowed fittings.

2.03 SOURCE QUALITY ASSURANCE

A. Approval for Shipment:

1. Pipe and fitting approval will be determined by inspection, during and after manufacture.
2. Notify Technical Service Center, Attn: 86-68140, and COR at least 14 days before manufacturing pipe and fittings and 3 days before shipping pipe and fittings.
3. Government will inspect pipe units and fittings and will approve for shipment those which have been manufactured and tested in accordance with these specifications, unless Contractor is notified in writing.
4. Further inspection of pipe units and fittings will be in accordance with clause at FAR 52.246-12 Inspection of Construction.

2.04 PIPE ACCESSORIES

A. Sectionalizing Valve, Air Valve, Blowoff, and Manhole Assemblies: In accordance with Section 33 22 15 – Valves and Equipment.

B. Temporary Construction Line: In accordance with Section 33 22 15 – Valves and Equipment.

C. Manholes:

1. Cement-mortar lining: AWWA C205, in accordance with shop applied mortar for lining of specials, except:
   a. Reinforcement required for pipe larger than 24-inch diameter.
   b. Cement: ASTM C150, Type V.
2. Required at locations shown on drawings 1695-D-60320, 1695-D-60322, and 1695-D-60323.

D. Warning Tape:

1. Polyethylene tape.
2. Thickness: 4 mils.
3. Magnetically detectable.
4. Width, minimum: 6-inches.
5. Color: Blue with silver lettering.

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

E. Tracer Wire for Non-Metallic Pipe:

1. Type: High strength copper clad steel.
2. Size: 10 AWG, minimum.
3. Insulation:
    a. High density, high molecular weight, polyethylene (HDPE).
    b. Jacket Color: Blue.
    c. Rated for direct burial.

F. Tracer Wire Terminal Post:

1. Designed and manufactured for specific application.
2. Temperature and ultraviolet light stable.
3. Color: Blue.
4. Terminals: Two, minimum, per post.
5. Provide terminal jumpers to interconnect lengths of trace wire as needed.
6. Space as recommended by manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Perform cleaning, filling, and testing after backfill has been placed to finished grade or as approved by COR.

B. Surveyor licensed in State of New Mexico shall be on site during excavation and pipelaying.

C. Protect pipe from contamination, damage, and elements during storage on-site by covering with tarp as directed by COR.

D. Install pipe based on these specifications or pipe manufacturer's recommendation, whichever is more stringent.

3.02 INSTALLATION

A. Install pipe in accordance with appropriate Section for pipe option installed.

B. Keep openings to installed pipe closed with watertight inflatable plugs during work stoppage, including end of work day, breaks, and work delays.

C. If pipe is flooded during construction, clear floodwater by draining and flushing with water, or other approved method, until pipe is clean.

D. Lubricant:

1. Keep clean.
2. Apply with dedicated, clean applicator brushes.
3. Apply lubricant as specified by pipe manufacturer:
    a. Use only lubricant supplied by pipe manufacturer.
    b. Lubricate spigot end of pipe as recommended by manufacturer.
    c. Do not lubricate either gasket or gasket groove in bells where gaskets are field installed.
    d. Lubricate factory-installed, non-removable-type gaskets as recommended by pipe manufacturer.

E. Coat buried manholes with cement mortar as shown on drawings.

F. Install tracer wire for non-metallic pipe.

G. Install warning tape over center of pipe at least 18-inches below ground and at least 18-inches above pipe.

3.03 LAYING PIPE

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

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

B. Keep pipe trenches free of water during pipelaying operations.

C. Lower pipe into trench and place pipe in position such that no soil gets inside pipe and pipe is not damaged.

D. Install pipe to line and grade as shown on drawings.

E. On grades exceeding 10 percent, lay pipe uphill.

F. When pipelaying is not in progress, keep ends of pipelines closed.

G. Joining Pipe:

1. Assemble push-on or mechanical joints in accordance with applicable AWWA standard for pipe type and manufacturer’s recommendations.
2. If adjustment of the position of length of pipe is required after installation, remove and relay length of pipe as new pipe.
3. Maintain pipe firmly in final position.

4. Placing Elastomeric Gasket:
    a. Clean gasket, bell, especially the groove, and spigot with rag, brush, or paper towel to remove any dirt or foreign material.
    b. Use only gaskets which are designed for and supplied with pipe.
    c. Lubricate spigot end of pipe as recommended by manufacturer.
    d. Spigot Groove Method:
        1) Follow manufacturer's recommended practices for gasket installation.
        2) After placing elastomeric gasket in spigot groove, equalize elastomeric gasket cross section by inserting tool such as a large screwdriver under elastomeric gasket and moving it around periphery of pipe spigot.
    e. Coupling Groove Method: Follow manufacturer's recommended practices for gasket installation. Typically factory installed.
5. Fit pipe unit's together, spigot to bell or coupling, and draw joints together so that bells or couplings and spigots are fully engaged with uniform contact to gasket.
6. Do not swing or "stab" joint and do not suspend pipe and swing into bell or coupling.
7. Fit pipe units together in a manner to avoid twisting or otherwise displacing or damaging elastomeric gasket.
8. After joining pipe units, insert feeler gauge between pipe bell and pipe spigot, move it around periphery of pipe to determine that position of elastomeric gasket is correct and there are no fish-mouth problems. If adjustment of position of a length of pipe is required after installation, remove and relay length of pipe as new pipe.

H. Changes in Alignment and Grade:
1. Make changes in alignment and grade with miter bends as shown on drawings.
2. Make other changes in alignment and grade by providing small deflections between adjacent pipe. Do not exceed manufacturer's deflection tolerances.
3. Provide restrained joint lengths upstream and downstream of bends or thrust blocks as shown on drawings. Ductile iron fittings with restrained joint lengths as limited by drawings may be used if Contractor submits revised plan and profile drawings for approval.
4. Do not encase rubber gasket joints in concrete.
5. Refer to individual pipe Sections for additional requirements. If requirements conflict use most stringent requirement.

I. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed with watertight inflatable plugs.

J. Schedule work so that at no time pipe remains in trench more than 7 days before backfill is placed to original ground surface or to other specified backfill limits shown on drawings.

K. Joints under Wash Crossing banks and waterway shall be restrained for length shown on drawings. Joints shall have hoop stress and longitudinal stress capacity equal to or greater than adjacent pipe.

3.04 THRUST RESTRAINT

A. Restrained joint couplings or concrete blocking and collars as shown on drawings. Refer to Section 03 30 00 - Cast-in-Place Concrete.

B. Plan, profile and restraint system shown on drawings require modification if alternate methods are used.

C. Alternate methods of restraint may not be used unless submitted and approved by COR.

3.05 TRACER WIRE

A. Install continuous length of tracer wire for full length of each run of non-metallic pipe,

B. Attach wire to top of pipe using suitable methods to ensure tracer wire will not be displaced during construction operations.

C. Locate tracer wire terminal posts at suitable locations to provide testing and/or jumper points for entire length of non-metallic pipe.

D. Verify tracer wire continuity prior to performing backfill operations.

3.06 BACKFILL

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

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

3.07 PIPE DEFLECTION

A. For pipe greater than 24-inch.

1. Measure short term deflection of internal diameter:

a. Within 2 weeks after completion of backfill.

b. When interior bracing required, remove before making measurements.

2. Measurement Frequency:

a. One pipe unit out of 3 for first 30 units laid. 1 pipe unit out of 10 thereafter.

b. In deep burial or problem areas, frequency of measurements may be increased at discretion of COR.

3. Measurements:

a. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.

b. Record pipe deflections and station where measurements were taken.

c. Mark inside of pipe so that future comparisons can be made.

B. Deflection limitations apply per individual pipe sections.

C. Take corrective action if required limits are not meet, including removing and replacing pipe that exceeds allowable deflection tolerance.

3.08 FIELD EXAMINATION

A. Flush pipe before filling.

1. Flush foreign material from pipeline prior to testing.

2. Flush using a minimum velocity of 3 feet per second toward low points in reach.

3. Flush at least 3 pipe volumes until water is clean as approved by COR.

4. Dispose of flush water in accordance with permits in Section 01 57 30 - Water Pollution Control.

5. Operate valves several times during flushing period.

3.09 FILLING AND DRAINING PIPELINE

A. Notify COR 4 days before filling and testing.

B. Water for filling and testing pipeline in accordance with Section 01 51 00 - Temporary Utilities.

C. Pipeline fill rate, maximum: 18 cubic feet per second.

1. Temporary Water Line fill rate: 2 cubic feet per second

D. Maintain pipeline completely filled for at least 72 hours before testing.

E. Blowoff pipeline after testing is completed and pump pipeline dry.

F. Dispose of testing water by approved method.

3.10 CONTRACTOR FIELD QUALITY TESTING

A. Leak testing pipeline:

1. Notify COR at least 7 days before applying pressure to pipeline.
2. Do not start leak testing when snow or standing water is on the ground. Suspend testing as directed by COR if precipitation accumulates on the ground.
3. Furnish pumps, power, pressure gages, and air valves at each end of pipeline and calibrated flow meters for testing.
4. Comply with applicable test standard except as noted below:
    a. AWWA C605 for PVC.
    b. AWWA C600 for Ductile Iron.
    c. AWWA C604 for Steel.
    d. AWWA M45 for Fiberglass.
    e. ASTM F2164 for HDPE.
5. Test pipeline with hydrostatic pressure equal to elevations listed for each Reach.
    a. Reach 9 and 10; Elevation 6,245 ft.
    b. Reach 11; Elevation 6,725 ft.
    c. Test Segment: Each pipe segment between sectionalizing valves.
    d. First test segment: Between start of pipeline and first sectionalizing valve.
    e. Last test segment: From last sectionalizing valve and end of pipeline.
6. Prior to starting test, maintain pressure in pipe for 24 hours.
7. Test for 96 hours or as approved by COR.
8. Measure volume of water required to maintain pressure during test.
    a. Acceptance criteria:
        1) Measured leakage shall not be greater than test allowance prescribed by the following test method:
            a) AWWA C600 for Ductile Iron Pipe.
            b) AWWA C604 for Steel Pipe.
            c) AWWA C605 for PVC.
            d) For Fiberglass Pipe and HDPE Pipe:

Leakage Rate: $Q = \frac{LD(P)^{1/2}}{148,000}$

Q = Quantity of makeup water (gph)
L = Length of pipe being tested (ft.)
D = Nominal diameter of pipe (in.)
P = Average test pressure (psi gage). If leakage rate is exceeded, halt test, identify and repair leaks in an approved manner.

b. If criteria is not met, repair or replace pipe or fitting and repeat test until acceptance criteria is achieved.

9. Drain pipe using both gravity flow and sump pump at blowoffs or as approved by COR.

10. Seal openings to pipe as approved by COR.

B. Locate tracer system testing:

1. Perform test of tracer wire system using applicable equipment along entire length of pipe to ensure proper performance.

2. Repair any identified breaks or separations and retest applicable section of system.

END OF SECTION

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SECTION 33 11 12
STEEL LINE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. In accordance with Section 33 11 10 - Pipeline General Requirements.

1.02 PROJECT CONDITIONS

A. Does not include pipe specified in Section 33 21 95 – Metal Piping for Line Pipe Installations.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A139/A139M-16	Electric-Fusion (Arc) - Welded Steel Pipe (NPS 4 and Over)
2.	ASTM A283/A283M-13	Low and Intermediate Tensile Strength Carbon Steel Plates
3.	ASTM A1011/A1011M-15	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow and High-Strength Low-Allow with Improved Formability
4.	ASTM A1018/A1018M-16a5	Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability
5.	ASTM E165/E165M-12	Liquid Penetrant Examination for General Industry
6.	ASTM E709/E709M-15	Standard Guide for Magnetic Particle Testing

B. American Welding Society, Inc. (AWS)

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

C. American Water Works Association (AWWA)

1.	AWWA C200-12	Steel Water Pipe - 6 Inch (150mm) and Larger

2.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100mm) and Larger - Shop Applied
3.	AWWA C206-17	Field Welding of Steel Water Pipe
4.	AWWA C208-12	Dimensions for Fabricated Steel Water Pipe Fittings
5.	AWWA C227-11	Bolted, Split-Sleeve Restrained and Non-restrained Couplings for Plain-End Pipe
6.	AWWA C604-11	Installation of Buried Steel Water Pipe 4 Inch (100 mm) and Larger
7.	AWWA M11-04	Steel Pipe: A Guide for Design and Installation, Fourth Edition

1.04 SUBMITTALS

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

B. RSN 33 11 12-1, Shop Drawings:

1. Show pipe and fitting fabrication details.
2. Show exact dimensions of joints, and proposed joint restraint.
3. Show exact dimensions of welding lead holes and repair method.
4. See RSN 33 11 10-2 for further details.

C. RSN 33 11 12-2, Ventilation Plan:

1. Method for ventilating inside of pipe when placing mortar lining for joints.

1.05 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

PART 2 PRODUCTS

2.01 STEEL LINE PIPE

A. Pipe:

1. Electric fusion (arc) welded helical-seam steel pipe: ASTM A139, grade C, D, or E.
2. Fabricated in accordance with AWWA C200:
   a. Except:

1) Steel plate: ASTM A283, grade C, D or E.

2) Steel Sheet or coil: ASTM A1011, designation SS, grade 40, 45, or 50; or ASTM A1018, designation SS, grade 40 or designation HSLAS-F, grade 50.

B. Inside diameter measured to inside of lining shall not be less than nominal diameter shown on drawings.

C. Minimum Steel Wall Thickness:

1. Greater thickness from the following requirements:

a. Steel Wall Thickness for Handling:

1) Equal to inside diameter (inches) of pipe steel shell divided by 240 for mortar lined and flexible coated steel pipe.

b. Steel Wall Thickness for Internal Pressure:

1) Hoop stress of pipe shell. Not to exceed:

a) 50 percent yield strength as defined by steel grade of steel using the Barlow formula. With pressure defined by Hydraulic Grade Line as shown on pipeline plan and profile drawings.

b) 75 percent yield strength as defined by grade of steel using the Barlow formula. With pressure defined by pipe head class as shown on pipeline plan and profile drawings.

2) Barlow formula as defined by AWWA M11 Equation 4-1.

D. Steel shall be fully killed and conform to fine grain practice.

E. Rubber gaskets: In accordance with AWWA C200.

2.02 FITTINGS

A. Steel: ASTM A283, grade C, D, or E or ASTM A1011, designation SS, grade 40, 45, or 50; or ASTM A1018, designation SS, grade 40 or designation HSLAS-F, grade 50.

B. Minimum steel wall thickness: 0.25-inches or thickness required to meet pipe classification shown on plan and profile, whichever is greater.

C. Welding:

1. AWS D1.1.

D. Lifting eyes and other handling devices: Made part of fitting before lining and coating are applied.

E. Bolts and Nuts: ASME B18.2.1 and FS FF-N-836.

F. Coating and lining in accordance with Section 09 96 20 - Coatings.

G. Cement-Mortar Lining for Specials and Bends Larger than 24-inches:

1. In accordance with AWWA C205.
2. Wire fabric:
    a. Self-furring.
    b. Secured to inside of pipe sections by tack welding.
3. Lining thickness: 3/4-inch with a tolerance of plus 1/16-inch.
4. Apply lining pneumatically and steel trowel lining with a resultant surface finish, including joints, equal to finish of adjacent pipe.

H. Joints between fittings and ductile iron pipe:

1. Rubber gasket joints.
2. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.

I. Miter Bends: Fabricate steel bends in accordance with AWWA C208 and as shown on drawings.

J. Pipe Couplings:

1. Coupling types as shown on drawings.
2. Suitable for line pipe materials used.
3. Suitable for cold water pressures of pipe head classes on drawings.

K. Closure Section Joints

1. Restraint requirements shown on drawings.
2. Field welded butt strap joints.
3. Bolted, Split-Sleeve Restrained and Nonrestrained Couplings for Plain – End
    a. In accordance with AWWA C227.

L. Tees:

1. Tees for air valves, blowoffs, manholes, and temporary construction line as shown on drawings.
2. Tee length, minimum: As shown on drawings, required for blocking, or in accordance with AWWA C208 whichever is greater

2.03 LININGS AND COATINGS

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

B. Do not field apply mortar lining without COR approval.

2.04 CONCRETE

A. Concrete in Thrust Blocks and Collars: Section 03 30 00 - Cast-in-Place Concrete.

2.05 FLANGES:

A. In accordance with AWWA C207.

B. Class: Working pressure meets or exceeds head class of attached pipe

2.06 FLANGE GASKETS:

A. BLUE-GARD Style 3000 manufactured by Garlock Sealing Technologies, 1666 Division Street, Palmyra NY 14522, or equal, having the following essential characteristics:

1. Sized in accordance with AWWA C207, Table 1.
2. For AWWA C207 flanged joints.
3. Compressed, Non-Asbestos (CNA) Gasketing with Aramid Fibers and a NGR Binder.
4. For potable cold water service.

2.07 CONTRACTOR SOURCE QUALITY TESTING

A. Pipe and Fittings:

1. Hydrostatic Test:
   a. Perform shop hydrostatic test on pipe which stresses steel to 75 percent of minimum yield point of the steel.
   b. Hold pressure long enough to allow thorough inspection of welded joints.
   c. Repair leaks by rewelding and retesting joints.
   d. Test sections prior to forming bell and spigot joints.
   e. Repair defects and retest section before applying lining and coating.
   f. Government may witness hydrostatic testing and calibration of pressure gauges. Notify Government 30 days prior to performing hydrostatic test.
2. Fittings fabricated from tested steel pipe do not require hydrostatic testing if welds are tested.
   a. Weld test: Dye penetrant test in accordance with ASTM E165 or Magnetic Particle in accordance with ASTM E709.
   b. Weld defect repair. Chip, flame gouge, or grind to sound metal; reweld; and test repaired weld.

B. Joint Testing: Assemble one joint for each pipe diameter to check bell and spigot to check fit prior to coating or lining.

PART 3 EXECUTION

3.01 INSTALLATION

A. Joining Pipe:

1. In accordance with AWWA C604.
2. Verify inside joint gap meets manufacturer's tolerances as work progresses.

B. Joints for Pipe with Welded Joints:

1. In accordance with AWWA C206.
2. Perform dye penetrant test on welds in accordance with ASTM E165.
3. Welded Butt Joints:
   a. As required for pipe on steep slopes as shown on drawings.
4. Double Lap Weld Joints:
   a. Provide joint with full fillet welds.
   b. Air test double lap welds in accordance with AWWA C206.
   c. Required on thrust restrained joints greater than 30 degree bend deflection angles, unless butt welded joints are required.
5. Single Lap Weld Joints:
   a. May be used on thrust restrained joints with 30 degree bend deflection angles or less.
   b. Road and wash crossings unless butt or double-lap welded joints are required.
6. Joint Thrust Restraint: As shown on drawings.

C. Connections at Thrust Blocks and Structures: As shown on drawings

D. Closure Sections:

1. Where necessary as determined by Contractor, subject to approval of COR.
2. Ambient temperature when closure section is welded, maximum: 60 degrees F.

3.02 TOLERANCES

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

1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.
2. Total departure from established alignment and grade, maximum: 1-inch.

3.03 CHANGES IN ALIGNMENT AND GRADE

A. Refer to Section 32 11 10 – Pipeline General Requirements.

B. Make small changes in alignment and grade by providing small deflections between adjacent pipe sections as follows:

1. Pulling rubber gasket bell-and-spigot joint:

a. A total 1-inch joint deflection may be permitted by reducing normal 1/2-inch inside mortar space to 1/4-inch and pulling opposite side of pipe 3/4-inch from normal closure.

b. Provide unsymmetrical closure at welded lap joint up to maximum pullout of 1-inch.

2. Maximum deflection angle between adjacent pipe sections: Manufacture's recommendations but shall not exceed 5 degrees.

C. Lay ends of each section of steel line pipe on theoretical centerline of curve and to grade shown on drawings within laying tolerances prescribed above.

3.04 JOINT LINING AND COATING

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

1. Line field joints with cement-mortar in accordance with AWWA C205.

2. Coat exterior joints as specified in Section 09 96 20 - Coatings.

3. Do not backfill field joints until coating is approved by COR.

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

3.05 BACKFILL

A. Keep internal supports in place until embedment has been placed and compacted above bottom of pipe to minimum height of 0.7 times diameter.

3.06 PIPE DEFLECTION

A. Allowable short term vertical pipe diameter deflection after backfilling is complete.

1. Decrease, maximum: 2 percent of nominal pipe diameter.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

3. Short term is within 2 weeks after backfilling is complete.

B. Allowable long term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 3 percent of nominal pipe diameter.

END OF SECTION

SECTION 33 11 13
DUCTILE IRON PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. In accordance with Section 33 11 10 - Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA)

1.	AWWA C104-16	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2.	AWWA C110-12	Ductile-Iron and Gray-Iron Fittings for Water
3.	AWWA C111-17	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4.	AWWA C151-09	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

1.03 SUBMITTALS

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

B. RSN 33 11 13-1, Shop Drawings:

1. Show pipe and fitting fabrication details.
2. Show exact dimensions of joints, and inside and outside pipe diameters, and diameter of rubber gasket including tolerances, other major dimensions, proposed restraint. Include all details of adjacent equipment if ductile iron fittings are used in place of steel fittings.
3. See RSN 33 11 10-2 for further details.

C. RSN 33 11 13-2, Commercial Products:

1. Joint restraint products.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

PART 2 PRODUCTS

2.01 PIPE

A. AWWA C151.Nominal laying length: 20-feet.

B. For allowable pipe size and classes, refer to Section 33 11 10 - Pipeline General Requirements.

C. Minimum DI Pressure Class of Pipe shall be the greater class from the following requirements:

1. Pressure defined by Hydraulic Grade Line as shown on pipeline plan and profile drawings.
2. Increase pipe pressure class as required so transient pressure defined by pipe head class as shown on pipeline plan and profile drawings is within transient allowance of pipe.
    a. Allowable transient pressure is equal to rated working pressure plus 100 psi.

D. Rubber Gaskets: AWWA C111.

E. Coatings and linings in accordance with Section 09 96 20 - Coatings. Cement mortar lining shall be double thickness as defined by AWWA C104.

2.02 FITTINGS

A. Joints between fittings and ductile iron pipe:

1. Rubber gasket joints.
2. Restrained joints.
3. Joint dimensions and tolerances: Same as pipe manufacturer's joint design.

B. Ductile Iron Fittings:

1. AWWA C110 and C111.
2. Coatings and Lining:
    a. Refer to Section 09 96 20 - Coatings.
    b. Cement mortar lining: Double thickness as defined by AWWA C104.
3. Tees, Bends, or Adaptors:
    a. Lengths: AWWA C110 or as shown on drawings.
    b. Ends: Fit type of joint in adjacent pipeline.
4. Plan, profile and restraint system shown on drawings require modification if ductile iron fittings are used.

5. Joints between fittings and other pipe types:
   a. PVC Pipe:
      1) Unrestrained: Rubber gasket joints.
      2) Restrained: Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716, or equivalent
      3) Joint dimensions and tolerances: Same as PVC pipe manufacturer's joint design.
   b. HDPE and Fiberglass Pipe:
      1) Flanged:
         a) Bolt patterns on flanges must match AWWA C110.
6. Joint Restraint Products: AWWA C110
   a. Between pipe sections: Push on joints with ductile iron locking elements
      1) US Pipe TR Flex, U.S. Pipe Two Chase Corporate Drive, Suite 200, Birmingham, AL 35244, telephone 866-347-7473 or equivalent.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Ductile Iron Pipe: AWWA C151.
   1. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

B. Ductile Iron Fittings: Test in accordance with AWWA C110.
   1. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

PART 3 EXECUTION

3.01 JOINING PIPE

A. Assemble push-on or mechanical joints in accordance with AWWA C111 and the manufacturer’s recommendations.

B. Coat exterior joints as specified in Section 09 96 20 - Coatings.
   1. Apply shrink sleeves in accordance 09 96 20 – Coatings.
   2. Do not backfill field joints until coating is approved by COR.

C. Thrust Restraint:
   1. US Pipe TR Flex or equal.
   2. Concrete in encasements, blocking and collars in accordance with Section 03 30 00 - Cast-in-Place Concrete.

D. Connections at Collars and Thrust Blocks: As shown on drawings.

E. Connections to Other Types of Pipe:

1. Use rubber gasket or flanged joints to make connections between ductile iron pipe and other types of pipe.

3.02 CHANGES IN ALIGNMENT AND GRADE

A. Refer to Section 33 11 10 – General Pipeline Requirements.

B. Make other changes in alignment and grade by providing deflections at joints.

1. Maximum deflection angle between adjacent pipe sections is 3 degrees or manufacturer's recommendation whichever is less.

3.03 TOLERANCES

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

1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.

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

3.04 PIPE DEFLECTION

A. Allowable short term vertical pipe diameter deflection after backfilling is complete.

1. Decrease, maximum: 2 percent of nominal pipe diameter.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

B. Allowable long term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 3 percent of nominal pipe diameter.

END OF SECTION

SECTION 33 11 16
PVC PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. In accordance with Section 33 11 10 - Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM F1674-11	Joint Restraint Products for Use with PVC Pipe

B. American Water Works Association (AWWA)

1.	AWWA C605-13	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
2.	AWWA C900-16	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

1.03 SUBMITTALS

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

B. RSN 33 11 16-1, Shop Drawings:

1. Show pipe and fitting fabrication details. Include:
   a. Lengths of pipe, joint type and overlap lengths, restrained lengths, inside pipe diameters and dimension ratios.
2. Dimensions of joints, diameter of rubber gasket including tolerances, other major dimensions, proposed restraint, and location which include station and elevation.
3. Connections details to other pipe types (coupling information and dimensions).
4. See RSN 33 11 10-2 for further details.

C. RSN 33 11 16-2, Pipe Manufacture Certification:

1. Pipe meet AWWA C900.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide sun protection for PVC pipe stored outside.

1. At minimum, wrap pipe with fastened opaque covering.
2. In warm climates, allow air circulation through and around pipe by puncturing or cutting covering in area of pipe ends.

PART 2 PRODUCTS

2.01 PIPE

A. PVC Pressure Pipe: AWWA C900: Elastomeric joint or fused joints where shown on drawings.

1. Nominal laying length: 20-feet.
2. PVC pipe dimensions: Based on AWWA Cast Iron (CI) sizes for diameters.
3. Minimum Pressure Rating of Pipe: Higher pressure rating from the following requirements:
    a. Pressure defined by steady state Hydraulic Grade Line as shown on pipeline plan and profile drawings.
    b. Transient pressure defined by pipe head class as shown on pipeline plan and profile drawings shall not be greater than 10 percent of continuous pressure rating of pipe.

B. Rubber Gaskets: Manufactured and tested in accordance with AWWA C900.

2.02 FITTINGS

A. Allowable:

1. Steel: In accordance with Section 33 11 12 – Steel Line Pipe.
2. Ductile Iron: In accordance with Section 33 11 13 – Ductile Iron Pipe.

B. Rubber Gaskets: Manufactured and tested in accordance with AWWA C605.

C. Joint Restraint Products: ASTM F1674

1. Joint Restraint
    a. Not allowed where thrust restraint requires more than 2 pipe joints

1) Maximum, 2 PVC restrained pipe joints allowed each side of miter bend.

b. Allowed for road and wash crossings where thrust restraint limitation is not reached.

2. Between pipe sections:

a. Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716 www.ebaa.com or equivalent

3. Between pipe and fittings:

a. Megalug Series, EBAA Iron Sales, Incorporated, P.O. Box 857, Eastland TX 76448, telephone: 800-433-1716 www.ebaa.com or equivalent

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. PVC Pipe: AWWA C900.

1. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

PART 3 EXECUTION

3.01 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

3.02 JOINING PIPE

A. Join pipe in accordance with AWWA C605 or as directed by COR.

B. Apply firm, steady pressure either by hand or using bar and block until spigot easily slips through gasket. Mechanical equipment such as come-alongs may be used to join pipe.

C. Spigot end of pipe: Marked by manufacturer to indicate proper depth of insertion.

D. Push spigot until reference mark on spigot end is flush with bell end.

E. Connections between PVC Pressure Pipe and Other Types of Pipe: Use rubber gasketed mechanical joints to make connections.

3.03 CHANGES IN ALIGNMENT AND GRADE

A. Cathodic protection required for metallic miter bends and metallic joint restraint.

B. Make small changes in alignment and grade by providing deflections at joints.

1. Maximum Deflection: 1 degree or deflection recommended by pipe manufacturer, whichever is less.

C. Longitudinal bending of pipe to obtain deflection: Not permitted.

D. Other methods of providing curves in pipelines may be submitted. If approved, use these methods to install curves.

3.04 TOLERANCES

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

1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.

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

3.05 PIPE DEFLECTION

A. Allowable short term vertical pipe diameter deflection after backfilling is complete.

1. Decrease, maximum: 4 percent of nominal pipe diameter.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

B. Allowable long term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 5 percent of nominal pipe diameter.

END OF SECTION

SECTION 33 11 18

HDPE PRESSURE PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. In accordance with Section 33 11 10 - Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B16.1-15	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2.	ASME B16.5-13	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B. ASTM International (ASTM)

1.	ASTM D2513-16a	Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
2.	ASTM D3350-14	Polyethylene Plastics Pipe and Fittings
3.	ASTM F2206-14	Fabricated Fittings of Butt-Fused Polyethylene (PE)
4.	ASTM F2620-13	Heat Fusion Joining of Polyethylene Pipe and Fittings
5.	ASTM F2634-15	Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

C. American Water Works Association (AWWA)

1.	AWWA C906-15	Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks

D. National Sanitation Foundation (NSF)

1.	NSF Standard 61-16	Drinking Water System Components - Health Effects

E. Plastic Pipe Institute (PPI)

1. TR-33-2012 Generic Butt Fusion Joint Procedure for Field Joint of Polyethylene Pipe

1.03 SUBMITTALS

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

B. RSN 33 11 18-1, Heat Fusion Joint Operator Qualifications:

1. Certifications from manufacturer.
2. Inspection results.
3. Date of Certification.

C. RSN 33 11 18-2, Shop Drawings:

1. Show pipe and fitting fabrication details such as dimensions and location which includes station and elevation.
2. Connections details to other pipe types and appropriate expansion and contraction blocking.
3. See RSN 33 11 10-2 for further details.

D. RSN 33 11 18-3, Certification:

1. Pipe meets AWWA C906.
2. Test reports correlated to shipping bills.

E. RSN 33 11 18-4, Fusion Procedures:

1. Fusion temperature.
2. Interface pressure.
3. Cooling time.
4. Record of pipe size and DR being joined and each joints fusion temperature, interface pressure and cooling time.

1.04 QUALIFICATIONS

A. Heat Fusion Joint Machine Operator:

1. Certified by machine manufacturer or representative.
2. Trained on specific fusion machine and bonding procedure and shall:
   a. Perform 1 pipe-to-pipe bond and,
   b. One pipe-to-fitting bond on each machine to be used.
   c. Bonds made as part of operator certification:

1) Visually inspected and tested in accordance with PPI and ASTM standards.

3. Qualification remains in effect for 6-months from date of qualification:

a. Ability to be revoked by certifying entity.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store HDPE pipe in unprotected, outside storage for more than 2-years.

PART 2 PRODUCTS

2.01 PIPE

A. HDPE Pressure Pipe: AWWA C906, except;

1. PE material:

a. Standard PE code designation: PE 4710.

b. Minimum cell Classification, ASTM D3350: PE 445574C or E.

c. Chlorine resistance classification: CC3

2. Pipe

a. Minimum continuous pressure rating of pipe: Higher pressure from the following requirements:

1) Pressure defined by steady state Hydraulic Grade Line as shown on pipeline plan and profile drawings.

2) Transient pressure defined by pipe head class as shown on pipeline plan and profile drawings shall not be greater than 10 percent of continuous pressure rating of pipe.

b. Each production lot of pipe: Tested for melt index, density, percent carbon, dimensions and ring tensile strength and results recorded.

c. Approved for potable water in accordance with NSF Standard 61.

d. Color: Black with 2 to 3 percent carbon black by weight.

e. Not less than 4 permanent co-extruded, equally spaced, blue color stripes in outside surface of pipe.

2.02 FITTINGS

A. Allowable:

1. Steel: In accordance with Section 33 11 12 – Steel Line Pipe.

2. Ductile Iron: In accordance with Section 33 11 13 – Ductile Iron Pipe.

3. As shown on drawings.

B. HDPE fittings:

1. Shop manufactured fittings constructed of HDPE PE 4710 in accordance with AWWA C906, ASTM F2206 and as shown on drawings.

2. Made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings:

a. Rated for internal pressure service at least equal to full service pressure rating of mating pipe.

b. Tested in accordance with AWWA C906.

3. HDPE flange and mechanical joint adaptors: Rated to at least same pressure as mating pipe.

4. Polyethylene flange or mechanical joint adapters made with sufficient through-bore to be clamped in a butt fusion-joining machine without use of a stub-end holder, as per pipe manufacturer's instructions.

5. HDPE fabricated mechanical adapters shall have steel stiffeners.

C. Adaptors, couplings, bends, and connections at encasements and thrust blocks:

1. Fabricated from HDPE in factory or steel unless shown otherwise on drawings.

2. HDPE pipe and fittings shall not be embedded in concrete thrust blocks.

D. Metal Back-up Flange:

1. Material: Ductile iron, Class 150, ASME B16.1 or ASME B16.5, coat in accordance with Section 09 96 20 - Coatings.

E. Joints between HDPE pipe and metallic fittings: Flanged with backing ring.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. HDPE Pipe and Fittings:

1. Notify Technical Service Center, Attn: 86-68140, and COR 14-days before HDPE pipe and fittings are tested.

2. General: AWWA C906 testing of HDPE pipe and fittings and ASTM F2634 testing of HDPE factory test fusions.

a. Completed and documented by qualified personnel.

b. Government reserves right to:

1) Observe testing while in process and to receive testing documentation.

2) Inspect materials both during and after manufacture.

c. Testing reports shall have unique identifiers with shipping bills to verify that pieces shipped belong to same as those tested.

3. Test in accordance with AWWA C906:

   a. Perform 1 butt fusion in accordance with ASTM F2620 and PPI Technical Report TR-33 on each run of pipe and from each batch of material feedstock.

      1) Test using Tensile Impact Test in accordance with ASTM F2634 prior to shipping pipe.

   b. Joints exhibiting yield point lower than unfused pipe or that fails in a brittle mode is considered unacceptable.

   c. Unacceptable test result, Government may reject pipe manufactured in same run and from same batch of material feedstock represented by unacceptable test. Manufacturer may, at own expense, supply additional testing to COR.

   d. Acceptable test results do not:

      1) Mean pipe from pipe run or material feedstock batch will be acceptable.

      2) Relieve pipe manufacturer or supplier from liability for defects in material or workmanship of pipe discovered during installation or warrantee period.

4. HDPE pipe out-of-roundness tolerances shall not exceed maximum allowances in ASTM D2513, Table 2.

   a. HDPE pipe ovality: Plus or minus 3 percent at pipe manufacturing facility.

B. HDPE Fittings:

1. Each HDPE fitting shipped to job site to be tested in accordance with AWWA C906.

PART 3 EXECUTION

3.01 LAYING PIPE

A. Plowing and planting: Not allowed.

B. Joining Pipe:

1. HDPE pipe butt fusions: In accordance with PPI Technical Report TR-33 (TR-33-12) and ASTM F2620.

2. Pipe may be joined above ground and then lowered into position, provided pipe is supported and handled in manner that prevents damage.

3. To avoid damage, do not join fabricated fittings larger than 16-inch diameter to more than one pipe before placement in trench.

4. Connections between HDPE pressure pipe and other types of pipe: Flange joints or as shown on drawings or per approved submittals.

5. Tied Joint Restraint System:
   a. Clean surfaces of pipe and fittings to receive tied joint restraint system.
   b. Install joint restraint system so joints are mechanically locked together to prevent joint separation.
6. Polyethylene Pipe Fusion Machine Data Loggers:
   a. Used during joint fusions.
   b. Record:
      1) Joint temperature,
      2) Pressure,
      3) Time.
   c. Supply data on fusion joints upon request of COR.
7. Thermal Contraction and Expansion of HDPE Pipe:
   a. COR may unbolt flange at transition between HDPE and steel to check for tensile or compressive loading due to thermal contraction of HDPE pipe.
   b. Excessive tension or excessive compression of flange beyond design limit:
      1) Cause for Contractor to excavate HDPE pipe,
      2) Lengthen or shorten and re-bury at own cost.
8. Concrete blocking as required for connections to other pipe types.

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

Table 33 11 18A - Minimum Cold Bending Radius

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

D. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipelines closed.

E. Closure sections:

1. Last fusion joint for HDPE pipe to HDPE pipe closure sections:

a. Make during coolest part of day.

b. Air temperature, maximum: 65 degrees F.

3.02 CONNECTION AT CONCRETE THRUST RESTRAINT

A. Connect pipe to structures as shown on drawings.

1. Locate flange connections as shown on drawings.

2. Suitably block flange connection to prevent pipe movement due to temperature changes, unless design incorporates pipe restraint.

3.03 TOLERANCES

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

1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.

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

3.04 PIPE DEFLECTION

A. Measure deflections in pipe with diameters equal to and greater than 27-inches

B. Allowable short term vertical pipe diameter deflection after backfilling is complete.

1. See Table 33 11 18B - Allowable Vertical Deflections.

2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

C. Allowable long term vertical pipe diameter deflection, at end of warranty period: See Table 33 11 18A - Allowable Vertical Deflections.

Table 33 11 18B – Allowable Vertical Deflections

Pipe Dimension Ratio (DR)	Short Term Vertical Deflection Decrease, %	Long Term Vertical Deflection Decrease, %
DR greater than or equal to 21	3	7.5
DR greater than or equal to 13.5 and less than 21	2.4	6

3.05 CONTRACTOR FIELD QUALITY TESTING

A. Fusion Quality Testing on Polyethylene pipe:

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

END OF SECTION

SECTION 33 11 19
FIBERGLASS PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. In accordance with Section 33 11 10 - Pipeline General Requirements.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM F477-14	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA)

1.	AWWA C950-13	Fiberglass Pressure Pipe

C. International Organization for Standardization

1.	ISO 14692-02	Petroleum and natural gas industries – Glass-reinforced plastics (GRP) Piping

1.03 SUBMITTALS

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

B. RSN 33 11 19-1, Qualification Reports

1. Pipe: AWWA C950 Section 5.1.2 Quality Control Tests and Records.
2. Fittings: ISO 14692 with English units listed.
    a. Section 11.3 Qualification documentation.
    b. Section 11.4.1 Product quality control documentation.
    c. Section 11.5 Installation documentation.
    d. Section 11.6.1 Published values for fittings and flanges.

C. RSN 33 11 19-1, Shop Drawings:

1. Show pipe and fitting fabrication details.
2. Show exact dimensions of joints, and diameter of rubber gasket including tolerances, and other major dimensions.
3. Include minimum ultimate axial strength of pipe.

4. See RSN 33 11 10-2 for further details.

D. RSN 33 11 19-2, Joint Repair Plan:

1. Proposed equipment, materials, and procedures for repairing leaks in pipe joints.

1.04 GENERAL

A. In accordance with applicable portions of Section 33 11 10 – Pipeline General Requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Transport pipe and fittings on padded bolsters either curved to fit outside of pipe or using triangular chocks. Use heavy padding under ties.

PART 2 PRODUCTS

2.01 PIPE

A. In accordance with AWWA C950.

B. Pressure pipe utilizing a continuous filament wound process with:

1. Type 1: Filament wound
2. Liner C: Reinforced thermoset polyester liner.
3. Grade 4: Glass-fiber-reinforced polyester mortar.
4. Pipe Stiffness: As required for internal and external pressures – 18 psi minimum.
5. Inside diameters: Equal to nominal diameter called out on drawings with tolerances indicated in AWWA C950 for “Dimensions for inside diameter series pipe”.

C. Design normal working pressure for pipe to meet head classes shown on pipeline plan and profile drawings.

D. Elastomeric Sealing Gaskets: Manufactured and tested in accordance with ASTM F477.

2.02 FITTINGS

A. Allowable:

1. Steel: In accordance with Section 33 11 12 – Steel Line Pipe.
2. Ductile Iron: In accordance with Section 33 11 13 – Ductile Iron Pipe.

B. Joint Restraint

1. Not allowed for thrust restraint.

2. Allowed for road and wash crossings where thrust restraint is not required.

C. Joints Between Metallic Fittings and Fiberglass Pipe:

1. Fiberglass line pipe to metallic fitting: flange to flange.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Test in accordance with AWWA C950:

1. Tests may be witnessed by Government. Notify COR 30-days prior to testing.

B. Restrained Joint and Flange Fittings:

1. Test in accordance with ISO 14692, except as follows:

a. Design lifetime: 50 years.

PART 3 EXECUTION

3.01 CHANGES IN ALIGNMENT AND GRADE

A. In accordance with Section 33 11 10 – Pipeline General.

B. Make changes in alignment with miter bends.

C. Make minor changes in alignment and grade by pulling pipe joints.

1. Pulling rubber gasket coupling or bell and spigot joint.

2. Maximum deflection:

a. 1 degree of deflection as recommended by pipe manufacturer, whichever is less, for pipe head class less than or equal to 450-feet.

b. 0.75 degree of deflection as recommended by pipe manufacturer, whichever is less, for pipe head class equal to or greater than 475-feet.

D. Lay ends of each section of pipe on theoretical centerline of curve and to grade shown on drawings within laying tolerances prescribed above.

3.02 THRUST RESTRAINT

A. Restrain coupling joint with rubber gaskets and locking rods, where allowed.

B. Alternate methods of restraint may not be used unless approved by COR.

3.03 CLOSURE SECTIONS

A. Use closure sections where necessary, subject to approval of COR.

B. Follow manufacturer’s recommendations.

3.04 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by COR. With a total maximum departure from established alignment and grade of 1-inch.

3.05 PIPE DEFLECTION

A. Allowable short term vertical pipe diameter deflection after backfilling is complete.

1. Decrease, maximum: 2 percent of nominal pipe diameter.
2. Elongation, maximum: 3 percent of nominal pipe diameter as measured when backfill reaches pipe crown.

B. Allowable long term vertical pipe diameter deflection, at end of warranty period:

1. Decrease, maximum: 5 percent of nominal pipe diameter.

END OF SECTION

SECTION 33 21 95

METAL PIPING FOR LINE PIPE INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for valves and equipment for various line pipe installations. See Section 33 22 15 - Valves and Equipment.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B16.5-17	Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
2.	ASME B16.9-12	Factory-Made Wrought Steel Butt-welding Fittings
3.	ASME B16.11-11	Forged Fittings, Socket-Welding and Threaded

B. ASTM International (ASTM)

1.	ASTM A36/A36M-14	Carbon Structural Steel
2.	ASTM A53/A53M-12	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3.	ASTM A105/A105M-14	Carbon Steel Forgings for Piping Applications
4.	ASTM A139/A139M-16	Electric-Fusion (Arc) - Welded Steel Pipe (NPS 4 In and over)
5.	ASTM A240/A240M-16a	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
6.	ASTM A283/A283M-13	Low and Intermediate Tensile Strength Carbon Steel Plates
7.	ASTM A325-14	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
8.	ASTM D2000-12	Standard Classification System for Rubber Products in Automotive Applications
9.	ASTM E165/E165M-12	Liquid Penetrant Examination for General Industry

10.	ASTM E709-15	Magnetic Particle Testing

C. American Welding Society (AWS)

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

D. American Water Works Association (AWWA)

1.	AWWA C200-12	Steel Water Pipe - 6 In (150 mm) and Larger
2.	AWWA C206-17	Field Welding of Steel Water Pipe
3.	AWWA C207-13	Steel Pipe Flanges for Waterworks Service, Sizes 4 In Through 144 In. (100 mm Through 3,600 mm)
4.	AWWA C208-12	Dimensions for Fabricated Steel Water Pipe Fittings
5.	AWWA C227-11	Bolted, Split-Sleeve Restrained and Nonrestrained Couplings for Plain-End Pipe
6.	AWWA C606-15	Grooved and Shouldered Joints

1.03 SUBMITTALS

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

1. General:
    a. Submit data that demonstrates equipment provided meets requirements of this section.
    b. Submit identifying data giving manufacturer’s name, type, model, size, and construction and performance characteristics of equipment.
    c. When a catalog sheet is submitted, underline or mark particular item proposed in a manner which allows data to be legibly reproduced.

B. RSN 33 21 95-1, Shop Drawings:

1. Checked shop drawings showing dimensions and tolerances, material data, joint details, welding requirements; and basic coating and lining requirements.

C. RSN 33 21 95-2, Commercial Product Data:

1. Pipe couplings.
2. Grooved end pipe couplings.
3. Weld test data and testing certification for:
    a. Shop welds.
    b. Field welds

D. RSN 35 21 95-3, Final Drawings:

1. Submit final drawings.
    a. After equipment is fabricated and is accepted by Government.
    b. Detailed drawings which clearly show steel piping sections exactly as they exist after completion, including dimensions and tolerances, material data, joint details, welding, and basic coating and lining requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage during loading, transporting, unloading, and at final storage location.
    1. Supply:
        a. Padded bolsters curved to fit under outside of pipe.
        b. Heavy padding under ties during transportation and storage.

B. Do not store directly on ground.

C. Store so that lifting straps can be passed beneath pipe sections.

D. Provide space to allow personnel to move between pipe sections.

E. Cover with tarps and tie tarps down securely.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Steel plate:
    1. ASTM A283, grade C or D, or ASTM A36.

B. Stainless steel plate:
    1. Orifice plates.
    2. ASTM A240, type 316 (type 316L if welded).

C. Standard and schedule steel pipe:
    1. ASTM A53, grade B:
        a. Pipe 4-inches in diameter and smaller: Galvanize in accordance with Section 09 96 20 - Coatings.
        b. Pipe larger than 4-inches in diameter: Coat in accordance with Section 09 96 20 - Coatings.

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

a. Class: Working pressure meets or exceeds head class of attached pipe.

3. Flange bolt patterns to match valves and equipment flanges.

E. Flange Gaskets:

1. BLUE-GARD Style 3000 manufactured by Garlock Sealing Technologies, 1666 Division Street, Palmyra NY 14522; or equal, having the following essential characteristics:

a. For AWWA C207 flanged joints.

b. Compressed, Non-Asbestos (CNA) Gasketing with Aramid Fibers and NBR Binder.

c. Full face or ring type.

d. For potable cold water.

F. Flange bolts:

1. AWWA C207.

G. Tapers/Reducers or Adaptors:

1. AWWA C208 or as shown on drawings.

H. Outlets:

1. Fabricate outlets for blowoffs as shown on drawings.

I. Threaded steel fittings:

1. ASME B16.11 or ASTM A105.

2. Suitable for cold water pressures of pipe head classes shown on drawings.

J. Butt-welding steel fittings:

1. In accordance with ASME B16.9 or ASTM A105.

2. Suitable for cold water pressures of pipe head classes shown on drawings.

3. Minimum steel wall thickness: 0.25-inches.

K. Grooved-end Pipe Couplings:

1. AWWA C606.

2. Flexible joint type with rolled or cut grooves.

3. Suitable for cold water pressures of pipe head classes shown on drawings.

L. Pipe couplings:

1. Style 232, (restrained flexible type) or Style 230 (non-restrained flexible type) manufactured by Victaulic, P.O. Box 48776, Atlanta, GA 30362; or equal, having following essential characteristics:

a. Restrained flexible coupling or non-restrained flexible coupling as shown on the drawings.

b. Conform to AWWA C227.

1) Steel material.

2) Coupling housing: Arched, 2 or more segmented, sleeve-type which when closed compresses elastomeric O-ring gaskets beneath arches of sleeve to create radial seal around pipe ends joined inside of coupling.

3) Gaskets: Isoprene, ASTM D2000, suitable for cold-water service.

c. Pipe diameter 8-inch and greater: width between 10.5- to 15-inches.

d. Suitable for cold water pressures of pipe head classes shown on drawings.

e. Provide regular and (electrically) insulating type as shown on drawings.

f. Bolts and nuts: Carbon steel, ASTM A325.

2.02 FABRICATION

A. Fabricate steel piping as indicated on drawings, and in accordance with AWWA C200.

B. Perform welding with a process that protects molten metal from atmosphere.

1. Where practicable, use automatic machines.

2. Where weld metal is deposited in successive layers, clean each layer before subsequent layer is deposited.

3. Align and separate edges of plates to be joined by butt welding to allow complete penetration and fusion of weld.

4. After welding is complete, remove weld spatter.

C. Protect work and operator from weather during welding operations.

1. Welding is not permitted on wet surfaces or when temperature of steel is lower than 0 degrees F.

2. Apply heat to welding areas during field installation. At pipe surface temperatures between 0 and 32 degrees F, heat surface of areas within 3-inches of start of weld to at least 60 degrees F.

D. Flanges and flanged connections:

1. During attachment of flanges to steel pipe, ensure face of flanges remain flat and perpendicular to centerline of attached piping.

2. Limit irregularities or warping in face of flanges to 0.0015-inch measured from:

a. A high point on face of flange at an inside diameter to a corresponding low point on face of flange at an outside diameter, along any radial line, (concave orientation of flange is not permissible) and,

b. A high point on face of flange along a circumferential line at centerline of flange bolt holes, to a low point on face of flange along same circumferential line, within a distance equal to circumferential distance between every third bolt hole.

3. Remove by machining irregularities that remain in face of flange after its attachment to steel piping that exceeds the above.

4. After machining, flange thickness shall not be reduced below minimum thickness specified in AWWA C207, ASME B16.5, or as shown on drawings.

5. Weld pipe flanges to piping so that bolt holes straddle vertical centerline when in installed position.

6. Provide pipe flanges that connect to valve body flanges with same number of bolt holes, bolt pattern, and bolt circle diameter as connecting valves.

E. Maintain circularity of pipe sections during coating, lining, transporting, and installing operations.

1. Provide stulls or adjustable spiders.

2. Measured thickness between maximum and minimum diameters at stulls or spiders shall not exceed 0.5 percent of nominal pipe diameter.

F. Continuously weld joints of flange supports and pipe supports.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Hydrostatic Pressure Testing:

1. Notify Government a minimum of 14 days before test.

2. Government will witness hydrostatic test and calibration of pressure gauges.

3. Hydrostatic test pressure: AWWA C200.

4. Use 2 or more pressure gauges with 1 being a recording type.

a. Upper limit of pressure gauges shall be between 1.5 and 3 times required test pressure. Calibrate pressure gauges with a deadweight tester.

b. At least 1 gauge, which is used for acceptance of test, shall be calibrated within 30 days prior to use.

c. Make a time-pressure record of hydrostatic pressure test.

5. Furnish equipment necessary to perform hydrostatic tests.

6. If a flange is attached to a piping section, after piping section has been hydrostatically tested, piping section will not require retesting.

7. Water temperature for tests: Greater than 45 degrees F.

8. Vent air from test sections.

9. Fill each section with water and uniformly increase pressure until required test pressure is reached.
    a. Hold test pressure for a minimum of 15 minutes.
    b. Apply and release test pressure 3 successive times.
    c. After each application, hold pressure to 2/3 of required pressure until welded joints and seams can be examined.
    d. Repair defects. After defects are repaired, repeat complete test procedure.
10. After hydrostatic testing is complete, cut sections for handling purposes on planes normal to pipe axis.

B. Shop Testing of Welds:

1. Straight sections of metal piping manufactured and hydrostatically tested in accordance with ASTM A53 or ASTM A139 need not be retested.
2. Partial penetration welds and fillet welds, including double welded buttstrap joints, double welded lap joints, and welding pads for outlet connections:
    a. Magnetic particle or dye penetrant:
        1) Technique and procedure for magnetic particle test in accordance with ASTM E709.
        2) Technique and procedure for dye penetrant in accordance with ASTM E165.
        3) Standards of acceptance: AWS D1.1.
3. Double welded buttstrap joints: air test in accordance with AWWA C206.

PART 3 EXECUTION

3.01 INSTALLATION

A. Metal piping to line and grade as shown on drawings.

B. Provide supports and bracing as may be required to hold metal piping in place and prevent distortion during installation.

C. Pipe spools with flanged connections so that bolt holes straddle vertical centerline when installed on horizontal pipe.

D. Couplings: In accordance with manufacturer instructions.

E. Field Joints:

1. Field joints shown on drawings are required to facilitate lining or installation of metal piping for line pipe installations.
2. Welded field joints: In accordance with AWWA C206 and this paragraph.

3. Allowable field joints for steel pipe:
    a. Threaded couplings for pipe less than 4-inches in diameter.
    b. Flanged for pipe 4-inches in diameter and larger, inclusive. Flanges shall be suitable for working pressure of adjacent pipe.
    c. Except as shown on drawings, field joints for pipe larger than 4-inches in diameter:
        1) Full-penetration butt welds.
        2) Double welded lap joints, or double welded buttstrap joints.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Nondestructive Testing of Field Welds:
1. In accordance with AWWA C206.
2. Complete inspections and tests in presence of COR and in accordance with AWS D1.1.
3. When welds are found to be defective, repair welds in accordance with AWS D1.1 and reexamine welds.
4. Visual Inspection: Visually inspect welds following procedures, techniques, and standards of AWS D1.1.
5. Full penetration butt welded field joints:
    a. Ultrasonic or radiograph methods in accordance with AWS D1.1.
6. Partial penetration joint welds and fillet welds, including testing of double welded buttstrap joints or double welded lap joints:
    a. Magnetic particle or dye penetrant:
        1) Technique and procedure for magnetic particle test in accordance with ASTM E709.
        2) Technique and procedure for dye penetrant in accordance with ASTM E165.
        3) Standards of acceptance: AWS D1.1.
7. Double welded buttstrap joints: Air test in accordance with AWWA C206.

3.03 COATING

A. Coat metal piping for line pipe installations in accordance with Section 09 96 20 - Coatings.

END OF SECTION

SECTION 33 22 15

VALVES AND EQUIPMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Includes the following valves and equipment for air valve, blowoff, manholes, and sectionalizing valve installations as listed below.

B. Assemblies do not include:

1. Line Pipe.
2. Earthwork inside Line Pipe earthwork paylines.

C. Sectionalizing Valve Assemblies

1. Measurement: Number of Sectionalizing Valve Assemblies of each size installed.
2. Payment: Assembly prices offered Price Schedules:
    a. All items associated with valves as shown on drawing 1695-D-60324.

D. Air Valve Assemblies:

1. Measurement: Number of Air Valve Assemblies installed.
2. Payment: Assembly prices offered in Price Schedules.
    a. All items associated with air valve as shown on drawing 1695-D-60318.

E. Air Valve with Manhole Assemblies

1. Measurement: Number of Air Valve with Manhole Assemblies installed.
2. Payment: Assembly prices offered in Price Schedules.
    a. All items associated with air valve with manhole assemblies as shown on drawing 1695-D-60319.

F. Blowoff Assemblies:

1. Measurement: Number of Blowoff Assemblies installed.
2. Payment: Assembly prices offered in Price Schedules.
    a. All items associated with blowoff as shown on drawing 1695-D-60321.

G. Blowoff with Manhole Assemblies:

1. Measurement: Number of Blowoff with Manhole Assemblies installed.

2. Payment: Assembly prices offered in Price Schedules.

a. All items associated with blowoff with manhole as shown on drawing 1695-D-60322.

H. Buried Manhole Assemblies:

1. Measurement: Number of Buried Manhole Assemblies installed.

2. Payment: Assembly prices offered in Price Schedules.

a. All items associated with buried manhole as shown on drawing 1695-D-60323.

I. Cost:

1. Include all equipment associated with Temporary Construction Line in price offered in Temporary Construction Line (Reach 10).

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers

1.	ASME B16.1-2015	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2.	ASME B16.5-2017	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch
3.	ASME B40.100-2013	Pressure Gauges and Gauge Attachments

B. American Water Works Association (AWWA)

1.	AWWA C207-13	Steel Pipe Flanges for Waterworks Service, Sizes 4 In Through 144 In. (100 mm Through 3,600 mm)
2.	AWWA C504-15	Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm)
3.	AWWA C507-11	Ball Valves, 6 In. Through 48 In. (150 mm through 1,200 mm)
4.	AWWA C512-15	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

C. Manufacturers Standardization Society (MSS)

1.	MSS SP-110-10	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.03 SUBMITTALS

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

1. General:

a. Submit data that demonstrates equipment provided meets requirements.

b. Submit data giving manufacturer's name, type, model, size, and construction and performance characteristics of equipment.

c. Mark proposed catalog sheet item which allows data to be legibly reproduced.

B. RSN 33 22 15-1, Commercial Product Data.

1. Butterfly valves:

a. Submit hydrostatic pressure testing certification under RSN 33 22 15-2, Service Manuals.

2. Valve boxes for buried valves.

3. Air valves.

4. Ball valves.

a. Submit hydrostatic pressure testing certification, including pressures used in testing valves, under RSN 33 22 15-2, Service Manuals.

5. Meter boxes.

6. Draft Control Damper.

a. Checked shop drawings showing damper design, dimensions and tolerances, material data, welding requirements; and basic coating requirements.

b. Adjusting weight details.

C. RSN 33 22 15-2, Service Manuals.

1. For items in RSN 33 22 15-1, Commercial Product Data.

2. Operation and Maintenance manuals:

a. Catalog cut sheets identifying model numbers, major components and materials.

b. Detailed start up and operating instructions.

c. Maintenance and lubrication schedules.

d. Troubleshooting.

e. Recommended spare parts with part numbers.

3. Hydrostatic pressure testing certifications for butterfly valves and ball valves as well as pressures used in testing valves.

1.04 HANDLING AND TRANSPORTATION

A. Take every precaution during loading, transportation, unloading, storage, and laying, to prevent damage to valves and equipment.

B. Repair damage to valves and equipment as directed if, in opinion of COR, a satisfactory repair can be made; otherwise replace damaged valves and equipment.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Butterfly Valves:

1. Cold water pressures up to 150 psig: AWWA C504, Class 150B.
2. Cold water pressures from 151 psig up to 250 psig: AWWA C504, Class 250B.
3. Cold water pressures from 251 psig to 350 psig: Model HP350 as manufactured by Henry Pratt, www.henrypratt.com, Pentair Keystone RMI Dubex as manufactured by Pentair, www.pentair.com; or equal, having the following essential characteristics:
    a. Designed for a cold water pressure of 350 psig.
    b. Body: Ductile iron, A536 grade 65-45-12, grade 70-50-05 or 80-55-06.
    c. Shaft: Stainless steel.
    d. On center or eccentric shaft.
    e. Flanged end connections, flat faced.
    f. Rubber seated.
    g. Rubber Seat Materials: AWWA C504.
    h. Tested in accordance with AWWA C504 including performance, leakage and hydrostatic testing.
4. Bubble tight at rated pressure in either direction and suitable for operation after long periods of inactivity.
5. Axis of valve leaf: Horizontal when valve is in installed position except where shown on drawings.
6. Flanged ends:
    a. Class 150B valves: Body flanges suitable for connection to AWWA Class D flanges.
    b. Class 250B valves: Body flanges suitable for connection to AWWA Class E flange or AWWA Class F flanges.

c. Valves suitable for pressures between 250-350 psig: Body flanges suitable for connection to AWWA Class F flanges.

7. Valve seat:

a. Rubber.

b. Located either in valve body, mating with a stainless steel seating surface, located on valve disc or in valve disc, mating with a stainless steel seating surface, located in valve body.

c. Fully rubber lined bonded seat in body type seats are unacceptable.

8. Manual operators:

a. Manually-operated butterfly valves with worm-gear or traveling nut type manual operator in accordance with AWWA C504.

b. Ensure rim pull and component strength meets AWWA C504.

c. Operators that open and close valves at full unbalanced pressure rating of valve.

d. Gears of self-locking type, holds valve in all positions without fluttering or creeping.

e. Handwheel where shown on drawings.

9. Buried butterfly valves:

a. Valve boxes.

b. 2-inch square-nut operator.

c. Eight Steel tee-handle wrenches, tee-handle with a length of 8-feet.

B. 6-inch Ball Valves for Blowoffs:

1. Flanged connection to AWWA Class D, E or F flanges to match head classes shown on drawings.

2. AWWA C507.

3. Carbon steel body.

4. Stainless steel ball.

5. Full-ported.

6. Cold-water pressure rating to match “Blowoff Data Tables” on drawing 1695-D-60322.

7. Manual operators:

a. Manually-operated butterfly valves with worm-gear or traveling nut type manual operator in accordance with AWWA C507.

b. Ensure rim pull and component strength meets AWWA C507.

c. Operators that open and close valves at full unbalanced pressure rating of valve.

d. Gears of self-locking type, holds valve in all positions without fluttering or creeping.

8. Buried ball valves:

a. Valve boxes.

b. 2-inch square-nut operator.

c. Two Steel tee-handle wrenches, each tee-handle with a length of 8-feet.

C. 1-inch and 2-inch Ball Valves:

1. 1-inch ball valves:

a. Integral with 6-inch air valves as shown on drawings 1695-D-60318 and 1695-D-60319.

b. Cold-water pressure rating of not less than pressure rating listed on "Air Valve Data Tables" on drawing 1695-D-60320.

2. 2-inch ball valve:

a. To isolate 2-inch air valve for Temporary Construction Water Line as shown on drawing 1695-D-60308.

b. Cold-water pressure rating of not less than 250 psi.

3. Threaded ends.

4. MSS SP-110, brass or bronze valve body, stainless steel ball, full-ported, female screwed ends

5. Bubble tight at rated pressure in either direction and suitable for operation after long periods of inactivity.

D. 2-inch Air Valves:

1. For Temporary Construction Water Line shown on drawing 1695-D-60308.

a. Val-Matic model (102S) manufactured by Val-Matic Valve and Manufacturing Corporation, 8448 West 45th street, Lyons, IL 60534;

b. DeZurik Model 145C manufactured by Valve and Primer Corporation, 1420 South Wright Boulevard, Schaumburg, IL 60193-4599;

c. Crispin Model AL20/M5 or UL20 Air and Vacuum Valve manufactured by Multiplex Manufacturing Company, 600 Fowler Avenue, Berwick, PA 18603;

d. or equal, having the following essential characteristics:

1) Manufactured in accordance with AWWA C512.

2) Combination air/vacuum and air-release type actuated by a float or floats.

3) Dual or single body.

4) Remains open for filling line until water has displaced air at point of attachment of valve assembly after which it closes.

5) Opens when pressure in pipeline drops sufficiently to create a vacuum.

6) Releases trapped air when pipeline is under pressure.

7) Furnish with petcocks:

a) One on top, permits checking effectiveness of air valve,

b) One at bottom, allows valve to be drained.

8) Stainless steel internal parts such as guides, bushings, and screws.

9) Stainless steel floats.

10) Float-pivot supports: Brass, bronze, stainless steel, or cast iron.

11) Cold-water pressure rating for body not less than pressure 250 psi.

12) Operating pressure for seat materials: Not less than 250 psi.

13) NPT inlets.

E. 6-inch Air Valves:

1. For air valve installations shown on drawings 1695-D-60318 and 1695-D-60319.

a. Val-Matic model (106S or 156S) manufactured by Val-Matic Valve and Manufacturing Corporation, 8448 West 45th street, Lyons, IL 60534;

b. DeZurik Model 150C manufactured by Valve and Primer Corporation, 1420 South Wright Boulevard, Schaumburg, IL 60193-4599;

c. Crispin Model AL61/PL10 Air and Vacuum Valve manufactured by Multiplex Manufacturing Company, 600 Fowler Avenue, Berwick, PA 18603;

d. or equal, having the following essential characteristics:

1) Manufactured in accordance with AWWA C512.

2) Combination air/vacuum and air-release type actuated by a float or floats.

3) Dual body.

4) Remains open for filling line until water has displaced air at point of attachment of valve assembly after which it closes.

5) Opens when pressure in pipeline drops sufficiently to create a vacuum.

6) Releases trapped air when the pipeline is under pressure.

7) Furnish with petcocks:

a) One on top, permits checking effectiveness of air valve,

b) One at bottom, allows valve to be drained.

8) Stainless steel internal parts such as guides, bushings, and screws.

9) Stainless steel floats.

10) Float-pivot supports: Brass, bronze, stainless steel, or cast iron.

11) Cold-water pressure rating for the body not less than pressure rating listed on "Air Valve Data Tables" on drawing 1695-D-60320.

12) Operating pressure for seat materials: Provide soft seats suitable for 0 to rated pressure listed on "Air Valve Data Tables" on drawing 1695-D-60320.

13) Covered by steel hood to prevent debris from entering pipe.

14) Flanged inlets:

a) Flange cold-water pressure rating not less than pressure rating listed on "Air Valve Data Tables" on drawing 1695-D-60320.

i. ANSI B16.1 for Class 125 or Class 250 iron flanges.

ii. ANSI B16.5 for Class 300 steel flanges.

2. Spare parts:

a. 7 complete sets of air valve spare parts including:

1) Seats, lever, and gasket.

2) Additional parts recommended by manufacturer.

3) Box and clearly label box.

a) Include detailed list of spare parts inside box.

4) Store in location as directed by COR.

F. Automatic Ball Drip Valve:

1. Threaded end.

2. Automatic draining, ball check.

3. Minimum 250 psig.

4. Provide dielectric insulating union as necessary to prevent galvanic corrosion between dissimilar metals.

G. Valve Boxes:

1. Steel, cast iron, composite or polyvinyl chloride (PVC).
2. 5 1/4-inch minimum inside diameter for valves 4-inches in diameter and larger.
3. 2-piece or 3-piece and slip type.
4. Locking lid with pentagon shaped bolt head.
    a. 2 special tools to unlock lid with pentagon shaped bolt head.
5. Collar with lid marked "WATER".
6. Cast iron:
    a. Model 6855 series, manufactured by Tyler Union, www.tylerunion.com; or equal, having the following essential characteristic:
        1) Cast iron locking lid with pentagon shaped bolt head.
        2) Cast iron extension from valve nut operator to ground surface
        3) Cast iron collar with lid marked "WATER".
7. Base and adequate extension items to extend from valve nut operator to ground surface. Extension items may be PVC or metal:
    a. Refer to Detail A on drawing 1695-D-60324.

H. Pressure Gauges:

1. Refer to drawing 1695-D-60319.
2. One gauge required for beginning of Reach 9.
3. One gauge required for beginning of Reach 10.
    a. Model 213.40 as manufactured by Wika Instrument Corporation, 1000 Wiegand Boulevard, Lawrenceville GA 30043,
    b. Ashcroft Duragauge 1279 as manufactured by Dresser Industries Instrument Division, 250 East Main Street, Stratford CT 06614;
    c. or equal, having the following essential characteristics:
        1) Range displayed on pressure gauges:
            a) Beginning of Reach 9: 0 to 150 psig.
            b) Beginning of Reach 10: 0 to 100 psig.
            c) Figures in intervals of 2 psi, and graduations in intervals of 0.5 or 1 psi.
        2) Bronze bourdon-tube, adjustable-movement type.
        3) Movement made of phosphor bronze, nylon, nickel, silver, stainless steel, Monel steel, nitride steel, or any combination thereof:

a) Bushings of above-mentioned material but different composition or hardness than shafts.

4) Case of brass or aluminum alloy.

5) Dust-proof and moisture-proof case.

6) Glycerin liquid filled.

7) 2.5-inch diameter or larger dial.

8) Dial: White with black markings.

9) Black indicating pointer.

10) Red maximum reading pointer indicating highest pressure attained.

11) Shatter resistant window.

12) Conform to ASME B40.100, Grade A accuracy or better.

13) Bottom connected with 0.25-inch diameter male pipe connection.

I. Flange Gaskets:

1. BLUE-GARD Style 3000 manufactured by Garlock Sealing Technologies, 1666 Division Street, Palmyra NY 14522; or equal, having the following essential characteristics:

a. For AWWA C207 flanged joints.

b. Compressed, Non-Asbestos (CNA) Gasketing with Aramid Fibers and a NBR Binder.

c. Full face or ring type.

d. For potable cold water.

J. Meter Boxes:

1. Manufactured by Oldcastle Precast, 7921 Southpark Plaza, Suite 200, Littleton, CO 80120, www.oldcastleprecast.com; or equal, having the following essential characteristics:

a. Pre-cast concrete box.

b. Pre-cast lockable lid.

K. Draft Control Damper:

1. Fabricated galvanized steel.

a. Galvanize in accordance with Section 09 96 20 – Coatings.

2. Adjusting weights.

L. Insulation:

1. For air valve insulation, see Section 07 21 60 – Insulation.

2. For blowoff valve insulation, see Section 07 21 60 – Insulation.

2.02 CONTRACTOR SOURCE QUALITY TESTING

A. Shop test butterfly valves in accordance with AWWA C504 for butterfly valves and AWWA ball valves in accordance with AWWA C507 for ball valves.

1. Leak test and hydrostatic test valves at manufacturer's facility or an alternate facility approved by COR.

2. Tests may be Government witnessed. Notify COR 30 days prior to valve testing.

3. Minimize the number of Government trips by testing all valves from the same manufacturer during the same Government trip.

4. Prior to shop leakage test and in presence of Government, Contractor shall verify that when valve is fully closed, valve position indicator indicates, "CLOSED".

5. If indicator is not in closed position (exactly at closed), remove operator from valve, fully close valve, reinstall operator so that it indicates, "CLOSED".

6. Butterfly valves shop leakage test:
   a. Pressure test valves and their seats for leaks with water in 100 percent closed position for a timed period of 5 minutes with pressure equal to rated design pressure. Valves shall be drip tight with no leakage.
   b. Downstream position of valve shall be visible to Government inspector. Downstream shall be visible and dry prior to and during test so that the seat can be visually inspected.
   c. Test Acceptance:
      1) Spray or high velocity leakage will not be acceptable.
      2) If valve leaks, adjustments shall be made until valve is drip tight with no leakage. Adjustments may include adjusting valve stops, seats, actuators, etc.
      3) If valve is not drip tight (any leakage) in either direction, valve is unacceptable.
   d. After any adjustments are made, valve position indicator shall be inspected again and corrected if necessary.
7. Butterfly valve hydrostatic test: In accordance with AWWA C504.
8. Ball valve shop leakage test: In accordance with AWWA C507.
   a. Downstream position of valve shall be visible to Government inspector.
9. Ball valve hydrostatic test: In accordance with AWWA C507.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Valves and equipment to lines and grades as shown on drawings.

B. Install valves complete and lubricated in accordance with manufacturer's instructions.

C. Valves with flanged connections: Bolt holes straddle vertical centerline when installed on horizontal pipe.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. After each valve has been completely installed, test valve in pipeline by opening and closing valve through full range of operation 3 times.

B. Make changes or adjustments until operation is approved by COR, and valves are bubble tight and do not leak water past seats.

C. Provide means for inspecting area downstream of valve during testing if required by Government.

3.03 COATING

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

END OF SECTION

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SECTION 35 42 35
BANK PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Wash Crossings:

1. Payment: Lump sum prices offered in Price Schedules for appropriate Wash Crossing Station.

   a. Includes:

      1) Compacting backfill to 85 percent.

      2) Vertical steel member (erosion indicator post).

      3) Toe rock and geotextile fabric, if required.

      4) Costs associated with stormwater discharge permit in accordance with Section 01 57 30 – Water Pollution Control.

   b. Does not include:

      1) Line pipe, joint restraints, or anchor blocks

      2) Erosion control blankets and coir wattles

1.02 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1.	AASHTO M288-15	Geotextile Specification for Highway Applications
2.	AASHTO T104-99	Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
3.	AASHTO T310-13	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
4.	AASHTO T85-14	Specific Gravity and Absorption of Coarse Aggregate
5.	AASHTO T99	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. American Society for Testing and Materials (ASTM)

1.	ASTM C535-16	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2.	ASTM D698-12e2	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 KN-m/m^3)
3.	ASTM D5080-17	Standard Test Method for Rapid Determination of Percent Compaction

1.03 SUBMITTALS

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

B. RSN 35 42 35-1, Samples:

1. Riprap: Contractor shall provide one sample of rock of at least 2 tons, meeting specified gradation.
    a. Sample shall be provided at the quarry.
    b. Sample will be used as reference for judging gradation of riprap supplied.
    c. When determined necessary, conformance of gradation will be verified through additional sampling by dumping and checking gradation of two random truckloads of stone:
        1) Riprap gradation verification can be done visually or through a particle size analysis perform in accordance with ASTM D5519, Test Method A or B.
        2) Analysis can be performed at quarry or worksite on a test pile of representative rock.
        3) Mass of test pile shall be at least 20 times the mass of largest rock in the pile.
        4) Results of test shall be compared to gradation required for project.
        5) Test pile results that do not meet construction specifications shall be cause for rock to be rejected.
        6) Mechanical equipment, a sorting site, and labor needed to assist in checking gradation shall be provided at Contractor's expense.

C. RSN 35 42 35-2, Certifications:

1. Certified test reports made by an independent testing laboratory indicating that all products meet or exceed requirements.

D. RSN 35 42 35-3, Field Verification of Wash Crossing Elevations:

1. As listed under this "Project Conditions" of this Section.

1.04 PROJECT CONDITIONS

A. Drawings included in these specifications show existing wash crossing locations, however, topography shown may not represent current ground surfaces.

1. Survey ground surface and verify depth of cover over line pipe before submitting pipe laying diagrams.

PART 2 PRODUCTS

2.01 RIPRAP

A. Rock from approved sources shall be excavated, selected, and processed to meet specified quality and grading requirements at the time rock is installed.

B. Consist of hard, dense, durable stone, angular in shape and resistant to weathering to ensure permanence in structure and climate in which it is used.

C. Rounded stone or boulders shall not be used as riprap material.

D. Stone shall have a specific gravity of at least 2.5 in accordance with AASHTO T85.

E. Each piece shall have its greatest dimension not greater than three times its least dimension.

F. Be rocks or rough quarry stone with:

1. Percent wear of not more than 60 as determined by ASTM C535.
2. Soundness loss of not more than 21 as determined by AASHTO T104.
3. Using a magnesium sulfate solution with a test duration of 5 cycles.

G. Conform to gradation requirements given in Table 34 42 35A – Riprap Gradation Requirements. Control of gradation will be by visual inspection.

Table 35 42 35A – Riprap Gradation Requirements

Stone Size D50 (In)	Percent Material Smaller Than Typical Stone	Typical Stone Dimensions (In.)	Typical Stone Weight (lbs.)
9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3

2.02 GEOTEXTILE

A. Provide Class 1 non-woven geotextile (filter fabric) in accordance with AASHTO M288, Table 6 (For *In Situ* Soil which has 15 to 50% passing 0.075mm).

2.03 EROSION CONTROL BLANKET

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.04 EROSION CONTROL BLANKET ANCHORS

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.05 COIR WATTLES

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

2.06 VERTICAL STEEL MEMBERS

A. Use angle iron, steel pipe, or steel railroad rails.

B. Use steel angles at least 4- by 4- by 0.25-inch.

C. Use standard weight steel pipe with minimum outside diameter of 4-inches, and minimum of 3/16-inch thick.

D. Use railroad rails with unit weight at least 30 pounds per yard.

1. Color: Neon orange.
2. Attach non-destructible label with the following:

NGWSP PIPELINE INDICATOR POST
If exposed, please contact Navajo Tribal Utility Authority with location

PART 3 EXECUTION

3.01 RIPRAP INSTALLATION

A. Site Preparation:

1. Compact channel bed and bank line excavated for pipe trench backfill.
   a. Compact to 85 percent of maximum density obtained using ASTM D698/AASHTO T99 (Standard Proctor) or ASTM D5080 in accordance with AASHTO T310.
2. Remove large, sharp objects including but not limited to rocks, cut trees, roots, shrubs, and glass that may damage geotextile fabric.
3. Grade wash bank slope as shown on drawings.

B. Geotextile Placement:

1. Place geotextile between riprap and supporting soil.
2. Place fabric as smoothly as possible on prepared surface.
3. Fabric may be folded or cut to conform to surface.
4. Folds and Overlaps:
    a. Fold or overlap in direction of construction.
    b. Overlap fabric a minimum of 30-inches.
5. Hold fabric in place with pins or staples.

C. Riprap Placement:

1. Place riprap stones to form continuous blanket of minimum thickness indicated on drawings.
2. Place stones with long axis parallel to toe of slope and have a stable bearing upon underlying soil or stones.
3. Make joints between larger stones as close as practicable and filled with smaller stones.
    a. Place stones with faces and shapes matched to minimize voids and form as smooth a surface as practical.
    b. Dumping backhoe placement alone is not sufficient to ensure a properly interlocked system.
    c. Material may be machine-placed then arranged as necessary by use of excavator with multi-prong grappling device or by hand to interlock and form a substantial bond.
4. Do not tear or otherwise damage geotextile fabric.
5. Ensure a layer of fabric is placed at interface between sloped and stone surfaces as shown on drawings.

D. Backfill and Compaction:

1. Place natural soil material in wash bottom to same grade as prior to pipeline trench excavation burying scour protection portion of riprap.
2. Compact soil material in 12-inch lifts using hand operated or larger compactor.

3.02 EROSION CONTROL BLANKET INSTALLATION

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

3.03 COIR WATTLE INSTALLATION

A. In accordance with Section 32 91 60 – Erosion Control Blanket.

3.04 VERTICAL STEEL MEMBER INSTALLATION

A. Drive or place vertical steel members in bed of wash crossings as shown on drawings to serve as advanced warning of channel bed lowering.

3.05 REPAIR

A. Repair or replace products damaged during installation at Contractor's expense.

END OF SECTION

SECTION 51 00 00

INFORMATION AVAILABLE TO OFFERORS

PART 1 GENERAL

1.01 ORDER OF PRECEDENCE

A. In case of differences between sections in Division 51 - Information Available to Offerors and sections in other divisions of the specifications, the requirements in the other divisions will govern.

B. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3 “Site Investigations and Conditions Affecting the Work”.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 10
CROSSING AGREEMENTS

PART 1 GENERAL

1.01 CROSSING AGREEMENTS

A. Insert Title Here

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Insert Document when provided

END OF SECTION

SECTION 51 00 20
SURVEYS

PART 1 GENERAL

1.01 SURVEYS

A. Insert Title

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Insert Document when provided

END OF SECTION

SECTION 52 00 00

DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.

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

1.02 PROJECT CONDITIONS

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

1.03 SPECIFICATION DRAWINGS

A. Some drawings show details of fabrication or other details and specifications which are not part of work under this contract. Disregard specifications and details shown on these drawings which are not applicable to work under this contract.

B. Reference drawings referred to on specification drawings and not considered necessary for contract purposes are not included in specifications.

C. Parts of work for which dimensions are not shown have been drawn to scale as nearly to final dimensions as possible before purchase of machinery or equipment and development of final general and detailed designs.

1.04 TYPICAL DRAWINGS

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

B. Use typical drawings for bidding purposes only.

1.05 ADDITIONAL OR REVISED DRAWINGS

A. Except as provided in these specifications for drawings to be furnished by Contractor, specifications drawings will be supplemented by additional or revised general and detail drawings as necessary or desirable as work progresses.

B. Do not perform work without proper drawings and instructions.

C. Additional or revised general and detail drawings will show dimensions and details necessary for construction purposes more completely than are shown on these specifications drawings for features of work.

D. Perform work in accordance with additional general and detail drawings or revisions at applicable prices offered in Price Schedules for such work.

1.06 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in drawing list are included to show existing features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.

B. If there are differences as determined by CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.07 STANDARD DRAWINGS

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

1.08 LIST OF DRAWINGS

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

1.09 DRAWING NUMBERS IN NUMERICAL ORDER

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	1695-529-60145	San Juan Lateral - General Map
2	1695-529-60098	San Juan Lateral – Reach 9 – Line Pipe – Location Map
3	1695-529-60099	San Juan Lateral – Reach 10 – Line Pipe – Location Map
4	1695-529-60100	San Juan Lateral – Reach 11 – Line Pipe – Location Map
5	1695-529-60163	San Juan Lateral – Block 9-11 – Staging Area
Civil:		
San Juan Lateral – Reach 9 – Line Pipe:		
6	1695-D-60281	Plan and Profile – Beginning to Sta. 90005+00 – Sheet 1 of 26
7	1695-D-60282	Plan and Profile – Sta. 90005+00 to Sta. 90050+00 – Sheet 2 of 26
8	1695-D-60283	Plan and Profile – Sta. 90050+00 to Sta. 90099+00 – Sheet 3 of 26
9	1695-D-60284	Plan and Profile – Sta. 90099+00 to Sta. 90150+00 – Sheet 4 of 26
10	1695-D-60285	Plan and Profile – Sta. 90150+00 to Sta. 90200+00 – Sheet 5 of 26
11	1695-D-60286	Plan and Profile – Sta. 90200+00 to Sta. 90250+00 – Sheet 6 of 26
12	1695-D-60287	Plan and Profile – Sta. 90250+00 to Sta. 90300+00 – Sheet 7 of 26
13	1695-D-60288	Plan and Profile – Sta. 90300+00 to Sta. 90350+00 – Sheet 8 of 26
14	1695-D-60289	Plan and Profile – Sta. 90350+00 to Sta. 90400+00 – Sheet 9 of 26
15	1695-D-60290	Plan and Profile – Sta. 90400+00 to Sta. 90450+00 – Sheet 10 of 26
16	1695-D-60291	Plan and Profile – Sta. 90450+00 to Sta. 90500+00 – Sheet 11 of 26

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
17	1695-D-60292	Plan and Profile – Sta. 90500+00 to Sta. 90550+00 – Sheet 12 or 26
18	1695-D-60293	Plan and Profile – Sta. 90550+00 to Sta. 90600+00 – Sheet 13 or 26
19	1695-D-60294	Plan and Profile – Sta. 90600+00 to Sta. 90649+00 – Sheet 14 or 26
20	1695-D-60295	Plan and Profile – Sta. 90649+00 to Sta. 90700+00 – Sheet 15 of 26
21	1695-D-60296	Plan and Profile – Sta. 90700+00 to Sta. 90750+00 – Sheet 16 of 26
22	1695-D-60297	Plan and Profile – Sta. 90750+00 to Sta. 90800+00 – Sheet 17 of 26
23	1695-D-60298	Plan and Profile – Sta. 90800+00 to Sta. 90850+00 – Sheet 18 of 26
24	1695-D-60299	Plan and Profile – Sta. 90850+00 to Sta. 90900+00 – Sheet 19 of 26
25	1695-D-60300	Plan and Profile – Sta. 90900+00 to Sta. 90950+00 – Sheet 20 of 26
26	1695-D-60301	Plan and Profile – Sta. 90950+00 to Sta. 91000+00 – Sheet 21 of 26
27	1695-D-60302	Plan and Profile – Sta. 91000+00 to Sta. 91050+00 – Sheet 22 of 26
28	1695-D-60303	Plan and Profile – Sta. 91050+00 to Sta. 91100+00 – Sheet 23 of 26
29	1695-D-60304	Plan and Profile – Sta. 91100+00 to Sta. 91150+00 – Sheet 24 of 26
30	1695-D-60305	Plan and Profile – Sta. 91150+00 to Sta. 91200+00 – Sheet 25 of 26
31	1695-D-60306	Plan and Profile – Sta. 91200+00 to End – Sheet 26 of 26
San Juan Lateral – Reach 10 – Line Pipe:		
32	1695-D-60307	Plan and Profile – Beginning to End (Station 10003+58)

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
33	1695-D-60308	Temporary 6-Inch Construction Water Line – Plan and Profile
San Juan Lateral – Reach 11 – Line Pipe:		
34	1695-D-60309	Plan and Profile – Beginning to Sta. 11100+00 – Sheet 1 of 5
35	1695-D-60310	Plan and Profile – Sta. 11100+00 to Sta. 11150+00 – Sheet 2 of 5
36	1695-D-60311	Plan and Profile – Sta. 11150+00 to Sta. 11200+00 – Sheet 3 of 5
37	1695-D-60312	Plan and Profile – Sta. 11200+00 to Sta. 11240+00 – Sheet 4 of 5
38	1695-D-60313	Plan and Profile – Sta. 11240+00 to End (Sta. 11279+60) – Sheet 5 of 5
San Juan Lateral – Block 9-11 – Line Pipe:		
39	1695-D-60314	Pressure Pipe Trench – Installation – Sections and Details
40	1695-D-60315	Concrete Encased – Miter Bends – Sections and Details – Sheet 1 of 2
41	1695-D-60316	Concrete Encased – Miter Bends – Sections and Details – Sheet 2 of 2
42	1695-D-60317	Concrete Encased – Miter Bends – Data Tables
43	1695-D-60318	Air Valve Installation – Sections and Details
44	1695-D-60319	Air Valves with Manholes – Sections and Details
45	1695-D-60320	Air Valves – Data Tables
46	1695-D-60321	Blowoff – Sections and Details
47	1695-D-60322	Manhole with Blowoff – Sections, Details, and Tables
48	1695-D-60323	Typical Buried Manhole – Plan, Sections and Table
49	1695-D-60324	Sectionalizing Valve – Installation – Plan, Sections and Details
50	1695-D-60325	Sectionalizing Valve – Installation – Tapers, Adaptors, and Collars

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
51	1695-D-60326	Sectionalizing Valve – Installation – Typical Layout
52	1695-D-60327	Precast Concrete Manholes – Details
53	1695-D-60328	Crownpoint Turnout – Plan, Sections and Details
54	1695-D-60329	Typical Road Crossing – Open Cut - Sections
55	1695-D-60330	Road Crossing – BIA Road 9 – Sta. 11065+20
56	1695-D-60331	Plan and Profile – Gas Line Crossings
57	1695-D-60332	Plan and Profile – Steep Pipe Anchor Blocks
58	1695-D-60333	Steep Pipe Anchor – Blocks – Profile, Sections, and Details
59	1695-D-60334	Reach 10 – Temporary Construction Water Line – Sections and Details – Sheet 1
60	1695-D-60335	Wash Crossing – Erosion Control Details – Sheet 1
61	1695-D-60336	Wash Crossing – Erosion Control Details – Sheet 2
62	1695-D-60337	Wash Crossing – Sta. 90023+26
63	1695-D-60338	Wash Crossing – Sta. 90077+09
64	1695-D-60339	Wash Crossing – Sta. 90097+40
65	1695-D-60340	Wash Crossing – Sta. 90106+05 & Sta. 90124+68
66	1695-D-60342	Wash Crossing – Sta. 90163+39
67	1695-D-60343	Wash Crossing – Sta. 90261+28
68	1695-D-60344	Wash Crossing – Sta. 90283+24
69	1695-D-60345	Wash Crossings – Sta. 90298+16 & Sta. 90628+16
70	1695-D-60346	Wash Crossing – Sta. 90376+25
71	1695-D-60347	Wash Crossing – Sta. 90389+71
72	1695-D-60348	Wash Crossing – Sta. 90401+39
73	1695-D-60349	Wash Crossing – Sta. 90465+63
74	1695-D-60351	Wash Crossing – Sta. 90579+06
75	1695-D-60352	Wash Crossing – Sta. 90609+15
76	1695-D-60355	Wash Crossing – Sta. 90833+35

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
77	1695-D-60356	Wash Crossing – Sta. 91186+26
78	1695-D-60357	Wash Crossing – Sta. 11167+00
79	1695-D-60360	Corrosion Protection – Impressed Current – Deep Well Anode Bed – Sheet 1
80	1695-D-60361	Corrosion Protection – Test Station Details 1 of 2 – Sheet 2
81	1695-D-60362	Corrosion Protection – Test Station Details 2 of 2 – Sheet 3
82	1695-D-60363	Corrosion Protection – Bond Details – Sheet 4
83	1695-D-60364	Corrosion Protection – Galvanic Anode – Cathodic Protection – Anode Bed – Sheet 5
Information Drawings:		
84	1695-D-1	San Juan Lateral – Reach 12A – Twin Lakes to Tohlakai Hill – Sta. 12011+00 to 12060+00 – Plan and Profile
Standard Drawings:		
85	40-D-6136	Manholes – Class 125 LB. – Plate Steel
86	40-D-6137	Manholes – Class 150 LB. and 300 LB. – Plate Steel
87	40-D-7102	Standard and Typical Designs - Government Drawing Format - Drawing Border, Sample Title Block, and Signature Lines
88	40-D-60002	Miscellaneous Metalwork – Typical Guard Posts – Non-Security Application
89	40-D-60003	Concrete Outline and Reinforcement – General Notes for Concrete Outline and Reinforcement – Sheet 1 of 2
90	40-D-60004	Concrete Outline and Reinforcement – Minimum Requirements for Detailing Reinforcement – Sheet 2 of 2
91	104-D-254	Box Terminations

Table 52 00 00B - Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-	

Table 52 00 00B - Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-1	84
1695-D-60281	6
1695-D-60282	7
1695-D-60283	8
1695-D-60284	9
1695-D-60285	10
1695-D-60286	11
1695-D-60287	12
1695-D-60288	13
1695-D-60289	14
1695-D-60290	15
1695-D-60291	16
1695-D-60292	17
1695-D-60293	18
1695-D-60294	19
1695-D-60295	20
1695-D-60296	21
1695-D-60297	22
1695-D-60298	23
1695-D-60299	24
1695-D-60300	25
1695-D-60301	26
1695-D-60302	27
1695-D-60303	28
1695-D-60304	29
1695-D-60305	30
1695-D-60306	31

Table 52 00 00B - Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-60307	32
1695-D-60308	33
1695-D-60309	34
1695-D-60310	35
1695-D-60311	36
1695-D-60312	37
1695-D-60313	38
1695-D-60314	39
1695-D-60315	40
1695-D-60316	41
1695-D-60317	42
1695-D-60318	43
1695-D-60319	44
1695-D-60320	45
1695-D-60321	46
1695-D-60322	47
1695-D-60323	48
1695-D-60324	49
1695-D-60325	50
1695-D-60326	51
1695-D-60327	52
1695-D-60328	53
1695-D-60329	54
1695-D-60330	55
1695-D-60331	56
1695-D-60332	57
1695-D-60333	58

Table 52 00 00B - Drawings in Numerical Order

Drawing No.	Sheet No.
1695-D-60334	59
1695-D-60335	60
1695-D-60336	61
1695-D-60337	62
1695-D-60338	63
1695-D-60339	64
1695-D-60340	65
1695-D-60342	66
1695-D-60343	67
1695-D-60344	68
1695-D-60345	69
1695-D-60346	70
1695-D-60347	71
1695-D-60348	72
1695-D-60349	73
1695-D-60351	74
1695-D-60352	75
1695-D-60355	76
1695-D-60356	77
1695-D-60357	78
1695-D-60360	79
1695-D-60361	80
1695-D-60362	81
1695-D-60363	82
1695-D-60364	83
1695-529-	
1695-529-401	1

Table 52 00 00B - Drawings in Numerical Order

Drawing No.	Sheet No.
1695-529-60098	2
1695-529-60099	3
1695-529-60100	4
1695-529-60163	5
40-D-	
40-D-6136	85
40-D-6137	86
40-D-7102	87
40-D-60002	88
40-D-60003	89
40-D-60004	90
104-D-	
104-D-254	91

END OF SECTION

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SECTION 53 10 00
GEOLOGIC INVESTIGATIONS

PART 1 GENERAL

1.01 GENERAL

A. This section describes surface and subsurface geologic conditions for Block 9 through 11 project areas. Other sections of these specifications contain geological and geotechnical information important for understanding the significance of geologic conditions to construction operations.

B. Project area foundation and site geology is discussed for each major project feature listed below:

1. Pipeline Station 90009+82 to 11280+50.

C. Geologic drawings, sections, descriptions, groundwater-level data, logs of subsurface explorations, and geologic surface map data contained in these specifications include geologic data on which design of the work are based and are considered. Selected samples recovered during subsurface exploration were laboratory tested to determine physical properties for the design of project features. All information and data included in these specifications supersede any previous versions, which may be available for examination by bidders. Only data that are specific to the needs of these specifications are included in these specifications. These data are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations. Bidders are encouraged to inspect the site to obtain their own samples and perform tests on the materials to evaluate properties, which the bidder believes to be significant.

D. Unconsolidated soil materials recorded in all geologic exploration logs included in these specifications were classified under Unified Soil Classification System procedures as described in Reclamation standards USBR 5000 (laboratory classification) and USBR 5005 (visual classification). These two procedures are similar to ASTM D2487 and ASTM D2488, respectively. Copies of the above Reclamation procedures are available for review through the Four Corners Construction Office (FCCO). Also refer to drawing 103-D-347.

E. Descriptions of bedrock materials, including weathering, fracturing, hardness, etc., have been standardized as shown and defined on standard drawings 40-D-7022 and 40-D-7023. These standards are further explained and defined in the Reclamation Engineering Geology Field Manual.

F. Geologic data describes geologic conditions at specific locations and dates collected. Encountered geologic conditions and contacts will differ from locations not investigated. Interpretive drawings are prepared to suggest general trends between data points and do not depict local irregularities. Details of important geologic considerations related to excavation of the foundation for the proposed site are discussed in Geology and Engineering Geology

Considerations sections below. Additional information is provided in applicable Earthworks sections.

G. Select samples of unconsolidated soil deposits recovered during investigations were tested by Reclamation FCCO Laboratory. Summaries of laboratory test results are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations. Additional information regarding Reclamation laboratory testing of soil materials is available by contacting Reclamation, FCCO materials laboratory at telephone number (505)-324-5035.

H. Geology site conditions, geologic investigation locations, and stick log information for the pipeline are shown as plan and profile drawings within Section 52 00 00 - Drawings. Additional geologic information for regulating tanks and pumping plants are shown on drawings included in Section 53 20 00 - Records of Geologic and Subsurface Investigations.

I. Bedrock surface as depicted on plan and profile drawings and geologic sections may not indicate final foundation grade or define limits of excavation.

1.02 REFERENCE REPORTS

A. Copies of the following reports and memoranda, which contain pertinent information on the area, site geology, and materials properties, may be examined at Bureau of Reclamation, FCCO, 2200 Bloomfield Highway, Farmington, New Mexico; or at Technical Service Center, 6th and Kipling, Building 67, Room 1068, Denver, Colorado. Bidders wishing to inspect reports and memoranda should make arrangements through FCCO at (505) 325-1794.

1. Navajo Gallup Water Supply Project - Geologic Design Data Report - San Juan Lateral Block 9-11; Department of the Interior, Bureau of Reclamation, Upper Colorado Region, Four Corners Construction Office, Durango, Colorado; 2016.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D2487-11	Classification of Soils for Engineering Purposes (Unified Soil Classification)
2.	ASTM D2488-09a	Description and Identification of Soils (Visual-Manual Procedure)
3.	ASTM D7382-15	Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibrating Hammer

B. Bureau of Reclamation Standards (Reclamation)

1. Earth Manual, Part 2, Third Edition (1990)

a.	Reclamation 5000	Determining Unified Soil Classification (Laboratory Method)

b.	Reclamation 5005	Determining Unified Soil Classification (Visual Method)
c.	Reclamation 5500	Performing Laboratory Compaction of Soils - 5.5-lbm Rammer and 18 inch Drop.
d.	Reclamation 7205	Determining Unit Weight of Soils In-place by the Sand-Cone Method.

2. Engineering Geology Field Manual, Second Edition (1998)

PART 2 GEOLOGIC INVESTIGATIONS

2.01 GEOLOGIC INVESTIGATIONS

A. Geologic investigations conducted for Block 9 through 11 project areas are listed below and pertinent data are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations.

1. Geologic investigations were conducted for Reach 9 through 11 project areas. Investigations have been included in the discussion and data section of these specifications.

2. Only subsurface investigations within about 100-feet from pipeline alignment and project structures have been included in these specifications, unless otherwise noted. Geologic logs and laboratory data from investigations are included in Section 53 20 00 - Records of Geologic Investigations and Subsurface Investigations. Locations of applicable subsurface investigations and stick log data are provided on drawings 1695-D-60281 through 1695-D-60307 and 1695-D-60309 through 1695-D-60313 located in Section 52 00 00 - Drawings. Additional geologic information is included on geology drawings included in section 53 20 00 – Records of Geologic and Subsurface Investigations. Relevant geologic investigations conducted by FCCO in 2014 through 2016 include:

   a. 31 drill holes, 84 test pits and 34 cone penetrometer test holes.

   b. In-place density testing using the sand cone replacement method, in accordance to USBR 7205, was conducted in most test pits.

   c. Laboratory testing included gradation and physical property testing for select soil samples from drill holes and test pits, and compaction testing of materials sampled from in-place density tests. Compaction testing, in accordance to USBR 5500, was conducted on cohesive soil materials. Vibratory hammer compaction tests, according to ASTM D7382, were conducted on select samples of non-cohesive soil materials.

   d. Geologic mapping at a scale of 1-inch to 400-feet was conducted along pipeline alignment.

3. Equipment:

a. Drill holes were conducted with two different drill rigs or by hand auger: Central Mining Equipment (CME) 85 truck-mounted drill rig and CME 850 track-mounted drill rig. Drill holes were advanced using hollow stem augers that were 4.25-inch outer-diameter and 3.25-inch inner-diameter. Sampling through the augers was conducted using a 2.5-inch inner-diameter split-barrel sampler and Standard Penetration Test (SPT) sampler. SPT was conducted using a 2-inch outer-diameter by 1 3/8-inch inner-diameter by 1.5-foot long split-barrel sampler and advanced using an automatic hammer system. Rock core was sampled using an HQ3 wireline coring system. Refer to drill hole logs for specific drilling equipment used. Hand auger drill holes were conducted using a 3 1/4-inch diameter steel auger.

b. Test pits were excavated using four different rubber tire backhoes: Case 580N backhoe, Case 580 Super M backhoe, Case 680L backhoe or John Deere 310J backhoe. Each used a bucket that was 2-feet wide with teeth. Refer to test pit logs for specific equipment used.

c. All Cone Penetrometer Test (CPT) holes were conducted using an electronic cone penetrometer, pushed via hydraulic push system. Cone penetrometer test push system was manufactured by Vertek/Applied Research Associates, Inc., in 2006. As cone is pushed at a rate of approximately 2-centimeters per second (0.8-inches per second), tip, sleeve, and pore pressures are measured and recorded every 25- to 55-millimeters (approximately 1- to 2-inches). Testing was performed in accordance with ASTM standard D 5778. A Ten cubic centimeter (cm^2) 10 ton digital subtraction cone with area ratio of 0.8 was used for all testing. The digital data acquisition system was an Electronic Field Computer System (EFCS4) originally manufactured by Hogentogler (currently Vertek).

PART 3 GEOLOGY

3.01 REGIONAL GEOLOGY

A. Block 9 through11 features are located east of Chuska Mountains, near the southern and western margins of the San Juan Basin north of Gallup New Mexico. San Juan Basin is a structural depression on the order of about 5,000-feet and contains Quaternary and Tertiary alluvium, resting on rocks of Cretaceous and Tertiary age, which crop out around the margins of the basin. The San Juan Basin is characterized by young plateaus, mesas, and dry-wash canyons presently being eroded in an arid climate.

3.02 SITE GEOLOGY

A. Stratigraphy: Project area includes unconsolidated surficial soils and sedimentary bedrock units of Cretaceous Menefee Formation.

B. Quaternary Pediment (Qpd): Pediment deposits are found on sloped, erosional surfaces of the Cretaceous Menefee Formation within project area. These deposits are typically found on bedrock and consist of various amounts of silt, sand, subangular to subrounded gravel,

and cobbles with intermittent subangular to surrounded boulders. Gravel cobbles and boulders are primarily comprised of hard sandstone with sporadic basalt, quartzite chert, and petrified wood. These deposits primarily originate from Chuska Mountains west of project area. Maximum observed thickness of Pediment deposits was up to 10.4-feet thick in test pit TPR9-16-43.

C. Quaternary Alluvium (Qal): Quaternary alluvium deposits overlie bedrock through most of project area. Numerous soil types are encountered, including Silty Sand (SM), Clayey Sand (SC), Lean Clay with Sand (CL)s, Lean Clay (CL), Sandy Lean Clay s(CL), and Fat Clay (CH). For more detail, see each specific geologic log. Quaternary Alluvium (Qal) is used to describe all unconsolidated surficial deposits along alignment regardless of origin. Alluvium is derived from a variety of sources including Aeolian, alluvial and colluvial deposition as well as weathering and decomposition of in-place claystone, shale, siltstone, and sandstone bedrock. Alluvium reaches a maximum observed thickness of 28.2-feet in DHR-15-23.

D. Cretaceous Menefee Formation (Kmf) is a bedrock unit comprised of sandstone, claystone, siltstone, shale and coal in some areas. Kmf in Block 9 through 11 project area is described as primarily light brown, fine grained sandstone with interbedded claystone, shale and siltstone but can vary in color and grain size. Bedrock generally has a shallow dip to the northeast. Sandstone is generally moderately weathered, moderately soft to soft and slightly fractured at the surface. The same sandstone unit when excavated below ground level, can occasionally be moderately hard and slightly weathered. A hard, iron rich, calcareous sandstone bed frequently cap the upper 1- to 3-feet in some areas and is occasionally interbedded within softer sandstone units. This cap rock/interbedded sandstone is often hard, broken with heavy hammer blow. Claystone is sandy, light brown to gray in color and is generally laminated to thinly bedded, intensely to moderately weathered and soft. Claystone often grades to siltstone and occasionally is fissile, grading to shale.

3.03 PIPELINE STATION TO STATION GEOLOGY

A. Approximate Station 90010+00 to 90019+50: Mostly soil will likely be encountered during trench excavation through this segment. Investigations include: 1 test pit and 1 CPT.

1. Test pit TPR9-15-1 encountered soil from 0.0 to 11.7-feet. Poorly Graded Sand with Gravel and Cobbles (SP)gc from 0.0 to 9.5-feet, Poorly Graded Sand with Gravel, Cobbles and Boulders (SP)gcb from 9.5- to 10.6-feet and Sandy Lean Clay s(CL) from 10.6- to 11.7-feet. Excavation was terminated at limits of equipment.

2. CPT hole CPT9-14-1 reached refusal at 5.0-feet.

B. Approximate Station 90019+50 to 90037+50: Mostly soil will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90022+50. Investigations include: 1 test pit and 1 CPT.

1. Test pit TPR9-15-2 encountered Silty Sand (SM) from 0.0 to 12.0-feet. Excavation was terminated at limits of equipment.

    a. An in-place density test conducted at about 7.5-feet had a dry density of 96.2 lbs/ft3 with a moisture content of 2.6 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 103.1 lbs/ft3 with an optimum water content of 14.3 percent.

2. CPT hole CPT9-14-2 reached refusal at 6.2-feet.

C. Approximate Station 90037+50 to 90042+20: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole.

1. Drill hole DHR9-15-1 encountered soil from 0.0 to 7.7-feet and bedrock from 7.7- to 28.7-feet. Silty Sand (SM) from 0.0 to 7.7-feet. Slightly weathered, soft sandstone interbedded with claystone was encountered from 7.7- to 10.3-feet. Moderately to slightly weathered, very soft claystone from 10.3- to 28.7-feet.

D. Approximate Station 90042+20 to 90044+50: Bedrock comprised of sandstone and claystone is exposed at the ground surface through this segment. No subsurface investigations were conducted along this segment of pipeline.

E. Approximate Station 90044+50 to 90055+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 test pits and 1 CPT.

1. Test pit TPR9-15-3 encountered soil from 0.0 to 5.0-feet and bedrock from 5.0- to 8.5-feet. Clayey Sand (SC) was encountered from 0.0 to 2.5-feet, Sandy Lean Clay s(CL) from 2.5- to 5.0-feet. Moderately weathered, soft claystone was encountered from 5.0- to 8.0-feet and intensely to moderately weathered, very soft to soft sandstone from 8.0- to 8.5-feet. Excavation was terminated at refusal in bedrock.

2. CPT hole CPT9-14-3 reached refusal at 10.2-feet.

F. Approximate Station 90055+00 to 90077+40: Mostly soil will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90076+00. Investigations include: 2 test pits and 1 CPT.

1. Test pit TPR9-15-4 encountered soil from 0.0 to 14.5-feet. Clayey Sand (SC) was encountered from 0.0 to 4.2-feet and Silty Sand (SM) from 4.2- to 14.5-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 104.7 lbs/ft3 with a moisture content of 2.8 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 116.3 lbs/ft3 with an optimum water content of 11.6 percent.

2. Test pit TPR9-15-5 encountered soil from 0.0 to 13.2-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 6.9-feet and Silty Sand (SM) from 6.9- to 13.2-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0--feet had a dry density of 103.4 lbs/ft3 with a moisture content of 6.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 106.4 lbs/ft3 with an optimum water content of 17.2 percent.

3. CPT hole CPTR9-14-4 was advanced to 30.0-feet of depth.

G. Approximate Station 90077+40 to 90082+30: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 CPT.

1. CPT hole CPTR9-14-5 reached refusal at 22.4-feet.

H. Approximate Station 90082+30 to 90099+50: Mostly soil will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90097+50. No subsurface investigations were conducted along this segment of pipeline.

I. Approximate Station 90099+50 to 90104+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole and 1 CPT.

1. Drill hole DHR9-15-2 encountered soil from 0.0 to 10.8-feet and bedrock from 10.8- to 25.0-feet. Clayey Sand (SC) was encountered from 0.0 to 10.8-feet. Intensely to moderately weathered, very soft claystone was encountered from 10.8- to 22.4-feet, moderately to slightly weathered, soft sandstone from 22.4- to 25.0-feet.

2. CPT hole CPTR9-14-7 reached refusal at 3.7-feet.

J. Approximate Station 90104+00 to 90139+50: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 90106+50 and Station 90124+00. Investigations include: 1 test pits.

1. Test pit TPR9-15-8 encountered soil from 0.0 to 11.0-feet. Silty Sand (SM) was encountered from 0.0 to 2.1-feet, Clayey Sand (SC) from 2.1- to 6.9-feet and Sandy Lean Clay s(CL) from 6.9- to 11.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a maximum dry density of 78.1 lbs/ft^3 with a moisture content of 2.6 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 109.0 lbs/ft^3 with an optimum water content of 17.0 percent.

K. Approximate Station 90139+50 to 90141+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 test pit.

1. Test pit TPR9-15-9 encountered soil from 0.0 to 6.7-feet and bedrock from 6.7- to 11.6-feet. Silty Sand with Gravel and Cobbles (SM)gc was encountered from 0.0 to 6.7-feet. Moderately weathered, soft claystone was encountered from 6.7- to 11.6-feet. Excavation was terminated at refusal in bedrock.

L. Approximate Station 90141+00 to 90149+40: Mostly soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. No subsurface investigations were conducted along this segment of pipeline.

M. Approximate Station 90149+40 to 90151+50: Bedrock comprised of sandstone and shale is exposed at ground surface through this segment. No subsurface investigations were conducted along this segment of pipeline.

N. Approximate Station 90151+50 to 90166+00: Mostly soil with some bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90163+50. Investigations include: 1 drill hole and 1 CPT.

1. Drill hole DHR9-15-3 encountered soil from 0.0 to 19.2-feet and bedrock from 19.2- to 25.0-feet. Silty Sand (SM) was encountered from 0.0 to 6.1-feet, Clayey Sand (SC) from 6.1- to 8.6-feet, Fat Clay (CH) from 8.6- to 10.9-feet and Clayey Sand (SC) from 10.9- to 19.2-feet. Decomposed claystone was encountered from 19.2- to 25.0-feet.
2. CPT hole CPTR9-14-8 reached refusal at 18.3-feet.

O. Approximate Station 90166+00 to 90198+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole, 2 test pits and 2 CPTs.

1. Drill hole DHR9-15-4 encountered soil from 0.0 to 2.5-feet and bedrock from 2.5- to 25.0-feet. Silty Sand with Gravel (SM)g was encountered from 0.0 to 2.5-feet. Very intensely weathered, very soft sandstone was encountered from 2.5- to 11.9-feet, slightly weathered to fresh, hard sandstone from 11.9- to 13.2-feet, intensely to moderately weathered, soft sandstone from 13.2- to 24.5-feet and intensely to moderately weathered, soft claystone from 24.5- to 25.0-feet.
2. Test pit TPR9-15-10 encountered soil from 0.0 to 10.2-feet and bedrock from 10.2- to 12.3-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 10.2-feet. Slightly weathered to fresh, moderately hard sandstone was encountered from 10.2- to 11.0-feet, moderately weathered, soft claystone from 11.0- to 12.3-feet. Excavation was terminated at refusal in bedrock.
    a. An in-place density test conducted at about 7.0-feet had a dry density of 91.9 lbs/ft^3 with a moisture content of 3.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.6 lbs/ft^3 with an optimum water content of 14.5 percent.
3. Test pit TPR9-15-11encountered soil from 0.0 to 7.2-feet and bedrock from 7.2- to 8.0-feet. Clayey Sand (SC) was encountered from 0.0 to 3.3-feet, Silty Sand (SM) from 3.3- to 7.2-feet. Very intensely weathered, very soft sandstone was encountered from 7.2- to 8.0-feet. Excavation was terminated at refusal in bedrock.
4. CPT hole CPT9-14-9 reached refusal at 14.1-feet.
5. CPT hole CPT9-14-10 reached refusal at 3.2-feet.

P. Approximate Station 90198+00 to 90237+00: Mostly soil is likely to be encountered during trench excavation through this segment. Investigations include: 1 drill hole and 2 test pits.

1. Drill hole DHR9-15-5 encountered soil from 0.0 to 21.1-feet. Silty Sand (SM) was encountered from 0.0 to 16.3-feet, Poorly Graded Sand with Gravel (SP)g from 16.3- to 21.1-feet.

2. Test pit TPR9-15-12 encountered soil from 0.0 to 12.2-feet. Clayey Sand (SC) was encountered from 0.0 to 2.5-feet, Silty Sand with Gravel and Cobbles (SM)gc from 2.5- to 12.2-feet. Excavation was terminated at limit of equipment.

3. Test pit TPR9-15-13 encountered soil from 0.0 to 11.7-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 3.8-feet, Lean Clay (CL) from 3.8- to 6.4-feet and Silty Sand with Gravel and Cobbles (SM)gc from 6.4- to 11.7-feet. Excavation was terminated at limit of equipment.

Q. Approximate Station 90237+00 to 90245+25: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 test pits and 1 CPT.

Test pit TPR9-15-14 encountered soil from 0.0 to 9.5-feet and bedrock from 9.5- to 10.0-feet. Silty Sand (SM) was encountered from 0.0 to 2.0-feet, Clayey Sand (SC) from 2.0- to 5.6-feet, Sandy Lean Clay s(CL) from 5.6- to 9.5-feet. Intensely to moderately weathered, soft sandstone was encountered from 9.5- to 10.0-feet. Excavation was terminated at refusal in bedrock.

a. An in-place density test conducted at about 7.5-feet had a dry density of 101.6 lbs/ft^3 with a moisture content of 6.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 113.3 lbs/ft^3 with an optimum water content of 14.5 percent.

2. CPT hole CPTR9-14-11 reached refusal at 6.4-feet.

R. Approximate Station 90245+25 to 90297+60: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 90262+00 and Station 90283+00. Investigations include: 1 drill hole, 3 test pits and 1 CPT.

1. Drill hole DHR9-15-6 encountered soil from 0.0 to 26.5-feet. Poorly Graded Sand with Clay (SP-SC) was encountered from 0.0 to 7.5-feet, Clayey Sand (SC) from 7.5- to 12.0-feet, Silty Sand with Gravel (SM)g from 12.0- to 17.0-feet, Poorly Graded Sand with Silt (SP-SM) from 17.0- to 17.5-feet, Poorly Graded Sand with Gravel (SP)g from 17.5- to 22.7-feet, and Silty Sand (SM) from 22.7- to 26.5-feet.

2. Test pit TPR9-15-15 encountered soil from 0.0 to 14.0-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 12.0-feet and Poorly Graded Sand with Gravel and Cobbles (SP)gc from 12.0- to 14.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.5--feet had a dry density of 89.4 lbs/ft^3 with a moisture content of 3.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.4 lbs/ft^3 with an optimum water content of 14.0 percent.

3. Test pit TPR9-15-16 encountered soil from 0.0 to 14.0-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 7.0-feet, Lean Clay with Sand (CL)s from 7.0- to 7.3-feet, Poorly Graded Sand (SP) from 7.3- to 12.5-feet and Poorly Graded Sand with Gravel and Cobbles from 12.5- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 8.0-feet had a dry density of 88.4 lbs/ft^3 with a moisture content of 4.1 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.4 lbs/ft^3 with an optimum water content of 13.6 percent.

4. Test pit TPR9-15-17 encountered soil from 0.0 to 14.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 1.9-feet, Poorly Graded Sand (SP) from 1.9- to 4.3-feet and Clayey Sand (SC) from 4.3- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.5-feet had a dry density of 92.1 lbs/ft^3 with a moisture content of 7.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.5 lbs/ft^3 with an optimum water content of 15.5 percent.

5. CPT hole CPTR9-14-12 reached refusal at 21.4-feet.

S. Approximate Station 90297+60 to 90321+00: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90298+00. Investigations include: 2 test pits and 1 CPT.

1. Test pit TPR9-15-18 encountered soil from 0.0 to 8.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 4.0-feet and Cobbles and Boulders with Gravel and Silt from 4.0- to 8.0-feet. Excavation was terminated at limit of equipment.

2. Test pit TPR9-15-19 encountered soil from 0.0 to 15.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 2.1-feet, Clayey Sand (SC) from 2.1- to 4.0-feet, Poorly Graded Sand with Silt (SP-SM) from 4.0- to 6.0-feet, Poorly Graded Sand with Silt Gravel, Cobbles and Boulders from 6.0- to 7.5-feet and Poorly Graded Sand with Silt (SP-SM) from 7.5- to 15.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 8.5-feet had a dry density of 104.8 lbs/ft^3 with a moisture content of 2.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 109.3 lbs/ft^3 with an optimum water content of 13.7 percent.

3. CPT hole CPT9-14-13 reached refusal at 3.4-feet.

T. Approximate Station 90321+00 to 90334+00: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90325+00. Investigations include: 1 test pit.

1. Test pit TPR9-15-20 encountered soil from 0.0 to 10.0-feet. Clayey Sand (SC) was encountered from 0.0 to 0.3-feet, Poorly Graded Sand with Silt (SP-SM) from 0.3- to

1.3-feet, Clayey Sand (SC) from 1.3- to 4.3-feet and Sandy Lean Clay s(CL) from 4.3- to 10.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 8.5-feet had a dry density of 96.8 lbs/ft^3 with a moisture content of 9.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 100.6 lbs/ft^3 with an optimum water content of 21.1 percent.

U. Approximate Station 90334+00 to 90360+00: Soil with shallow bedrock will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90342+00. Investigations include: 1 drill hole, 2 test pits.

1. Drill hole DHR9-15-7 encountered soil from 0.0 to 7.3-feet and bedrock from 7.3- to 25.0-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 7.3-feet. Decomposed, very soft sandstone was encountered from 7.3- to 7.8-feet and moderately weathered, soft sandstone from 7.8- to 25.0-feet.

2. Test pit TPR9-15-21 encountered soil from 0.0 to 13.5-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 2.0-feet, Poorly Graded Gravel with Sand, Cobbles and Boulders (GP)scb from 2.0- to 11.0-feet and Poorly Graded Sand with Gravel (SP)g from 11.0- to 13.5-feet. Excavation was terminated at limit of equipment.

3. Test pit TPR9-15-22 encountered soil from 0.0 to 1.2-feet and bedrock from 1.2- to 5.0-feet. Lean Clay with Sand (CL)s was encountered from 0.0 to 1.2-feet. Very intensely weathered, soft claystone was encountered from 1.2- to 2.5-feet and moderately weathered, moderately hard claystone from 2.5- to 5.0-feet. Excavation was terminated at refusal in bedrock.

V. Approximate Station 90360+00 to 90376+50: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses three significant drainages located at approximate Station 90363+00, Station 90367+00 and Station 90376+00. Investigations include: 1 test pit.

1. Test pit TPR9-15-23 encountered soil from 0.0 to 14.5-feet. Clayey Sand (SC) was encountered from 0.0 to 1.5-feet, Poorly Graded Sand (SP) from 1.5- to 7.0-feet, Silty Sand (SM) from 7.0- to 14.0-feet and Clayey Sand (SC) from 14.0- to 14.5-feet.

a. An in-place density test conducted at about 7.5-feet had a dry density of 92.2 lbs/ft^3 with a moisture content of 7.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.2 lbs/ft^3 with an optimum water content of 14.6 percent.

W. Approximate Station 90376+50 to 90407+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 90379+50 and Station 90401+00. Investigations include: 1 drill hole and 1 test pit.

1. Drill hole DHR9-15-8 encountered soil from 0.0 to 10.0-feet and bedrock from 10.0- to 25.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 2.7-feet, Poorly Graded Sand with Gravel (SP)g from 2.7- to 10.0-feet. Very intensely

weathered, very soft claystone was encountered from 10.0- to 12.0-feet, intensely to moderately weathered, soft claystone from 12.0- to 25.0-feet.

2. Test pit TPR9-15-24 encountered soil from 0.0 to 6.5-feet and bedrock from 6.5- to 7.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 3.0-feet, Poorly Graded Sand with Silt and Gravel (SP-SM)g from 3.0- to 4.0-feet, Poorly Graded Sand with Silt (SP-SM) from 4.0- to 6.5-feet. Moderately weathered, moderately hard claystone was encountered from 6.5- to 7.5-feet. Excavation was terminated at refusal in bedrock.

X. Approximate Station 90407+00 to 90416+00: Mostly soil is likely to be encountered during trench excavation through this segment. Investigations include: 1 test pit.

1. Test pit TPR9-15-25 encountered soil from 0.0 to 17.0-feet. Silty Sand (SM) was encountered from 0.0 to 17.0-feet. Excavation was terminated at limits of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 86.6 lbs/ft^3 with a moisture content of 6.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 112.6 lbs/ft^3 with an optimum water content of 13.6 percent.

Y. Approximate Station 90416+00 to 90432+00: Mostly soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole.

1. Drill hole DHR9-15-9 encountered soil from 0.0 to 11.1-feet and bedrock from 11.1- to 25.0-feet. Silty Sand (SM) was encountered from 0.0 to 6.9-feet, Clayey Sand (SC) from 6.9- to 11.1-feet. Decomposed and Very intensely weathered, very soft to soft sandstone was encountered from 11.1- to 25.0-feet.

Z. Approximate Station 90432+00 to 90478+50: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 90432+50 and Station 90465+50. Investigations include: 4 test pits and 1 CPT.

1. Test pit TPR9-15-26 encountered soil from 0.0 to 14.0-feet. Clayey Sand (SC) was encountered from 0.0 to 3.7-feet, Poorly Graded Sand (SP) from 3.7- to 5.7-feet, Clayey Sand (SC) from 5.7- to 8.5-feet, Poorly Graded Sand (SP) from 8.5- to 12.0-feet and Clayey Sand (SC) from 12.0- to 14.0-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.5-feet had a dry density of 91.6 lbs/ft^3 with a moisture content of 6.5 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 112.9 lbs/ft^3 with an optimum water content of 14.5 percent.

2. Test pit TPR9-15-27 encountered soil from 0.0 to 15.2-feet. Silty Sand (SM) was encountered from 0.0 to 1.8-feet, Lean Clay with Sand (CL)s from 1.8- to 4.6-feet, Silty Sand with Cobbles (SM)c from 4.6- to 15.2-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 89.1 lbs/ft^3 with a moisture content of 7.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.3 lbs/ft^3 with an optimum water content of 15.3 percent.

3. Test pit TPR9-15-28 encountered soil from 0.0 to 15.6-feet. Silty Sand (SM) was encountered from 0.0 to 15.6-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 83.1 lbs/ft^3 with a moisture content of 8.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.3 lbs/ft^3 with an optimum water content of 14.3 percent.

4. Test pit TPR9-15-29 encountered soil from 0.0 to 15.0-feet. Silty Sand with a trace of Gravel (SM)g was encountered from 0.0 to 15.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a maximum dry density of 83.8 lbs/ft^3 with a moisture content of 4.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 106.3 lbs/ft^3 with an optimum water content of 16.5 percent.

5. CPT hole CPT-14-17 reached refusal at 8.4-feet.

AA. Approximate Station 90478+50 to 90495+50: Mostly soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole,1 test pit and 1 CPT.

1. Drill hole DHR9-15-10 encountered soil from 0.0 to 16.0-feet and bedrock from 16.0- to 25.0-feet. Poorly Graded Sand was encountered from 0.0 to 1.5-feet, Poorly Graded Sand with Gravel (SP)g from 1.5- to 2.5-feet, Well Graded Gravel with Silt, Sand, Cobbles and Boulders (GW-GM)scb from 2.5- to 16.0-feet. Very intensely weathered, very soft claystone was encountered from 16.0- to 18.0-feet and intensely to moderately weathered, soft claystone from 18.0- to 25.0-feet.

2. Test pit TPR9-15-30 encountered soil from 0.0 to 14.5-feet and bedrock from 14.5- to 15.0-feet. Silty Sand (SM) was encountered from 0.0 to 3.0-feet, Sandy Lean Clay s(CL) from 3.0- to 5.0-feet, Lean Clay with Sand (CL)s from 5.0- to 7.0-feet, Silty Sand (SM) from 7.0- to 8.0-feet, Lean Clay with Sand (CL)s from 8.0- to 13.0-feet, Sandy Lean Clay with Cobbles s(CL)c from 13.0- to 14.5-feet. Moderately weathered, very soft sandstone was encountered from 14.5- to 15.0-feet. Excavation was terminated at refusal in bedrock.

a. An in-place density test conducted at about 7.5-feet had a dry density of 95.7 lbs/ft^3 with a moisture content of 5.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 114.4 lbs/ft^3 with an optimum water content of 14.6 percent.

3. CPT hole CPT9-14-18 reached refusal at 2.3-feet.

BB. Approximate Station 90495+50 to 90518+00: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90497+50. Investigations include: 1 test pit and 1 CPT.

1. Test pit TPR9-15-31 encountered soil from 0.0 to 14.0-feet Silty Sand (SM) was encountered from 0.0 to 7.0-feet, Clayey Sand (SC) from 7.0- to 13.0-feet and Clayey Sand with Gravel, Cobbles and Boulders (SC)gcb from 13.0- to 14.0-feet.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 95.0 lbs/ft^3 with a moisture content of 3.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.5 lbs/ft^3 with an optimum water content of 14.3 percent.

2. CPT hole CPT9-14-19 reached refusal at 18.8-feet.

CC. Approximate Station 90518+00 to 90546+00: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 90525+00 and Station 90535+00. Investigations include: 1 drill hole, 2 test pits and 1 CPT.

1. Drill hole DHR9-15-11 encountered soil from 0.0 to 25.0-feet. Silty Sand (SM) was encountered from 0.0 to 9.7-feet, Poorly Graded Sand with Silt (SP-SM) from 9.7- to 12.2-feet, Silty Sand (SM) from 12.2- to 16.3-feet, Sandy Lean Clay s(CL) from 16.3- to 23.5-feet, Lean Clay (CL) from 23.5- to 24.2-feet and Silty Gravel with Sand (GM)s from 24.2- to 25.0-feet.

2. Test pit TPR9-15-32 encountered soil from 0.0 to 16.0-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 3.6-feet and Silty Sand (SM) from 3.6- to 16.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 101.7 lbs/ft^3 with a moisture content of 3.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 112.9 lbs/ft^3 with an optimum water content of 11.6 percent.

3. Test pit TPR9-15-33 encountered soil from 0.0 to 15.0-feet. Silty Sand (SM) was encountered from 0.0 to 13.5-feet and Lean Clay with Sand (CL)s from 13.5- to 15.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 86.3 lbs/ft^3 with a moisture content of 5.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 115.9 lbs/ft^3 with an optimum water content of 14.0 percent.

4. CPT hole CPT9-14-20 reached refusal at 19.4-feet.

DD. Approximate Station 90546+00 to 90567+80: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1test pit.

1. Test pit TPR9-15-34 encountered soil from 0.0 to 12.0-feet and bedrock from 12.0- to 15.2-feet. Silty Sand (SM) was encountered from 0.0 to 9.0-feet and Lean Clay (CL)

from 9.0- to 12.0-feet. Slightly weathered, soft claystone was encountered from 12.0- to 13.0-feet and slightly weathered, moderately soft sandstone from 13.0- to 15.2-feet. Excavation was terminated at refusal in bedrock.

a. An in-place density test conducted at about 7.0-feet had a dry density of 76.9 lbs/ft^3 with a moisture content of 11.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.8 lbs/ft^3 with an optimum water content of 18.2 percent.

EE. Approximate Station 90567+80 to 90646+00: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses four significant drainages located at approximate Station 90578+00, Station 90594+00, Station 90607+50 and Station 90628+00. Investigations include: 2 drill holes, 6 test pits and 1 CPT.

1. Drill hole DHR9-15-12 encountered soil from 0.0 to 26.5-feet. Clayey Sand (SC) was encountered from 0.0 to 3.0-feet, Poorly Graded Sand with Silt from 3.0- to 17.5-feet, Poorly Graded Sand (SP) from 17.5- to 22.5-feet and Poorly Graded Sand with Silt (SP-SM) from 22.5- to 26.5-feet.

2. Drill hole DHR9-15-13 encountered soil from 0.0 to 25.1-feet. Silty Sand (SM) was encountered from 0.0 to 24.2-feet and Clayey Sand (SC) from 24.2- to 24.1-feet.

3. Test pit TPR9-15-35 encountered soil from 0.0 to 15.7-feet. Silty Sand (SM) was encountered from 0.0 to 1.4-feet, Sandy Lean Clay s(CL) from 1.4- to 5.6-feet, and Silty Sand (SM) from 5.6- to 15.7-feet. Excavation terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 88.1 lbs/ft^3 with a moisture content of 4.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.7 lbs/ft^3 with an optimum water content of 14.5 percent.

4. Test pit TPR9-15-36 encountered soil from 0.0 to 17.0-feet. Sandy Lean Clay with Cobbles s(CL)c was encountered from 0.0 to 6.3-feet and Silty Sand with Cobbles (SM)c from 6.3 to 17.0-feet. Excavation terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 94.3 lbs/ft^3 with a moisture content of 3.4 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.2 lbs/ft^3 with an optimum water content of 12.3 percent.

5. Test pit TPR9-15-37 encountered soil from 0.0 to 16.7-feet. Silty Sand (SM) was encountered from 0.0 to 3.2-feet, Sandy Lean Clay s(CL) from 3.2- to 7.2-feet and Silty Sand (SM) from 7.2- to 16.7-feet. Excavation terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 81.1 lbs/ft^3 with a moisture content of 6.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.0 lbs/ft^3 with an optimum water content of 18.2 percent.

6. Test pit TPR9-15-38 encountered soil from 0.0 to 17.1-feet. Silty Sand (SM) was encountered from 0.0 to 2.5-feet, Lean Clay (CL) from 2.5- to 6.6-feet, Silty Sand

with Cobbles (SM)c from 6.6- to 15.8-feet. Excavation terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 87.8 lbs/ft^3 with a moisture content of 4.8 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.8 lbs/ft^3 with an optimum water content of 15.2 percent.

7. Test pit TPR9-15-39 encountered soil from 0.0 to 17.1-feet. Silty Sand with Cobbles (SM)c was encountered from 0.0 to 15.5-feet and Lean Clay (CL) from 15.5- to 17.1-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 87.5 lbs/ft^3 with a moisture content of 5.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 114.3 lbs/ft^3 with an optimum water content of 13.7 percent.

8. Test pit TPR9-15-40 encountered soil from 0.0 to 16.5-feet. Clayey Sand (SC) was encountered from 0.0 to 16.5-feet.

a. An in-place density test conducted at about 7.0-feet had a dry density of 102.7 lbs/ft^3 with a moisture content of 4.5 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.3 lbs/ft^3 with an optimum water content of 14.2 percent.

9. CPT hole CPT9-14-21 was advanced to 30.0-feet.

FF. Approximate Station 90646+00 to 90688+50: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90676+00. Investigations include: 1 test pit.

1. Test pit TPR9-15-42 encountered soil from 0.0 to 16.7-feet. Clayey Sand (SC) was encountered from 0.0 to 2.4-feet, Sandy Lean Clay s(CL) from 2.4- to 5.2-feet and Silty Sand (SM) from 6.4 to 16.7-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 90.8 lbs/ft^3 with a moisture content of 2.4 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 106.7 lbs/ft^3 with an optimum water content of 14.5 percent.

GG. Approximate Station 90688+50 to 90709+20: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole and 1 CPT.

1. Drill hole DHR9-15-15 encountered soil from 0.0 to 8.8-feet and bedrock from 8.8- to 25.0-feet. Poorly Graded Sand (SP) was encountered from 0.0 to 2.5-feet and Well Graded Sand (SW) from 2.5- to 8.8-feet. Very intensely weathered, very soft claystone was encountered from 8.8- to 10.8-feet, intensely to moderately weathered, soft sandstone from 10.8 to 13.8-feet, very intensely weathered, very soft claystone from 13.8- to 14.2-feet, intensely to moderately weathered, soft sandstone from 14.2-

to 15.1-feet, very intensely weathered very soft claystone from 15.1- to 15.5-feet, moderately weathered, moderately soft sandstone from 15.5- to 25.0-feet.

2. CPT hole CPT9-14-29 reached refusal at 8.0-feet.

HH. Approximate Station 90709+20 to 90756+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Alignment parallels the Kinder Morgan Inc., El Paso Pipeline from approximately Station 90709+20 to Station 90722+10. Investigations include: 1 drill hole and 3 test pits and 1 CPT.

1. Drill hole DHR9-15-16 encountered soil from 0.0 to 2.5-feet and bedrock from 2.5- to 25.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 2.5-feet. Slightly weathered, hard sandstone was encountered from 2.5- to 4.6-feet, very intensely weathered, very soft claystone from 4.6- to 5.0-feet, intensely to moderately weathered, soft sandstone from 5.0- to 8.3-feet, very intensely weathered, very soft claystone from 8.3- to 9.3-feet, intensely to moderately weathered, soft sandstone from 9.3- to 25.0-feet.

2. Test pit TPR9-15-43 encountered soil from 0.0 to 12.7-feet. Clayey Sand (SC) was encountered from 0.0 to 2.3-feet and Poorly Graded Sand with Silt, Gravel, Cobbles and Boulders from 2.3- to 12.7-feet. Excavation was terminated at limit of equipment.

3. Test pit TPR9-15-44 encountered soil from 0.0 to 11.5-feet and bedrock from 11.5- to 13.2-feet. Silty Sand (SM) was encountered from 0.0 to 3.4-feet and Fat Clay (CH) from 3.4- to 11.5-feet. Intensely weathered, soft claystone was encountered from 11.5- to 13.2-feet. Excavation was terminated at refusal in bedrock.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 91.9 lbs/ft^3 with a moisture content of 7.4 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.3 lbs/ft^3 with an optimum water content of 16.0 percent.

4. Test pit TPR9-15-45 encountered soil from 0.0 to 9.8-feet and bedrock from 9.8- to 11.2-feet. Silty Sand (SM) was encountered from 0.0 to 9.8-feet. Intensely weathered, soft sandstone was encountered from 9.8- to 11.2-feet. Excavation was terminated at refusal in bedrock.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 95.0 lbs/ft^3 with a moisture content of 5.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.0 lbs/ft^3 with an optimum water content of 13.5 percent.

5. CPT hole CPT-14-30 reached refusal at 4.2-feet.

II. Approximate Station 90756+00 to 90961+60: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 90833+00. Investigations include: 3 drill holes, 14 test pits and 14 CPTs.

1. Drill hole DHR9-15-17 encountered soil from 0.0 to 25.6-feet. Clayey Sand (SC) was encountered from 0.0 to 4.5-feet, Poorly Graded Sand with Silt (SP-SM) from

4.5- to 7.4-feet, Clayey Sand (SC) from 7.4- to 8.7-feet, Poorly Graded Sand with Silt (SP-SM) from 8.7- to 14.7-feet, Clayey Sand (SC) from 14.7- to 17.0-feet, Poorly Graded Sand with Silt (SP-SM) from 17.0 to 17.5-feet, Poorly Graded Sand (SP) from 17.5- to 19.0-feet and Poorly Graded Sand with Silt (SP-SM) from 19.0- to 26.5-feet.

2. Drill hole DHR9-15-18 encountered soil from 0.0 to 26.5-feet. Clayey Sand (SC) was encountered from 0.0 to 12.5-feet, Poorly Graded Sand with Silt (SP-SM) from 12.5- to 14.2-feet, Clayey Sand (SC) from 14.2- to 16.0-feet, Poorly Graded Sand with Silt (SP-SM) from 16.0- to 18.0-feet and Clayey Sand (SC) from 18.0- to 26.5-feet.

3. Drill hole DHR9-15-19 encountered soil from 0.0 to 25.0-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 5.0-feet, Clayey Sand (SC) from 5.0- to 7.0-feet, Lean Clay with Sand (CL)s from 7.0- to 8.0-feet, Clayey Sand (SC) from 8.0- to 15.0-feet, Poorly Graded Sand (SP) from 15.0- to 16.4-feet, Clayey Sand (SC) from 16.4- to 17.5-feet, Poorly Graded Sand (SP) from 17.5- to 19.5-feet, Clayey Sand (SC) from 19.5- to 21.4-feet, Lean Clay with Sand (CL)s from 21.4- to 24.6-feet and Poorly Graded Sand with Silt (SP-SM) from 24.6- to 25.0-feet.

4. Test pit TPR9-16-46 encountered soil from 0.0 to 14.5-feet. Silty Sand (SM) was encountered from 0.0 to 14.5-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 87.7 lbs/ft^3 with a moisture content of 5.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.9 lbs/ft^3 with an optimum water content of 14.5 percent.

5. Test pit TPR9-16-47 encountered soil from 0.0 to 14.0-feet. Lean Clay (CL) was encountered from 0.0 to 2.2-feet, Poorly Graded Sand with Silt (SP-SM) from 2.2- to 2.6-feet, Lean Clay with Sand (CL)s from 2.6- to 11.2-feet and Clayey Sand (SC) from 11.2- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 85.6 lbs/ft3 with a moisture content of 8.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.9 lbs/ft3 with an optimum water content of 16.2 percent.

6. Test pit TPR9-16-48 encountered soil from 0.0 to 14.4-feet. Clayey Sand (SC) was encountered from 0.0 to 1.8-feet, Sandy Lean Clay s(CL) from 1.8- to 7.6-feet and Clayey Sand (SC) from 7.6- to 14.4-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 85.7 lbs/ft3 with a moisture content of 7.8 percent. Compaction test results from material sampled from the in-place density test had a maximum dry density of 109.9 lbs/ft3 with an optimum water content of 16.0 percent.

7. Test pit TPR9-16-49 encountered soil from 0.0 to 14.0-feet. Clayey Sand (SC) was encountered from 0.0 to 2.2-feet, Lean Clay (CL) from 2.2- to 11.3-feet and Silty Sand (SM) from 11.3- to 14.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 96.8 lbs/ft^3 with a moisture content of 13.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 98.5 lbs/ft^3 with an optimum water content of 23.0 percent.

8. Test pit TPR9-16-50 encountered soil from 0.0 to 12.9-feet. Lean Clay (CL) was encountered from 0.0 to 0.6-feet, Clayey Sand (SC) from 0.6- to 1.6-feet, Sandy Lean Clay s(CL) from 1.6- to 8.8-feet and Lean Clay (CL) from 8.8- to 12.9-feet. Excavation was terminated at refusal in stiff clay.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 80.6 lbs/ft^3 with a moisture content of 8.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 103.6 lbs/ft^3 with an optimum water content of 19.4 percent.

9. Test pit TPR9-16-51 encountered soil from 0.0 to 13.9-feet. Silty Sand (SM) was encountered from 0.0 to 2.6-feet, Lean Clay with Sand (CL)s from 2.6- to 8.2-feet and Lean Clay (CL) from 8.2- to 13.9-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 92.1 lbs/ft^3 with a moisture content of 13.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 101.5 lbs/ft^3 with an optimum water content of 20.9 percent.

10. Test pit TPR9-16-52 encountered soil from 0.0 to 14.7-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 2.1-feet, Lean Clay (CL) from 2.1- to 4.0-feet, Silty Sand (SM) from 4.0 to 4.6-feet, Lean Clay with Sand (CL)s from 4.6- to 9.2-feet and Silty Sand (SM) from 9.2- to 14.7-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 83.9 lbs/ft^3 with a moisture content of 12.1 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 103.0 lbs/ft^3 with an optimum water content of 19.5 percent.

11. Test pit TPR9-16-53 encountered soil from 0.0 to 14.9-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 3.0-feet, Clayey Sand (SC) from 3.0- to 8.9-feet and Silty Sand (SM) from 8.9- to 14.9-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 92.0 lbs/ft^3 with a moisture content of 4.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 113.8 lbs/ft^3 with an optimum water content of 14.3 percent.

12. Test pit TPR9-16-54 encountered soil from 0.0 to 14.4-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 1.0-feet, Lean Clay with Sand (CL)s from 1.0 to 2.4-feet, Sandy Lean Clay s(CL) from 2.4- to 10.4-feet and Lean Clay with Sand (CL)s from 10.4 to 14.4-feet. Excavation was terminated at the limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 88.1 lbs/ft^3 with a moisture content of 7.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.0 lbs/ft^3 with an optimum water content of 16.0 percent.

13. Test pit TPR9-16-55 encountered soil from 0.0 to 14.0-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 1.2-feet, Clayey Sand (SC) from 1.2- to 4.3-feet, Silty Sand (SM) from 4.3- to 11.0-feet and Clayey Sand (SC) from 11.0- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 96.5 lbs/ft^3 with a moisture content of 4.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.4 lbs/ft^3 with an optimum water content of 14.6 percent.

14. Test pit TPR9-16-56 encountered soil from 0.0 to 14.0-feet. Clayey Sand (SC) was encountered from 0.0 to 4.8-feet, Silty Sand (SM) from 4.8- to 12.1-feet and Lean Clay with Sand (CL)s from 12.1- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 94.8 lbs/ft^3 with a moisture content of 5.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.5 lbs/ft^3 with an optimum water content of 16.3 percent.

15. Test pit TPR9-16-57 encountered soil from 0.0 to 14.5-feet. Lean Clay with Sand (CL)s was encountered from 0.0 to 2.7-feet, Silty Sand (SM) from 2.7- to 4.1-feet, Lean Clay with Sand (CL)s from 4.1- to 7.3-feet, Silty Sand (SM) from 7.3 to 8.6-feet and Clayey Sand (SC) from 8.6- to 14.5-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 86.8 lbs/ft^3 with a moisture content of 10.8 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 107.6 lbs/ft^3 with an optimum water content of 17.6 percent.

16. Test pit TPR9-16-58 encountered soil from 0.0 to 14.0-feet. Lean Clay with Sand (CL)s was encountered from 0.0 to 1.4-feet and Sandy Lean Clay s(CL) from 1.4- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 88.3 lbs/ft^3 with a moisture content of 7.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.7 lbs/ft^3 with an optimum water content of 16.8 percent.

17. Test pit TPR9-16-59 encountered soil from 0.0 to 13.2-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 1.6-feet and Lean Clay (CL) from 1.6- to 13.2-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 92.3 lbs/ft^3 with a moisture content of 15.7 percent. Compaction test results from

material sampled from in-place density test had a maximum dry density of 96.8 lbs/ft^3 with an optimum water content of 22.8 percent.

18. CPT hole CPT9-14-31 was advanced to 30.0-feet.

19. CPT hole CPT9-14-32 reached refusal at 20.7-feet.

20. CPT hole CPT9-14-33 was advanced to 30.0-feet.

21. CPT hole CPT9-14-35 was advanced to 30.0-feet.

JJ. Approximate Station 90961+60 to 90979+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole and 1 CPT.

1. Drill hole DHR9-15-20 encountered soil from 0.0 to 13.3-feet and bedrock from 13.3- to 25.0-feet. Clayey Sand (SC) was encountered form0.0 to 10.5-feet and Silty Sand (SM) from 10.5- to 13.3-feet. Intensely to moderately weathered, very soft claystone was encountered from 13.3- to 18.1-feet, moderately to slightly weathered, soft sandstone from 18.1- to 20.4-feet and moderately to intensely weathered, very soft claystone from 20.4- to 25.0-feet.

2. CPT hole CPT10-14-2 reached refusal at 11.2-feet.

KK. Approximate Station90979+00 to 91068+50: Mostly soil is likely to be encountered during trench excavation through this segment. Investigations include: 6 test pits.

1. Test pit TPR9-16-60 encountered soil from 0.0 to 13.4-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 1.6-feet, Fat Clay (CH) from 1.6- to 4.4-feet, Clayey Sand (SC) from 4.4- to 6.3-feet and Lean Clay with Sand (CL)s from 6.3- to 13.4-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 93.8 lbs/ft^3 with a moisture content of 9.1 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.1 lbs/ft^3 with an optimum water content of 17.0 percent.

2. Test pit TPR9-16-61 encountered soil from 0.0 to 14.8-feet. Lean Clay (CL) was encountered from 0.0 to 7.2-feet and Silty Sand (SM) from 7.2- to 14.8-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 90.9 lbs/ft^3 with a moisture content of 3.5 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.0 lbs/ft^3 with an optimum water content of 14.6 percent.

3. Test pit TPR9-16-62 encountered soil from 0.0 to 14.4-feet. Lean Clay (CL) was encountered from 0.0 to 4.2-feet, Silty Sand (SM) from 4.2- to 10.7-feet and Clayey Sand (SC) from 10.7- to 14.4-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 91.5 lbs/ft^3 with a moisture content of 5.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 109.3 lbs/ft^3 with an optimum water content of 15.6 percent.

4. Test pit TPR9-16-63 encountered soil from 0.0 to 14.5-feet. Lean Clay (CL) was encountered from 0.0 to 3.2-feet, Lean Clay with Sand (CL)s from 3.2- to 10.2-feet and Clayey Sand (SC) from 10.2- to 14.5-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 90.5 lbs/ft^3 with a moisture content of 16.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 93.3 lbs/ft^3 with an optimum water content of 25.8 percent.

5. Test pit TPR9-16-64 encountered soil from 0.0 to 14.5-feet. Lean Clay with Sand (CL)s was encountered from 0.0 to 3.7-feet, Silty Sand (SM) from 3.7- to 6.9-feet and Lean Clay (CL) from 6.9- to 14.5-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 85.1 lbs/ft^3 with a moisture content of 15.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 93.2 lbs/ft^3 with an optimum water content of 26.7 percent.

6. Test pit TPR9-16-65 encountered soil from 0.0 to 14.4-feet. Lean Clay with Sand (CL)s was encountered from 0.0 to 8.2-feet and Clayey Sand (SC) from 8.2 to 14.4-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 77.6 lbs/ft^3 with a moisture content of 11.5 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 101.7 lbs/ft^3 with an optimum water content of 20.5 percent.

LL. Approximate Station 91068+50 to 91105+50: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole and 2 test pits.

1. Drill hole DHR9-15-21 encountered soil from 0.0 to 10.7-feet and bedrock from 10.7- to 25.7-feet. Clayey Sand (SC) was encountered from 0.0 to 6.8-feet and Poorly Graded Sand with Silt (SP-SM) from 6.8 to 10.7-feet. Decomposed and very intensely weathered, soft and very soft sandstone was encountered from 10.7- to 25.7-feet.

2. Test pit TPR9-16-66 encountered soil from 0.0 to 8.2-feet and bedrock from 8.2 to 11.2-feet. Silty Sand (SM) was encountered from 0.0 to 8.2-feet. Slightly weathered, moderately soft sandstone was encountered from 8.2- to 9.5-feet, slightly weathered and soft claystone from 9.5- to 11.2-feet. Excavation was terminated at refusal in bedrock.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 96.0 lbs/ft^3 with a moisture content of 4.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 112.2 lbs/ft^3 with an optimum water content of 13.6 percent.

3. Test pit TPR9-16-67 encountered soil from 0.0 to 5.5-feet and bedrock from 5.5- to 11.8-feet. Silty Sand (SM) was encountered from 0.0 to 5.5-feet. Slightly weathered,

soft claystone was encountered from 5.5- to 11.8-feet. Approximate Station 91105+50 to 91110+40: Bedrock is exposed at and just below the ground surface through this segment. Investigations include: 1 drill hole.

4. Drill hole DHR9-15-22 encountered soil from 0.0 to 0.2-feet and bedrock from 0.2- to 26.0-feet Silty Sand (SM) was encountered from 0.0 to 0.2-feet. Intensely to moderately weathered, very soft claystone was encountered from 0.2- to 21.9-feet and moderately to slightly weathered, moderately hard siltstone from 21.9- to 26.0-feet.

MM. Approximate Station 91110+40 to 91132+70: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 test pit.

1. Test pit TPR9-16-68 encountered soil from 0.0 to 6.2-feet and bedrock from 6.2- to 8.5-feet. Silty Sand (SM) was encountered from 0.0 to 6.2-feet. Slightly weathered to fresh, moderately soft sandstone was encountered from 6.2- to 8.5-feet. Excavation was terminated at refusal in bedrock.

NN. Approximate Station 91132+70 to 91226+23(end of reach 9): Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses two significant drainages located at approximate Station 91186+00 and Station 91220+00. Investigations include: 2 drill holes and 5 test pits.

1. Drill hole DHR9-15-23 encountered soil from 0.0 to 28.2-feet. Silty Sand (SM) was encountered from 0.0 to 19.2-feet, Clayey Sand (SC) was encountered from 19.2- to 23.2-feet, Silty Sand (SM) from 23.2- to 24.7-feet and Clayey Sand (SC) from 24.7- to 28.2-feet.

2. Drill hole DHR9-15-24 encountered soil from 0.0 to 25.0-feet. Clayey Sand (SC) was encountered from 0.0 to 6.0-feet, Silty Sand (SM) from 6.0- to 13.4-feet and Clayey Sand (SC) from 13.4- to 25.0-feet.

3. Test pit TPR9-16-69 encountered soil from 0.0 to 14.5-feet. Silty Sand (SM) was encountered from 0.0 to 14.5-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 85.9 lbs/ft^3 with a moisture content of 6.5 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.9 lbs/ft^3 with an optimum water content of 17.4 percent.

4. Test pit TPR9-16-70 encountered soil from 0.0 to 14.8-feet. Lean Clay (Cl) was encountered from 0.0 to 3.8-feet, Sandy Lean Clay s(CL) from 3.8- to 6.2-feet and Silty Sand (SM) from 6.2- to 14.8-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 87.3 lbs/ft^3 with a moisture content of 4.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 106.7 lbs/ft^3 with an optimum water content of 15.7 percent.

5. Test pit TPR9-16-71 encountered soil from 0.0 to 14.8-feet. Silty Sand (SM) was encountered from 0.0 to 7.2-feet, Lean Clay with Sand (CL)s from 7.2- to 8.6-feet

and Sandy Lean Clay s(CL) from 8.6- to 14.8-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 78.5 lbs/ft^3 with a moisture content of 13.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 97.7 lbs/ft^3 with an optimum water content of 22.5 percent.

6. Test pit TPR9-16-72 encountered soil from 0.0 to 14.6-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 1.8-feet, Silty Sand (SM) from 1.8- to 7.6-feet, Lean Clay (CL) from 7.6- to 9.2-feet and Sandy Lean Clay s(CL) from 9.2- to 14.6-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 76.5 lbs/ft^3 with a moisture content of 13.1 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 99.0 lbs/ft^3 with an optimum water content of 21.1 percent.

7. Test pit TPR9-16-73 encountered soil from 0.0 to 14.5-feet. Silty Sand (SM) was encountered from 0.0 to 3.8-feet and Lean Clay with Sand (CL)s from 3.8- to 14.5-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 82.2 lbs/ft3 with a moisture content of 8.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 105.1 lbs/ft3 with an optimum water content of 17.5 percent.

OO. Approximate Station10010+00 to 10020+00: Mostly soil is likely to be encountered during trench excavation through this segment. Investigations include: 1 test pit and 1 CPT.

1. Test pit TPR10-16-1 encountered soil from 0.0 to 14.8-feet. Sandy Lean Clay s(CL) was encountered from 0.0 to 4.7-feet, Silty Sand (SM) from 4.7- to 9.5-feet and Lean Clay with Sand (CL)s from 9.5- to 14.8-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 83.0 lbs/ft3 with a moisture content of 4.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 106.0 lbs/ft3 with an optimum water content of 16.3 percent.

2. CPT hole CPT10-14-6 reached refusal at 10.4-feet.

PP. Approximate Station 10020+00 to 10050+57 (end of reach 10): Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 1 drill hole, 3 test pits and 1 CPT.

1. Drill hole DHR10-15-1 encountered soil from 0.0 to 19.5-feet and bedrock from 19.5- to 25.0-feet. Silty Sand (SM) was encountered from 0.0 to 4.3-feet and Clayey Sand (SC) from 4.3- to 19.5-feet. Slightly weathered, very soft claystone was encountered from 19.5- to 25.0-feet.

2. Test pit TPR10-15-2 encountered soil from 0.0 to 9.5-feet and bedrock from 9.5- to 10.5-feet. Clayey Sand (SC) was encountered from 0.0 to 4.2-feet, Poorly Graded Sand with Clay (SP-SC) from 4.2- to 6.0-feet and Poorly Graded Sand with Silt (SP-SM) from 6.0- to 9.5-feet. Very intensely weathered, very soft sandstone was encountered from 9.5- to 10.0-feet and moderately to intensely weathered, soft to hard sandstone from 10.0- to 10.5-feet. Excavation was terminated at refusal in bedrock.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 93.9 lbs/ft^3 with a moisture content of 3.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 109.1 lbs/ft^3 with an optimum water content of 14.8 percent.

3. Test pit TPR10-15-3 encountered soil from 0.0 to 10.0-feet and bedrock from 10.0- to 11.5-feet. Poorly graded Sand (SP) was encountered from 0.0 to 2.6-feet, Clayey Sand (SC) from 2.6- to 5.3-feet and Poorly Graded Sand with Silt (SP-SM) from 5.3- to 10.0-feet. Moderately to intensely weathered, moderately soft sandstone was encountered from 10.0- to 11.5-feet. Excavation was terminated at refusal in bedrock.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 93.5 lbs/ft^3 with a moisture content of 3.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 110.0 lbs/ft^3 with an optimum water content of 14.4 percent.

4. Test pit TPR10-15-4 encountered soil from 0.0 to 10.5-feet and bedrock from 10.5- to 11.5-feet. Poorly graded Sand (SP) was encountered from 0.0 to 1.9-feet, Clayey Sand (SC) from 1.9- to 6.5-feet and Silty Sand (SM) from 6.5- to 10.5-feet. Moderately to intensely weathered, moderately soft sandstone was encountered from 10.5- to 11.5-feet.

    a. An in-place density test conducted at about 7.0-feet had a dry density of 97.9 lbs/ft^3 with a moisture content of 6.0 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 111.0 lbs/ft^3 with an optimum water content of 15.6 percent.

5. CPT hole CPT10-14-7 reached refusal at 8.0-feet.

QQ. Approximate Station 11053+60 to 11083+00: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 3 drill holes and 1 test pit.

1. Drill hole DHR10-15-2 encountered soil from 0.0 to 5.2-feet and bedrock from 5.2- to 25.0-feet. Clayey Sand (SC) was encountered from 0.0 to 5.2-feet. Intensely weathered, soft sandstone was encountered from 5.2- to 8.2-feet, moderately weathered, moderately soft sandstone from 8.2 -to 25.0-feet.

2. Drill hole DHR10-15-3 encountered soil from 0.0 to 11.1-feet and bedrock from 11.1- to 40.0-feet. Clayey Sand (SC) was encountered from 0.0 to 6.4 fet and Silty Sand (SM) from 6.4- to 11.1-feet. Moderately to intensely weathered, moderately soft sandstone was encountered from 11.1- to 18.0-feet, moderately to intensely

weathered, very soft claystone from 18.0- to 20.0-feet, moderately weathered, moderately soft sandstone from 20.0- to 22.5-feet, moderately to intensely weathered, very soft claystone from 22.5- to 35.5-feet and moderately weathered, moderately soft sandstone from 35.5 to 40.0-feet.

3. Drill hole DHR11-15-1 encountered soil from 0.0 to 18.0-feet and bedrock from 18.0- to 40.5-feet. Silty Sand (SM) was encountered from 0.0 to 6.9-feet and Lean Clay from 6.9- to 18.0-feet. Moderately to slightly weathered, soft sandstone was encountered from 18.0- to 29.2-feet, moderately to slightly weathered, very soft claystone from 29.2- to 34.9-feet and moderately to slightly weathered, soft sandstone from 34.9- to 40.5-feet.

4. Test pit TPR11-15-1 encountered soil from 0.0 to 2.0-feet and bedrock from 2.0- to 11.0-feet. Poorly Graded Sand and Silt (SP-SM) was encountered from 0.0 to 2.0-feet. Moderately to slightly weathered, hard sandstone was encountered from 2.0- to 3.0-feet, moderately to intensely weathered, soft to moderately soft sandstone from 3.0- to 11.0-feet. Excavation was terminated at refusal on bedrock.

RR. Approximate Station 11083+00 to 11179+50: Mostly soil is likely to be encountered during trench excavation through this segment. Alignment crosses a significant drainage located at approximate Station 11104+00. Investigations include: 5 test pits.

1. Test pit TPR11-15-2 encountered soil from 0.0 to 14.0-feet. Clayey Sand (SC) was encountered from 0.0 to 1.0-feet, Lean Clay (CL) from 1.0- to 1.3-feet, Poorly Graded Sand (SP) from 1.3- to 3.4-feet, Lean Clay (CL) from 3.4- to 11.5-feet and Clayey Sand (SC) from 11.5- to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 6.5-feet had a dry density of 86.7 lbs/ft^3 with a moisture content of 16.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 93.9 lbs/ft^3 with an optimum water content of 24.4 percent.

2. Test pit TPR11-15-3 encountered soil from 0.0 to 14.0-feet. Clayey Sand (SC) was encountered from 0.0 to 14.0-feet. Excavation was terminated at limit of equipment.

    a. An in-place density test conducted at about 6.5-feet had a dry density of 84.0 lbs/ft^3 with a moisture content of 6.2 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 107.2 lbs/ft^3 with an optimum water content of 15.0 percent.

3. Test pit TPR11-15-4 encountered soil from 0.0 to 15.0-feet. Clayey Sand (SC) was encountered from 0.0 to 15.0-feet. Excavation was terminated at the limit of the equipment.

    a. An in-place density test conducted at about 6.5-feet had a dry density of 84.0 lbs/ft^3 with a moisture content of 4.9 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 108.8 lbs/ft^3 with an optimum water content of 15.3 percent.

4. Test pit TPR11-15-5 encountered soil from 0.0 to 16.0-feet. Clayey Sand (SC) was encountered from 0.0 to 1.3-feet, Lean Clay with Sand (CL)s from 1.3- to 1.6-feet,

Poorly Graded Sand (SP) from 1.6- to 6.0-feet, Clayey Sand (SC) from 6.0- to 10.0-feet and Poorly Graded Sand (SP) from 10.0- to 16.0-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 6.5-feet had a dry density of 81.0 lbs/ft^3 with a moisture content of 5.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 107.7 lbs/ft^3 with an optimum water content of 16.3 percent.

5. Test pit TPR11-15-6 encountered soil from 0.0 to 15.5-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 3.0-feet, Clayey Sand (SC) from 3.0- to 3.4-feet, Poorly Graded Sand with Silt (SP-SM) from 3.4- to 4.0-feet and Clayey Sand (SC) from 4.0- to 15.5-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 6.5-feet had a dry density of 85.9 lbs/ft^3 with a moisture content of 8.3 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 109.0 lbs/ft^3 with an optimum water content of 16.2 percent.

SS. Approximate Station 11179+50 to 11280+50: Soil with bedrock occurring at varying depths will likely be encountered during trench excavation through this segment. Investigations include: 4 drill holes and 4 test pits.

1. Drill hole DHR11-15-2 encountered soil from 0.0 to 25.7-feet. Silty Sand (SM) was encountered from 0.0 to 9.1-feet, Clayey Sand (SC) from 9.1- to 10.5-feet, Lean Clay (CL) from 10.5- to 16.8-feet, Silty Sand (SM) from 16.8- to 21.2-feet and Clayey Sand (SC) from 21.2- to 25.7-feet.

2. Drill hole DHR11-15-3 encountered soil from 0.0 to 14.1-feet and bedrock from 14.1- to 29.1-feet. Silty Sand (SM) was encountered from 0.0 to 9.5-feet, Clayey Sand (SC) from 9.5- to 10.1-feet Fat Clay (CH) from 10.1- to 12.6-feet and Sandy Lean Clay s(CL) from 12.6- to 14.1-feet. Moderately to slightly weathered, soft sandstone was encountered from 14.1- to 28.4-feet and moderately to slightly weathered, very soft claystone from 28.4- to 29.1-feet.

3. Drill hole DHR11-15-4 encountered soil from 0.0 to 5.1-feet and bedrock from 5.1- to 25.7-feet. Silty Sand (SM) was encountered from 0.0 to 5.1-feet. Slightly weathered, soft sandstone was encountered from 5.1- to 10.5-feet, moderately to slightly weathered, very soft claystone from 10.5- to 20.3-feet and slightly weathered, soft sandstone from 20.3- to 25.7-feet.

4. Drill hole DHR11-15-5 encountered soil from 0.0 to 18.7-feet and bedrock from 18.7- to 28.7-feet. Silty Sand (SM) was encountered from 0.0 to 4.9-feet, Clayey Sand (SC) from 4.9- to 8.7-feet, Silty Sand (SM) from 8.7- to 14.9-feet, Clayey Sand (SC) from 14.9- to 17.2-feet and Lean Clay (CL) from 17.2- to 18.7-feet. Moderately to slightly weathered, very soft claystone was encountered from 18.7- to 28.7-feet.

5. Test pit TPR11-15-8 encountered soil from 0.0 to 14.6-feet. Poorly Graded Sand with Silt (SP-SM) was encountered from 0.0 to 1.2-feet and Silty Sand (SM) from 1.2- to 14.6-feet. Excavation was terminated at limit of equipment.

a. An in-place density test conducted at about 7.0-feet had a dry density of 95.8 lbs/ft^3 with a moisture content of 3.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 72.7 lbs/ft^3 with an optimum water content of 14.2 percent.

6. Test pit TPR11-15-9 encountered soil from 0.0 to 12.8-feet and bedrock from 12.8- to 13.0-feet. Clayey Sand (SC) was encountered from 0.0 to 11.4-feet and Sandy Lean Clay s(CL) from 11.4- to 12.8-feet. Moderately weathered, moderately soft sandstone was encountered from 12.8- to 13.0-feet. Excavation was terminated at refusal in bedrock.

7. TPR11-15-10 encountered soil from 0.0 to 14.5-feet. Clayey Sand (SC) was encountered from 1.0- to 5.9-feet, Silty Sand (SM) from 5.9- to 6.2-feet and Clayey Sand (SC) from 6.2- to 14.5-feet. Excavation was terminated at limit of equipment.

   a. An in-place density test conducted at about 7.0-feet had a dry density of 93.8 lbs/ft^3 with a moisture content of 6.7 percent. Compaction test results from material sampled from in-place density test had a maximum dry density of 113.7 lbs/ft^3 with an optimum water content of 14.3 percent.

8. Test pit TPR11-15-12 encountered soil from 0.0to 6.0-feet and bedrock from 6.0- to 14.0-feet. Clayey Sand (SC) was encountered from 0.0to 6.0-feet. Intensely to moderately weathered, soft sandstone was encountered from 6.0- to 13.5-feet and moderately weathered, soft claystone from 13.5- to 14.0-feet. Excavation was terminated at refusal on bedrock.

3.04 GROUNDWATER OCCURRENCE

A. The water level data show the conditions at the particular time or times the information was obtained and may not indicate variations such as those caused by periods of drought, increased rainfall, seasonal fluctuations in precipitation, or application of irrigation water.

B. Sand washes and tributary streams that intersect the pipeline alignment may have intermittent surface water flow particularly after rainfall. Surface flow would have an adverse effect on excavation and construction of the pipeline and structures in close proximity. Surface flow is likely to increase groundwater elevation in the surrounding areas and would likely increase groundwater elevations in areas that are dry (relative to pipeline and structure foundations) when streams do not have flowing surface water.

C. Only one drill hole encountered groundwater during investigations. Groundwater was encountered in drill hole DHR9-15-2 located near the beginning of Reach 9. Groundwater was encountered at 11.0-feet of depth under perched conditions above an impervious claystone. Substantial perched water tables could be encountered along claystone or shale bedrock surfaces. Additional ground and surface water should be expected after extensive rainfall and snowmelt.

PART 4 ENGINEERING GEOLOGY CONSIDERATIONS

4.01 ENGINEERING GEOLOGY

A. Temporary and Permanent Cut Slopes and Slope Stability: All cut slopes shall be constructed in accordance with the Reclamation Safety and Health Standards and OSHA standards. Recommendations are for dry or adequately drained materials. These recommendations are for all slopes with a vertical height less than 20-feet. Slopes with a vertical height of 20-feet or greater should be designed by a registered professional engineer in accordance with the Reclamation Safety and Health Standards and OSHA standards. Materials with excessive moisture will require further flattening for stability or other slope stability measures.

1. Temporary and permanent slopes excavated in fill, soil, and bedrock shall conform to OSHA slope requirements.
2. Other specification sections detail slope requirements and shall be used for construction of the pipeline and structures.

B. Excavation Considerations:

1. Soil and fill can be excavated using common excavation methods.
2. Decomposed to intensely weathered sandstone, and decomposed to moderately weathered claystone and siltstone can be excavated using common methods. Less weathered sandstone, claystone and siltstone layers may require rock excavation methods.
3. Local, hard, moderately or less weathered zones and cemented zones may be encountered within decomposed and weathered bedrock. These zones are likely to require rock excavation methods. Excavation of these zones may generate larger blocks that may have to be reduced to a manageable size by hydraulic hoe-ram, mechanical spitting, or other non-explosive methods.
4. Excavation of bedrock in confined areas with limited access for ripping with a bulldozer and single ripper shank may require rock excavation methods (such as excavation with a hydraulic hoe-ram).

C. Constructability Considerations:

1. Access roads may become muddy and excessively slick with rain, surface run-off, or water applied for construction.

END OF SECTION

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SECTION 53 20 00

RECORDS OF GEOLOGIC AND SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.01 GEOLOGY DRAWINGS

A. Some drawings are in color to highlight geologic information. Geologic information shown on drawings is of equal importance regardless of whether or not it is highlighted.

Geology Drawings

Sheet No.	Drawing No.	Title
G1	103-D-347	Unified Soil Classification – Including Identification and Description
G2	40-D-7022	Standard Descriptors and Descriptive Criteria for Rock
G3	40-D-7023	Standard Descriptors and Descriptive Criteria for Discontinuities

1.02 GEOLOGIC LOGS

Geologic Logs

Sheet No.	Title
Drill Holes	
G4	DHR9-15-1
G5	DHR9-15-2
G6	DHR9-15-3
G7	DHR9-15-4
G8	DHR9-15-5
G9	DHR9-15-6
G10	DHR9-15-7

Geologic Logs

Sheet No.	Title
G11	DHR9-15-8
G12	DHR9-15-9
G13	DHR9-15-10
G14	DHR9-15-11
G15	DHR9-15-12
G16	DHR9-15-13
G17	DHR9-15-15
G18	DHR9-15-16
G19	DHR9-15-17
G20	DHR9-15-18
G21	DHR9-15-19
G22	DHR9-15-20
G23	DHR9-15-21
G24	DHR9-15-22
G25	DHR9-15-23
G26	DHR9-15-24
G27	DHR10-15-1
G28	DHR10-15-2
G29	DHR10-15-3
G30	DHR11-15-1
G31	DHR11-15-2
G32	DHR11-15-3
G33	DHR11-15-4

Geologic Logs

Sheet No.	Title
G34	DHR11-15-5
CPT Holes	
G35	CPT9-14-1
G36	CPT9-14-2
G37	CPT9-14-3
G38	CPT9-14-4
G39	CPT9-14-5
G40	CPT9-14-7
G41	CPT9-14-8
G42	CPT9-14-9
G43	CPT9-14-10
G44	CPT9-14-11
G45	CPT9-14-12
G46	CPT9-14-13
G47	CPT9-14-15
G48	CPT9-14-17
G49	CPT9-14-18
G50	CPT9-14-19
G51	CPT9-14-20
G52	CPT9-14-21
G53	CPT9-14-22
G54	CPT9-14-23
G55	CPT9-14-24

Geologic Logs

Sheet No.	Title
G56	CPT9-14-25
G57	CPT9-14-26
G58	CPT9-14-27
G59	CPT9-14-28
G60	CPT9-14-29
G61	CPT9-14-30
G62	CPT9-14-31
G63	CPT9-14-32
G64	CPT9-14-33
G65	CPT9-14-35
G66	CPT10-14-2
G67	CPT10-14-6
G68	CPT10-14-7
Test Pits	
G69	TPR9-15-1, Sheet 1 of 2
G70	TPR9-15-2, Sheet 2 of 2
G71	TPR9-15-2
G72	TPR9-15-3, Sheet 1 of 2
G73	TPR9-15-3, Sheet 2 of 2
G74	TPR9-15-4
G75	TPR9-15-5
G76	TPR9-15-8
G77	TPR9-15-9

Geologic Logs

Sheet No.	Title
G78	TPR9-15-10, Sheet 1 of 2
G79	TPR9-15-10, Sheet 2 of 2
G80	TPR9-15-11
G81	TPR9-15-12
G82	TPR9-15-13
G83	TPR9-15-14
G84	TPR9-15-15
G85	TPR9-15-16, Sheet 1 of 2
G86	TPR9-15-16, Sheet 2 of 2
G87	TPR9-15-17
G88	TPR9-15-18
G89	TPR9-15-19, Sheet 1 of
G90	TPR9-15-19, Sheet 2 of 2
G91	TPR9-15-20
G92	TPR9-15-21
G93	TPR9-15-22
G94	TPR9-15-23, Sheet 1 of 2
G95	TPR9-15-23, Sheet 2 of 2
G96	TPR9-15-24
G97	TPR9-15-25
G98	TPR9-15-26, Sheet 1 of 2
G99	TPR9-15-26, Sheet 2 of 2
G100	TPR9-15-27

Geologic Logs

Sheet No.	Title
G101	TPR9-15-28
G102	TPR9-15-29
G103	TPR9-15-30, Sheet 1 of 3
G104	TPR9-15-30, Sheet 2 of 3
G105	TPR9-15-30, Sheet 3 of 3
G106	TPR9-15-31
G107	TPR9-15-32
G108	TPR9-15-33
G109	TPR9-15-34
G110	TPR9-15-35
G111	TPR9-15-36
G112	TPR9-15-37
G113	TPR9-15-38
G114	TPR9-15-39
G115	TPR9-15-40
G116	TPR9-15-42
G117	TPR9-16-43
G118	TPR9-16-44
G119	TPR9-16-45
G120	TPR9-16-46
G121	TPR9-16-47, Sheet 1 of 2
G122	TPR9-16-47, Sheet 2 of 2
G123	TPR9-16-48

Geologic Logs

Sheet No.	Title
G124	TPR9-16-49
G125	TPR9-16-50
G126	TPR9-16-51
G127	TPR9-16-52, Sheet 1 of 2
G128	TPR9-16-52, Sheet 2 of 2
G129	TPR9-16-53
G130	TPR9-16-54
G131	TPR9-16-55
G132	TPR9-16-56
G133	TPR9-16-57, Sheet 1 of 2
G134	TPR9-16-57, Sheet 2 of 2
G135	TPR9-16-58
G136	TPR9-16-59
G137	TPR9-16-60
G138	TPR9-16-61
G139	TPR9-16-62
G140	TPR9-16-63
G141	TPR9-16-64
G142	TPR9-16-65
G143	TPR9-16-66
G144	TPR9-16-67
G145	TPR9-16-68
G146	TPR9-16-69

Geologic Logs

Sheet No.	Title
G147	TPR9-16-70
G148	TPR9-16-71
G149	TPR9-16-72
G150	TPR9-16-73
G151	TPR10-16-1
G152	TPR10-15-2
G153	TPR10-15-3
G154	TPR10-15-4
G155	TPR11-15-1
G156	TPR11-15-2
G157	TPR11-15-3
G158	TPR11-15-4
G159	TPR11-15-5
G160	TPR11-15-6
G161	TPR11-15-8
G162	TPR11-15-9, Sheet 1 of 2
G163	TPR11-15-9, Sheet 2 of 2
G164	TPR11-15-10
G165	TPR11-15-12

1.03 LABORATORY TEST DATA

Laboratory Test Data

Sheet No.	Title
Laboratory Test Data for Drill Holes	
G166	Summary of Physical Properties Test Results- DHR9-15-1
G167	Summary of Physical Properties Test Results- DHR9-15-2
G168	Summary of Physical Properties Test Results- DHR9-15-3
G169	Summary of Physical Properties Test Results- DHR9-15-5
G170	Summary of Physical Properties Test Results- DHR9-15-6
G171	Summary of Physical Properties Test Results- DHR9-15-7
G172	Summary of Physical Properties Test Results- DHR9-15-8
G173	Summary of Physical Properties Test Results- DHR9-15-9
G174	Summary of Physical Properties Test Results- DHR9-15-10
G175	Summary of Physical Properties Test Results- DHR9-15-11
G176	Summary of Physical Properties Test Results- DHR9-15-12
G177	Summary of Physical Properties Test Results- DHR9-15-13
G178	Summary of Physical Properties Test Results- DHR9-15-15
G179	Summary of Physical Properties Test Results- DHR9-15-17
G180	Summary of Physical Properties Test Results- DHR9-15-18
G181	Summary of Physical Properties Test Results- DHR9-15-19
G182	Summary of Physical Properties Test Results- DHR9-15-20
G183	Summary of Physical Properties Test Results- DHR9-15-21
G184	Summary of Physical Properties Test Results- DHR9-15-22
G185	Summary of Physical Properties Test Results- DHR9-15-23
G186	Summary of Physical Properties Test Results- DHR9-15-24
G187	Summary of Physical Properties Test Results- DHR10-15-1

Laboratory Test Data

Sheet No.	Title
G188	Summary of Physical Properties Test Results- DHR10-15-2
G189	Summary of Physical Properties Test Results- DHR10-15-3
G190	Summary of Physical Properties Test Results- DHR11-15-1
G191	Summary of Physical Properties Test Results- DHR11-15-2
G192	Summary of Physical Properties Test Results- DHR11-15-3
G193	Summary of Physical Properties Test Results- DHR11-15-4
G194	Summary of Physical Properties Test Results- DHR11-15-5
Laboratory Test Data for Test Pits	
G195	Summary of Physical Properties Test Results- TPR9-15-2, TPR9-15-4, TPR9-15-5, TPR-15-8 and TPR9-15-10
G196	Summary of Physical Properties Test Results- TPR9-15-14, TPR9-15-15, TPR9-15-16, TPR9-15-17, TPR9-15-19, TPR9-15-20, TPR9-15-23 and TPR9-15-26
G197	Summary of Physical Properties Test Results- TPR9-15-18
G198	Summary of Physical Properties Test Results- TPR9-15-20
G199	Summary of Physical Properties Test Results- TPR9-15-22
G200	Summary of Physical Properties Test Results- TPR9-15-25, TPR9-15-27, TPR9-15-28, TPR9-15-29, TPR9-15-30, TPR9-15-31, TPR9-15-32 and TPR9-15-33
G201	Summary of Physical Properties Test Results- TPR9-15-34, TPR9-15-35, TPR9-15-36, TPR9-15-37, TPR9-15-38, TPR9-15-39, TPR9-15-40 and TPR9-15-42
G202	Summary of Physical Properties Test Results- TPR9-16-44, TPR9-16-45, TPR9-16-46, TPR9-16-47, TPR9-16-48, TPR9-16-49, TPR9-16-50, TPR9-16-51 and TPR9-16-52
G203	Summary of Physical Properties Test Results- TPR9-16-53, TPR9-16-54, TPR9-16-55, TPR9-16-56, TPR9-16-57, TPR9-16-58, TPR9-16-59 and TPR9-16-60
G204	Summary of Physical Properties Test Results- TPR9-16-61, TPR9-16-62, TPR9-16-63, TPR9-16-64, TPR9-16-65, TPR9-16-66, TPR9-16-69, TPR9-16-70, TPR9-16-71, TPR9-16-72 and TPR9-16-73

Laboratory Test Data

Sheet No.	Title
G205	Summary of Physical Properties Test Results- TPR10-15-2, TPR10-15-3 and TPR10-15-4
G206	Summary of Physical Properties Test Results- TPR10-16-1
G207	Summary of Physical Properties Test Results- TPR11-15-2, TPR11-15-3, TPR11-15-4, TPR11-15-5 and TPR11-15-6
G208	Summary of Physical Properties Test Results- TPR11-15-8, TPR11-15-9 and TPR11-15-10

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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