



— BUREAU OF —
RECLAMATION

San Juan Lateral Water Treatment Plant

**Navajo-Gallup Water Supply Project
New Mexico**

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**Navajo-Gallup Water Supply Project
San Juan Lateral Water Treatment Plant
Upper Colorado Region, New Mexico**

FOREWORD

Work is located south of BIA Route 36 (N36) approximately 6.1 miles east of intersection of U.S. Highway 491 and N36. The intersection of U.S. Highway 491 and N36 is approximately 4 miles south of Shiprock, New Mexico, in San Juan County. Principal components of work include a new 18.8 MGD water treatment plant and associated components with capability to expand to 35 MGD.

PRE-BID SITE VISIT: A PREBID SITE VISIT WILL BE HELD ON [REDACTED], AT [REDACTED], BEGINNING AT [REDACTED]. OFFERORS ARE STRONGLY URGED TO PARTICIPATE IN THE SITE VISIT. PROSPECTIVE BIDDERS SHOULD MAKE ARRANGEMENTS BY CONTACTING [REDACTED] AT THE TELEPHONE NUMBER LISTED ABOVE. ATTENDEES ARE TO PROVIDE AND WEAR SAFETY BOOTS, HARD HATS, AND SAFETY VESTS. FAILURE BY OFFERORS TO INSPECT THE SITE WILL NOT RELIEVE THEM OF THE RESPONSIBILITY TO PROPERLY ESTIMATE THE DIFFICULTY OR COST OF SUCCESSFULLY PERFORMING THE WORK IN ACCORDANCE WITH THE SPECIFICATIONS AND WITHIN THE ALLOWED TIME.

FOR DATE AND PLACE OF BID OPENING, SEE "SOLICITATION, OFFER, AND AWARD," STANDARD FORM 1442.

FOR INFORMATION REGARDING BUREAU OF RECLAMATION'S PUBLICATION "RECLAMATION SAFETY AND HEALTH STANDARDS" WHICH IS APPLICABLE TO WORK UNDER THIS CONTRACT, SEE CLAUSE AT WBR 1452.223-81, SAFETY AND HEALTH.

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**SECTION B – SUPPLIES OR SERVICES AND PRICES
SAN JUAN LATERAL WATER TREATMENT PLANT
NAVAJO-GALLUP WATER SUPPLY PROJECT – NEW MEXICO**

B.1 PRICE SCHEDULE

- (a) Offers will be considered for award on the basis of the following Price Schedules but no offer will be considered for award on only a part of the Price Schedules. Government will award depending upon available funds.
- (b) Failure to complete any Price Schedule will result in an incomplete offer that will not be considered. The Government reserves the right to award items designated as optional individually.
- (c) Offers are subject to the terms and conditions of this solicitation.
- (d) Offerors are cautioned to carefully review the proposal submission requirements contained in Section L. Failure to comply with these requirements may result in an offer being determined technically unacceptable.
- (e) The contract will be awarded to the offeror as detailed in Sections L and M.
- (f) Definitions:
 - (1) CLIN – Contract Line Item Number
- (g) Form J
 - (1) Include breakdown of the pricing as shown on Form J.
 - (2) Incorporate all construction work, although the WBS descriptions may not specifically identify each element of the Work.
 - (3) Revise Form J to add WBS Activities.
 - (4) Provide a comment on Form J or attach an explanation describing the reasons for each revision.
 - (5) Except as provided in this paragraph, do not revise Form J.

PHASE 1

No pricing information shall be submitted with the Phase 1 Request for Qualifications / Statement of Qualifications

PHASE 2

All of the following (Table A, Price Schedule B, Price Schedule C and Price Schedule D) shall be submitted by the offerors on the short list for Bid Phase 2.

TABLE A – OVERHEAD AND PROFIT

Item	Category	Design, Percent	Construction, Percent
A-1	Job Management/General/Field Overhead Costs		
A-2	Home Office Overhead (General and Administrative)		
A-3	Profit		
A-4	Bonds and Insurance		

PRICE SCHEDULE B

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
B-1	01 81 05	Partnering (50 percent of total price of partnering)	For the lump sum of		\$
B-2	01 81 05	Design of Water Treatment Plant	For the lump sum of		\$

Subtotal FOR PRICE SCHEDULE B \$ _____

Estimated NMGR at 6.6250% for Price Schedule B (if applicable) \$ _____

Estimated Navajo Nation Taxes at 6.00% for Price Schedule B (if applicable) \$ _____

TOTAL FOR PRICE SCHEDULE B \$ _____

PRICE SCHEDULE C

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
C-1	Form J 01 81 05	Construction of Water Treatment Plant	Lump Sum		\$

Subtotal FOR PRICE SCHEDULE C \$ _____

Estimated NMGR at 6.6250% for Price Schedule C (if applicable) \$ _____

Estimated Navajo Nation Taxes at 6.00% for Price Schedule C (if applicable) _____

TOTAL FOR PRICE SCHEDULE C \$ _____

PRICE SCHEDULE D

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
D-1	01 81 05	Repair of San Juan Lateral (downstream/upstream)	Time-and-Materials		\$0.00 (not evaluated)
D-2	01 81 05	Start up and Commissioning of San Juan Lateral for Initial 6-Month Period	For the lump sum of		\$
D-3	01 81 05	Start up and Commissioning of Water Treatment Plant for Initial 6-Month Period	For the lump sum of		\$
D-4	01 81 05	Operation and Maintenance of San Juan Lateral for 6-Month Period after Startup and Commissioning 6 Month Period	For the lump sum of		\$
D-5	01 81 05	Operation and Maintenance of Water Treatment Plant for 6-Month Period after Startup and Commissioning 6 Month Period	For the lump sum of		\$

PRICE SCHEDULE D

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
D-5	01 81 05	Standard Tools and Maintenance Equipment	For the lump sum of		\$25,000
D-6	01 81 05	Optional Extended Operation and Maintenance of Lateral for 12-Month Period	For the lump sum of		\$(not evaluated as TEP)
D-7	01 81 05	Optional Extended Operation and Maintenance of WTP for 12-Month Period	For the lump sum of		\$(not evaluated as TEP)

Subtotal FOR PRICE SCHEDULE D \$ _____

Estimated NMGRT at 6.6250% for Price Schedule D (if applicable) \$ _____

Estimated Navajo Nation Taxes at 6.00% for Price Schedule D (if applicable)\$ _____

TOTAL FOR PRICE SCHEDULE D \$ _____

END OF SECTION

FORM J
PROPOSER'S SCHEDULE C: PRICE ALLOCATION FORM
(See Book 2, Section 2- Exhibit A, Work Breakdown Structure)

Proposed Major Feature	Itemization	Schedule of Values for CLIN C-1				Scope Description
SITE CIVIL	Subfeatures	Proposed Quantity	Units	Unit Price	Total Price	
A	Grading		CY			Earthwork for site development
B	Storm Drain		LS			Enclosed Drainage (If applicable)
C	Base and Pavements		LS			Access and Parking
D	Sidewalk		LS			Building Access
E	Landscaping		ACRE			Permanent Erosion BMPs and Aesthetic Items
F	Fencing		LS			Site Perimeter and other proposal controlled access locations
G	Other Site Improvements		LS			Minor Architecture
H	Site Security		LS			Telecommunication, Cameras, Etc....
I	Site Electrical		LS			Raceway, Cables, Conductors, Transformers, Switchgear
J	Generators and Emergency Power		EA			Backup Generator and Emergency Generators
K	Proposer Added Items		Enter Unit			Additional Items Included by the Proposer
YARD PIPE	Subfeatures					
A	Yard Pipe (Type, Class, Size 1)		LF			Provide type and size of significant pipe
B	Yard Pipe (Type, Class, Size 2)		LF			
C	Yard Pipe (Type, Class, Size 3)		LF			
D	Valves (Type, Class, Size 1)		EA			Provide type and size of significant valves
E	Valves (Type, Class, Size 2)		EA			
F	Valves (Type, Class, Size 3)		EA			
G	Pipe Excavation and Backfill		CY			Excavation and Backfill for Buried Pipe, valves, and vaults
H	Small Vaults and Buried Pipe Access		EA			Concrete or Other to access valves, controls, pressure gauges etc...
I	Proposer Added Items		Enter Unit			Additional Items Included by the Proposer
Building #1	Subfeatures					
A	Structural Excavation and Backfill		CY			Earthwork for building foundation
B	Foundation and Structural Concrete		CY			Concrete for building foundation, walls, columns, etc
C	Metal Superstructure		SF			Structural Steel, roof panels, wall panels, access hatches
D	Process Piping		CY			Pipe, fittings, supports
E	Valves		EA			Control valves, check valves, PRV, tecss
F	Water Treatment Process Equipment		LS			Tanks, Filters, Chemical Storage Tanks, Chemical Feed Systems, Etc
G	HVAC		LS			All Heating and ventilation
H	SCADA		LS			Monitoring and Control Devices
I	Electrical		LS			Building lighting and electrical
J	Fire Protection		LS			Alarms and automatic protection systems
K	Proposer Added Items		Enter Unit			Additional Items Included by the Proposer
Building #2	Subfeatures					
A	Structural Excavation and Backfill		CY			Earthwork for building foundation
B	Foundation and Structural Concrete		CY			Concrete for building foundation, walls, columns, etc
C	Metal Superstructure		SF			Structural Steel, roof panels, wall panels, access hatches
D	Process Piping		CY			Pipe, fittings, supports
E	Valves		EA			Control valves, check valves, PRV, tecss

F	Water Treatment Process Equipment		LS		Tanks, Filters, Chemical Storage Tanks, Chemical Feed Systems, Etc
G	HVAC		LS		All Heating and ventilation
H	SCADA		LS		Monitoring and Control Devices
I	Electrical		LS		Building lighting and electrical
J	Fire Protection		LS		Alarms and automatic protection systems
K	Proposer Added Items		Enter Unit		Additional Items Included by the Proposer
Building #3	Subfeatures				
A	Structural Excavation and Backfill		CY		Earthwork for building foundation
B	Foundation and Structural Concrete		CY		Concrete for building foundation, walls, columns, etc
C	Metal Superstructure		SF		Structural Steel, roof panels, wall panels, access hatches
D	Process Piping		CY		Pipe, fittings, supports
E	Valves		EA		Control valves, check valves, PRV, tecss
F	Water Treatment Process Equipment		LS		Tanks, Filters, Chemical Storage Tanks, Chemical Feed Systems, Etc
G	HVAC		LS		All Heating and ventilation
H	SCADA		LS		Monitoring and Control Devices
I	Electrical		LS		Building lighting and electrical
J	Fire Protection		LS		Alarms and automatic protection systems
K	Proposer Added Items		Enter Unit		Additional Items Included by the Proposer
NOTE TO PROPOSER: CREATE A MAJOR FEATURE AND BUILDING SUBFEATURES (A THROUGH K) FOR EACH MAJOR BUILDING IN THE PROPOSED DESIGN					
Pump Station	Subfeatures				
A	Structural Excavation and Backfill		CY		Earthwork for building foundation
B	Foundation and Structural Concrete		CY		Concrete for building foundation, walls, columns, etc
C	Metal Superstructure		SF		Structural Steel, roof panels, wall panels, access hatches
D	Process Piping		CY		Pipe, fittings, supports
E	Valves		EA		Control valves, check valves, PRV, etc
F	Distribution Equipment		LS		Pumps, Air Chambers, Compressors, Meters
G	HVAC		LS		All Heating and ventilation
H	SCADA		LS		Monitoring and Control Devices
I	Electrical		LS		Building lighting and electrical
J	Fire Protection		LS		Alarms and automatic protection systems
K	Proposer Added Items		Enter Unit		Additional Items Included by the Proposer
Backwash Ponds	Subfeatures				
A	Structural Excavation and Backfill		CY		Earthwork for building foundation
B	Foundation and Structural Concrete		CY		Concrete for building foundation, walls, columns, etc
C	Process Piping		CY		Pipe, fittings, supports
D	Distribution Equipment		LS		Pumps, Air Chambers, Compressors, Meters
E	SCADA		LS		Monitoring and Control Devices
F	Electrical		LS		Building lighting and electrical
Clearwell	Subfeatures				
A	Structural Excavation and Backfill		CY		Earthwork for building foundation
B	Foundation and Structural Concrete		CY		Concrete for building foundation, walls, columns, etc
C	Storage Tank		LS		Concrete or Steel Clear Well Tanks
C	Process Piping		CY		Pipe, fittings, supports
D	Distribution Equipment		LS		Pumps, Air Chambers, Compressors, Meters
E	SCADA		LS		Monitoring and Control Devices
F	Electrical		LS		Building lighting and electrical
Commissioning	Subfeatures				
A	Management		LS		Commissioning Manager Specialist

B	Planning		LS			Develop commission plan and operations manuals
C	Testing		LS			Leak tests, operations tests, water quality tests
D	Staffing		LS			6 months operations
E	Chemicals		LS			6 months operations
General Requirements	Subfeatures					
A	Mobilization		LS			Labor and Equipment mobilization
B	Quality Control		LS			QC Inspection and Testing
C	Bonds		LS			Performance and Payment Bonds
D	Insurance		LS			General Liability
Additive Costs	Subfeatures					
A	Design Contingency		LS			Labor and Equipment mobilization
B	Construction Contingency		LS			QC Inspection and Testing
C	Risk		LS			Performance and Payment Bonds
D	Escalation		LS			General Liability
	PROPOSER'S SUBTOTAL				\$0.00	
	New Mexico Gross Receipts Tax					xx % of Subtotal
	TERO					xx % of Subtotal
	PROPOSER'S PRICE: CLIN C-1				\$0.00	Total Construction and Commissioning Price

CERTIFICATION

I, ___[Authorized Representative]___, hereby certify that I am the authorized representative of ___[Proposer's Name]___, and that

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

- A. Work is located south of BIA Route 36 (N36) approximately 6.1 miles east of intersection of U.S. Highway 491 and N36. The intersection of U.S. Highway 491 and N36 is approximately 4 miles south of Shiprock, New Mexico, in San Juan County. Refer to Section 52 00 00 - Drawings for vicinity and location maps.

1.02 PRINCIPAL COMPONENTS OF WORK

- A. Water Treatment Plant Design and Construction:
1. 18.80 million gallons per day (MGD) water treatment plant (WTP) at Phase 1, with infrastructure ready for expansion to 37.6 MGD Phase 1 capacity capable of turn down to 3.0 MGD at startup during 24 hours of operation.
 2. Water Treatment Process, contractor to select, design, and build one of two options:
 - a. Conventional and Granular Activated Carbon.
 - b. Ultrafiltration and Nanofiltration.
 3. Components
 - a. Pipeline connection to Reach 3 at WTP boundary.
 - b. Main process area.
 - c. Operation and maintenance area.
 - d. Ancillary process structures including chemical storage.
 - e. Pumping plant to convey treated water to the Reach 4A Pipeline project connection point at WTP boundary.
 - f. Design high voltage interface with NTUA's 13.2/7.62 kV distribution circuit.
 - g. Administration Building.
 4. Testing, training, and commissioning.
 5. Demonstration test operation period, including maintenance.
- B. San Juan Lateral:
1. Reclamation and their partners have constructed or are constructing water conveyance facilities from San Juan River Intake, to San Juan Generating Station

Reservoir, through San Juan Lateral Water Treatment Plant, to the City of Gallup and neighboring communities.

2. Refer to Table 01 11 00A – San Juan Lateral Facilities for details on Facilities include:

Table 01 11 00A – San Juan Lateral Facilities

Reach	Year	Main Feature	Pipe Diameter	Pipe Type
Reclamation Facilities				
Reach 1 – San Juan River Intake/Pumping Plant	2026	Updates to existing PP/Intake		-
San Juan Generating Station Reservoir				-
Pumping Plant 1	2027			-
Reach 2-3	2027	19 miles of pipe	36-42	Not installed yet
Reach 4A-4B	2025	17 miles of pipe	42	Not installed yet
Reach 4C-8	2022	29 miles of pipe	42-48	Steel – Welded Joints
Pumping Plant 2-3	2025			-
Pumping Plants 4 and 7	2023			-
Block 9-11	2021	28 miles of pipe	42-48”	Steel – Bell and Spigot
Reach 12A	2013	4 miles of pipe	42”	Steel – Bell and Spigot
Tohalkai Pumping Plant	2018			
Reach 12B	2018	1.5 miles	36”	Steel – Bell and Spigot
Navajo Code Talkers Sublateral (12.1-12.2)	2023	17 miles of pipe	24-30”	Steel – Bell and Spigot
NTUA Facilities				
Shiprock Connection*				
Crownpoint (Reach 10.1/10.2/10.3/10.3.1)				
Pumping Plant 12 and 13				
Coyote Canyon (Reach 10.1)				
Reach 14.1/14.2				
Pumping Plant 14.1 and 14.2				
Reach 14.6a				
Pumping Plant 14.6a				

Table 01 11 00A – San Juan Lateral Facilities

Reach	Year	Main Feature	Pipe Diameter	Pipe Type
Pumping Plant 14.7a				
Reach 14.8a				
Gallup Facilities				
Gamerco Tank (?)				
Pumping Plant 8				
Gallup Regional System				

3. Design and Construction:

- a. Review as-built and construction drawings. Perform field inspection of existing facilities.
- b. Design and construct Shiprock connection for treated water from the Water Treatment Plant to the northwest corner of the WTP site.
- c. Determine and perform required repairs.
- d. Integrate the WTP operation into the operation of the raw water conveyance system, treated water conveyance/disinfection system, and finished water distribution system.
- e. Provide Testing, training and commissioning.
- f. Demonstration test operation period, including maintenance.

C. Operation

1. Raw Water Conveyance System.
2. San Juan Lateral Water Treatment Plant.
3. Treated Water Conveyance/Disinfection System.
4. Finished Water Distribution System (aka Wholesale System).

D. Future Installation Considerations:

1. 18.8 MGD expansion of Phase 1 WTP to Phase 2 capacity of 37.6 MGD, including area allocated for sludge drying beds at Phase 2 Average Day Demand capacity.
2. Expandable infrastructure to accommodate increasing flows over time up to Phase 2 capacity for final build out.
3. 3.5 acres on the WTP property for a future onsite San Juan Lateral maintenance facility on the WTP property but outside of the perimeter fence.

1.03 SPECIFICATIONS REQUIREMENTS

- A. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.
- B. Where specifications are written in streamlined form, words “shall be” are included by inference where a colon (:) is used within sentence or phrase.

1.04 DEFINITIONS

- A. When specifications use a word or term defined in Federal Acquisition Regulations (FAR), definition of the word or term shall be in accordance with FAR sections in effect at the time solicitation was issued.
- B. CE: Construction Engineer.
- C. CO: Contracting Officer.
- D. COR: Contracting Officer’s Representative.
- E. NTUA: Navajo Tribal Utility Authority.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 12 16

WORK SEQUENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 WORK SEQUENCE

- A. Government is flexible to an alternate approach to packaging the design and construction submittals (submittal register). The Contractor may propose an alternative approach including fast-tracking via Early Work Packages. Update submittal register during the initial design stages of the project.
- B. Reclamation will provide informational comments on the Request for Proposal Design to the selected contractor 30 days after issuance of Notice to Proceed.
- C. Fast-tracking via Early Work Packages:
1. After issuance of Notice to Proceed, Contractor may begin construction on Early Work Packages that Navajo Nation EPA, USEPA, and NMED have reviewed and accepted for constructing the completed design submittal requirements of the applicable package. Early Work Packages shall be complete and self-standing without references to other documentation or packages.
 2. Government will not grant a time extension for a design re-submittal when, in the opinion of the CO, the initial submission failed to meet minimum performance requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 14 10

USE OF SITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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:
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 Right-of-Way (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) Water and sanitary waste plan.
 - 6) 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.
 - 7) Areas for processing, storing, and disposing of waste materials from construction operations.
 - 8) 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 reseed disturbed areas in accordance with 32 92 20 – Seeding.
 - d. Describe methods to protect, and repair, existing improvements, and utilities at or near jobsite.
 - e. 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.
- C. RSN 01 14 10-2, Optional Onsite Security Plan:
 - 1. Schedule for single individual to live on job site to provide full-time inhabitation including estimated or fixed dates.
 - 2. Residence facilities, indicating:
 - a. If existing job trailer will be used or if a new trailer will be placed onsite.
 - b. Utilities for residence facility to be used and if modifications are required:
 - 1) Electric.
 - 2) Water.
 - 3) Waste management.
 - c. Any changes required to existing site security lighting.
 - 3. Map showing residence facility in relation to overall site, including plant, construction trailer, etc.
 - 4. Other items not listed pertinent to additional site use.

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 for approved location of construction trailers.
 - 2. Include space and hookups for Government 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 Sections 01 31 19 – Project Management and Coordination and 01 57 90 – Preservation of Historical and Archeological.

- 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 and/or Government in vicinity, or with reservations made by Government for use of such land.
- E. See 01 51 00 – Temporary Utilities.
- F. Optional (not required), limited Contractor-provided housing for onsite security team member will be permitted with approved RSN 01 14 10-2.

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 Contractor 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 in accordance with SWPPP and Section 01 57 30 – Water Pollution Control.

END OF SECTION

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SECTION 01 20 10

RISK MANAGEMENT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.03 QUALIFICATIONS

- A. Risk Manager:
1. Minimum 10 years' experience preparing, facilitating and modeling:
 - a. Risk management plans for work of similar complexity and contract value.
 - b. Schedule risk analysis for work of similar complexity and contract value.
 2. May have collateral duties including construction scheduler.
- B. Construction Scheduler:
1. Minimum 10 years' experience preparing detailed construction schedules of similar scope with the ability to modify in response to different scenarios and possible changes to scope, sequence, and other variations.
 2. May have collateral duties including risk manager.

1.04 RISK MANAGEMENT PLAN

- A. Define how risks shall be identified.
- B. Specify how Schedule Risk Analysis shall be developed and executed.
- C. Define how response strategies for risks shall be developed.
- D. Specify how risks shall be controlled or mitigated for the work.
- E. Identify roles and assign responsibilities for the Contractor and COR for each component of the Risk Management Plan.

1.05 SCHEDULE RISK ANALYSIS

A. Risk Identification Sessions:

1. 30 days before 30, 60, 90, and 100 Percent Designs.
2. Risk Manager shall present purpose of Schedule Risk Analysis, how process works, and products generated from analysis.
3. Include Contractor representatives deemed necessary by Risk Manager, COR, and other stakeholders requested by the COR.
4. Provide meeting facility preapproved by the COR.
5. Duration: Subject to time needed to satisfy the Risk Manager, COR, and Contractor that risks have been identified and discussed.
6. Update Risk Register during session. Include:
 - a. Risk Number, Risk Summary Description, Expanded Description of the Risk, Risk Responsibility, Session Discussion, and Responsible Person for Management of the Risk Mitigation Measures.
 - b. Identified risks during the session, whether determined pertinent or not.

B. Risk Register:

1. For the Request for Proposal Design, develop a Risk Register that identifies Risk Number, Risk Summary Description, Expanded Description of the Risk, and Risk Responsibility.
2. Prior to 60, 90, and 100 Percent Designs, distribute draft update from Risk Identification Session to participants for review and comment.
 - a. Risk Manager shall review comments and document reasoning for inclusion or exclusion in Risk Register.
 - b. Include in final report generated for analysis.

C. Schedule Risk Analysis model in table format:

1. Risk Number, Risk Summary Description, Variance Distribution, Correlation to Other Risk Items, Estimated Schedule Impacts (Low, Most Likely, High)
2. Documentation and calculations for the development of Estimated Schedule Impacts.
3. Documentation of the software used to run the Monte Carlo method.

D. Schedule Risk Analysis Report:

1. Prior to 60, 90, and 100 Percent Designs, distribute draft Schedule Risk Analysis for review and comment. Include:
 - a. Date, times, location, and list of attendees at the Risk Identification Session.

- b. Risk Register and documented responses noted.
 - c. Schedule Risk Analysis model utilizing the Monte Carlo method.
 - d. Sensitivity analysis.
 - e. A probability frequency curve with the minimum statistics:
 - 1) Trials.
 - 2) Base Case (Most Likely).
 - 3) Mean.
 - 4) Median.
 - 5) Standard Deviation.
 - 6) Variance.
 - 7) Skewness.
 - 8) Kurtosis.
 - 9) Minimum.
 - 10) Maximum.
 - 11) Percentiles in 10 percent increments ranging from 0 percent to 100 percent with forecast values.
 - f. Details of each risk element in the model to include:
 - 1) Distribution assumptions assigned.
 - 2) Low, Most Likely, High Values (Schedule).
2. Risk Manager shall review comments and document reasoning for inclusion or exclusion in Risk Register. Include in final report.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 24 13

VALUE ENGINEERING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM E1699 Performing Value Analysis (VA) of Buildings and Building Systems and Other Construction Projects

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. RSN 01 24 13-1, Value Team Members:
1. A list of each team member's profession or specialty.
 2. Provide a diverse group of four design and construction professionals. Include a cost estimator.

1.04 SCHEDULE

- A. Include value engineering on the Baseline Schedule - Design detailed in Section 01 32 10 - Design and Construction Program.
- B. Reclamation will conduct value engineering study in accordance with ASTM E1699 within 60 days after the Contractor submits the 30 Percent Design.
1. Reclamation will provide certified value engineering facilitator, along with four design and construction professionals.
 2. Contractor shall participate in the value engineering study.
- C. Reclamation will issue a Value Engineering Report within 21 days after value engineering study completion.
- D. Reclamation will issue a draft Accountability Report within 30 days after issuing the Value Engineering Report. Reclamation will issue a final Accountability Report within 45 days after issuing the Value Engineering Report.

1.05 VALUE ENGINEERING STUDY FOCUS AND SAVINGS

- A. Study Focus:
 - 1. Construction cost savings that does not affect the quality of the final product.
 - 2. Improving the quality of the building and life cycle cost savings.
- B. Use construction savings from the study to offset additional up front cost generated by a proposal with life cycle cost savings.

1.06 VALUE ENGINEERING CHANGE PROPOSALS

- A. May be submitted after the Accountability Report has been issued.
- B. Attach a letter from the designer explaining why idea initially rejected is now acceptable. Include changed conditions that make idea acceptable.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 04

PARTNERING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 INTENT

- A. Discuss effectively and successfully implementing work under an integrated traditional design-build approach. Form an informal management partnership with the Contractor to develop a cohesive team.
- B. Form a bilateral relationship striving for mutual trust, dedication to common goals, and an understanding of individual expectations and values.
- C. Develop a cooperative management team drawing on strengths of each team member. Expected benefits include improved efficiency, cost effectiveness and innovation between parties to ensure a quality deliverable completed on time and within budget.
- D. Anticipated partnership between Contractor, primary construction subcontractors and designers, and Government including NTUA and City of Gallup.
- E. Partnering Sessions:
1. Facilitated by a third party selected by the Contractor with approval by Government.
 2. At the Contractor's request, Government will supply a list of pre-qualified/acceptable facilitators.
 3. Held in Farmington, New Mexico.
 4. One full-day initial partnering session.
 - a. Team scoping/partnering workshop held within 30 days following Notice to Proceed to discuss the specific elements related to the pre-construction services/design phase of the project.
 - b. Discussion shall include design reviews, reconciliation of review comments, determine packaging requirements, discuss incremental submittal approach, determine schedule of values needs (level of appropriate break down), project goals, issue escalation plan during design, roles and responsibilities of design build team and Government, expectations of the design build process, project communication plan, schedule management, risk analysis, design charrettes, and construction partnering.

5. Quarterly half day sessions during the design and construction.
6. Full-day final lessons learned session once construction is complete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 19
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards including revisions posted at:
<https://www.usbr.gov/safety>

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. RSN 01 31 19-1, Pre-Work Conference.
- C. RSN 01 31 19-2, Design Visits and Meetings Notes.
- D. RSN 01 31 19-3, Written Summary:
1. Written weekly summary of upcoming work, traffic plans, and progress meeting minutes.
- E. RSN 01 31 19-4, 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:
 - 1) Minimum information required for Cultural analysis:
 - a) Map and UTM data in NAD83 format of the location, narrative of intended use of the new area, summary of intended access to the new area, and a need by date.
 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 Plan Protection.

- d. Section 01 57 60 – Protected Species.
- 4. Do not use proposed land until approved by COR: Approvals may require up to 6-months.
- 5. Requirement does not apply to existing commercial facilities.

1.04 DESIGN MEETINGS

- A. Pre-Work Conference:
 - 1. Conducted after contract award and as needed.
 - 2. Government and Contractor shall review design submission and review procedures, discuss preliminary design schedule, phase completion of the design documents and construction activities.
- B. A minimum of 75 percent and 95 percent Design Charettes shall be held in person in Farmington, New Mexico or more frequently as needed.
- C. Site visits and meetings scheduled with the COR. Document design site visits, telephone and in-person meetings. Include subject, names, discussion, recommendations or conclusions.
- D. Request for Proposal Design, 30 Percent Design, 60 Percent Design, and 90 Percent Design Review Conferences:
 - 1. For each design review package submittal at Government's facilities in Farmington, New Mexico or as approved by the COR.
 - 2. Attendees: Contractor personnel responsible for the design.
 - 3. Agenda at least 3 days prior to the conference.
 - 4. 7 days after the close of the review period.
 - 5. Contractor shall provide written summary of review conference.
- E. WTP SCADA and Design Charettes:
 - 1. Conduct a minimum of three design coordination meetings with both the Contractor and Government in attendance.
 - a. Integrator to attend.
 - b. Two design coordination meetings shall be held at Government facilities in Farmington, NM or a mutually agreed upon location.
 - c. One design coordination meeting shall be held at the construction site or a mutually agreed upon location.
 - d. Perform a design coordination meeting before and after submittal of the Section 01 86 25 - System Control and Monitoring 60 Percent Design submittal.

- e. Perform a design coordination meeting after submittal of the Section 01 86 25 - System Control and Monitoring 90 Percent Design submittal and prior to installation of the WTP SCADA system.
2. The purpose of the meetings shall be to discuss coordination issues, programming and control logic algorithms, specific details of the plant operation, report generation, and human-machine interface screen configurations.
3. Design coordination meetings shall be scheduled at a mutually agreed upon date.
4. The Contractor is responsible for providing equipment and paperwork needed for review and discussion of the design coordination subjects.
5. Any additional meetings shall be mutually agreed upon.

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 the project's property, rights-of-way, or temporary construction easements.

3.02 PROJECT COORDINATION

- A. Coordinate work with COR, other Government staff, Navajo Nation Department of Water Resources, Navajo Tribal Utility Authority, Bureau of Indian Affairs, and other Federal, Tribal, State, and local agencies as needed, which may include but not be limited to the following:
 1. City of Gallup.
 2. Cultural resources contractor.
 3. Environmental services contractor.
 4. Navajo Nation Department of Fish and Wildlife.
 5. Navajo Nation Water Code Administration and Navajo Nation Environmental Protection Agency.
 6. Oil and gas companies.
- B. Attend two to three public meetings per year to assist Reclamation with public outreach. Provide materials for quarterly meetings.
- C. Facilitate onsite work with above listed agencies.

- D. Provide COR, via email, with a rolling 48-hour construction schedule for Cultural Resources coordination.

3.03 CONSTRUCTION MEETINGS

- A. The following meetings are considered significant but do not relieve Contractor from responsibility of other meetings required by contract.

1. Pre-Construction Meeting:

- a. Meet with Government prior to start of construction. Contractor shall provide as minimum Project Manager or Project Superintendent for Preconstruction Meeting. Review will include, but may not be limited to:
 - 1) Use of ROW by Contractor, Government, and public.
 - 2) Off ROW land use coordination.
 - 3) Construction facilities and controls.
 - 4) Access to work and haul routes.
 - 5) Temporary utilities.
 - 6) Survey layout.
 - 7) Security.
 - 8) Housekeeping procedures.
 - 9) Schedules and sequence of work.
 - 10) Procedures for testing.
 - 11) Procedures for maintaining record documents.
 - 12) 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.
 - 13) Roles and responsibilities:
 - a) Government organization and personnel.
 - b) Contractor organization and personnel.
 - c) Subcontractors.
 - d) Proposed work schedule.
 - 14) 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.
 - i) As-builts, O&M manuals and SOP's.
- 2. Pre-Construction Safety Meeting:
 - a. Meet with COR prior to start of construction.
 - b. Prior to start of construction review will include approved safety plan.
 - c. 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 and OSHA.
- 3. Progress Meetings:
 - a. Meet weekly with Government to review:
 - 1) Progress made.
 - 2) Review As-built drawings.
 - 3) Difficulties in performing work.
 - 4) Discuss safety performance
 - 5) Resolution necessary to meet specifications requirements.
 - 6) Status of contract documents (RFI's, submittals, etc.).
 - 7) Three-week look ahead including upcoming cultural monitoring areas discussed.
 - 8) Updating of progress reports.
 - 9) 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 (CDMS)

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Contract Document Management System:

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

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. RFIs: Request for Information (Contractor generated document).
 - e. RFPs: Request for Proposal (Reclamation generated document).
 - f. CMs: Contract Modifications.
 - g. Contractor Proposals.
 - h. Value Engineering Proposals.
 - i. Bureau of Reclamation (Reclamation) Inspection Reports.
 - j. DIR: Daily 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. System provider experience, number of systems operations, references.
2. Documentation of system capabilities.
3. Instructions for system use.

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

1. Reclamation provided USB Drive with all uploads to CDMS as available.

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 the following supported file formats, minimum:
 - a. Adobe Acrobat.
 - b. MS Word.
 - c. MS Excel.
 - d. MS Project.
 - e. MS PowerPoint
 - f. MP4 for Videos.
 - g. Oracle Primavera P6 Project Manager.
 - h. AutoCAD Civil 3D Version 2021.
 - i. 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 project manager 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 include:
 - 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 include:
 - a. RFP linked to a CM.
 - b. Submittal linked to a Specification or Drawing.
- C. Reports:
 - 1. CDMS shall:
 - a. Generate reports that list and sort documents by status; examples include:
 - 1) Submittals that have been approved.
 - 2) Invoices paid to date.
 - 3) RFIs under review.
 - b. Generate alerts when documents requiring action approach or exceed allowable time.
 - c. Generate customizable summary reports; examples include:
 - 1) Submittal Turn-around.
 - 2) RFI Turn-Around.
 - 3) CM Processing Turn-Around.
 - 4) Total CM costs.
 - 5) Total CM Request Exposure.
 - d. Reports shall be printable, exportable as searchable .pdf or printer friendly .html, and exportable to Excel (.xls, .xml, or .csv).
 - e. Ability to link from an item in a report directly to item by clicking on it:
 - 1) For example: In submittal report, clicking on submittal that is 15-days old takes you directly to information on that submittal.
 - f. Capable of producing complete and logically organized set of documents within CDMS in both .pdf and .xml format.
- D. Document Security and Backup:

1. Secure Server Language (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 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 record of changes.
 3. Backup/Archiving to FTP site of documents to which an organization has access on a regular (minimum monthly) basis. Backups shall be in .pdf format.
 4. Documents shall be downloadable to FTP sites where Government and other organizations can 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, and 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.).
 - b. Document changes including who entered or changed document and date change was made.
 - c. 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 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 the submittal package, and to route each sub-item to appropriate reviewers.

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

G. RFI Tracking and Control:

1. Provide 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 Reclamation 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 Government 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. CDMS shall 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., the 1st response to Memo 32 to be 32.1, 2nd response to be 32.2, etc.
 3. Official correspondence from Government to Contractor shall contain Government'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, daily inspection reports, 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., 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 Government'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

2.01 SOFTWARE

- A. 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 within 45-days of Award:
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 system.
- B. Contractor shall input entrees to Schedule of Submittals before making submittals:
1. Schedule of Submittals shall include 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:
1. Be in a table format and include:
 - a. Required Submittal Number (RSN).
 - b. Section Title.
 - c. Submittal Title.
 - d. Date Submitted.
 - e. Date of Response.
 - f. Approval Status (approved, partially approved, approved subject to identified changes and resubmit, or not approved).
 - g. Days in Review.
 - h. Due Date.
- D. CDMS shall be operational until final project closeout.

END OF SECTION

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PART 1 GENERAL

A. In accordance with Section 01 81 05 - General Performance Requirements.

A. Days: Calendar days.

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

- ### 1.03 REFERENCE STANDARDS

- Submittals
01 33 00 - 1

1. PIP PIC001-2018 Piping and Instrumentation Diagram Documentation Criteria
2. PIP PIE001-2018 Process Flow Diagram Documentation Guidelines

D. Bureau of Reclamation (Reclamation)

1. Information Management Handbook Volume 3 Part 2 Drafting Standards

1.04 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, notify COR for clarification.

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.
3. Measurement Units: US Customary Units.
4. 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.
 - d. Provide a drawing title block consistent with National CAD Standard Title Block.
 - e. Project Information:
 - 1) Navajo-Gallup Water Supply Project, New Mexico.
 - 2) San Juan Lateral – Water Treatment Plant.
2. Reserve 3- by 3-inch space next to title block for review stamps.
3. Reserve space required for block detail titled "Drawings with Non-Reclamation Title Block" identified in the Reclamation Information Management Handbook Volume 3 Part 2 Drafting Standards, Figure 4, refer to Section 52 00 00 - Drawings.
4. Size: D size (22 inches by 34 inches) as defined by ASME Y14.1.
5. 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 and Civil 3D, Version 2018 or later.
 - 3) Compile using “eTransmit” utility in AutoCAD.
 - 4) Building Information Model (BIM): Compatible with Autodesk Revit Version 2018 or later.
 - a) Other BIM or 3D integrated software may be accepted per CO review and approval.
 - b) Provide at minimum a BIM viewer at no additional cost to the Government for software other than Autodesk Revit.
 - c) BIM or 3D modeling software shall have the capability of integrating applicable discipline models into a single central model.
 - 5) Government will own drawings and model.
- b. Drawing prepared with drafting equipment, when allowed: Lettering shall be neat.
6. Government will provide an electronic AutoCAD format template.
7. Final Drawings:
 - a. Computer drafted.
 - b. Show as-built changes, including revision dates, made during installation. Indicate changes by clouding.
8. Process Flow Diagrams (PFDs): In accordance with PIP PIE001.
9. Piping and Instrumentation Diagrams (P&IDs): In accordance with ISA 5.1 and PIP PIC001.

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.
2. Manufacturer’s Certifications: Signed by authorized representative of manufacturer.

F. Manuals:

1. Electronic copies:
 - a. Searchable Adobe pdf.
 - b. Bookmark files to assist in navigating.
 - c. 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.
2. Contents:
 - a. Index sheet at front of each binder which provides page or index tab number information for each device or item.
 - b. Use heavy section dividers with reinforced holes and numbered plastic index tabs to facilitate location of information.
 - c. Parts identification lists, lists of special tools, and accessories.
 - d. Schematics and wiring diagrams for equipment, including all control and lighting systems. List of electrical relay settings and control and alarm contact settings.
 - e. Manufacturer's detailed instructions for installing, operating, lubricating, and maintaining equipment, including maintenance schedule.
 - 1) Operating instructions include equipment startup, normal operation, shutdown, emergency operation, and troubleshooting.
 - 2) Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list, and recommended spare parts.
 - f. As-built drawings, photographs, and test records or reports.

G. Photographs: Jpeg or similar format, larger than 1 megabyte per photo, label electronically.

H. Fixtures, Finishes, Samples, and Color Selection Submittals:

1. Label with complete manufacturer's product and color identification.
2. Include type and quantity of materials specified in the referenced section in each "set" of samples.
3. Samples: Representative of product to be installed. Xerographic sheets for color selection are not acceptable.
4. Color Chips: Sample paint chips. Ink color reproductions are not acceptable.
5. Label each sample, sample kit, set of color chips, or color chart with contract number and title.
6. Government will select architectural color and pattern after product acceptance.

- I. This Section applies to design and construction phase submittals.

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 the “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 accepted:
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 the comments unless otherwise directed.
 4. Requirements for initial submittals apply to resubmittals.
- F. 60, 90, and 100 Percent Submittals:
1. Note differences from previous submittals.
 2. Refine previous design. Note changes since the previous submittal. If there was no change made to an item since last submittal, indicate by adding “No Change”.
- G. More than one RSN may be submitted under a transmittal letter, provided responsible code is same.
- H. Reconcile the submittal table in accordance with Section 01 81 05 - General Performance Requirements.

1.06 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 14 days for review of each submittal or resubmittal, including submittals between Contractor and engineer of record, 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 CDMS posting date.
3. The following submittals will require 28 days for review of each submittal or resubmittal.
 - a. Early Work Package(s).
 - b. RSN 01 81 05-3, 30 Percent Design.
 - c. RSN 01 81 05-5, 60 Percent Design.
 - d. RSN 01 81 05-8, 90 Percent Design.
 - e. RSN 01 81 05-10, 100 Percent Design.

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 the extent that:
 - a. Acceptance was required under the contract, and
 - b. Requests for acceptance were properly and timely submitted and were accepted.
4. Adjustment will be subject to terms of paragraphs (b) and (c) of clause at FAR 52.242-14, Suspension of Work; however, no such delay shall be deemed to be a “suspension order” as term is used in that clause.

C. Return of Submittals:

1. Return of submittals will be by CDMS.

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 accepted
 - a. Revise and resubmit submittals not accepted.
 - b. Do not change designs without acceptance of CO after drawings, documentation, and technical data have been accepted.
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 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 Street, Room 6107, Salt Lake City, UT 84138-1147.
 2. Construction Engineer, Bureau of Reclamation, 1235 La Plata Highway, Farmington, NM 87401.
 3. Technical Service Center, Bureau of Reclamation, Attn: 86-68160, P.O. 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 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

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 60-days before use of ROW	A	CE	CDMS		
01 14 10-2	Use of Site	Optional Onsite Security Plan	At least 60-days before use of site	A	CE	CDMS		
01 24 13-1	Value Engineering	Value Team Information	Per Contractor's baseline schedule	A	CE	CDMS		
01 31 19-1	Project Management and Coordination	Pre-Work Conference	Within 14 days after receipt of Notice to Proceed	I	CE	1	1	1
01 31 19-2	Project Management and Coordination	Design Visits and Meetings Notes	Within 7 days of visits and meetings	I	CE	CDMS		
01 31 19-3	Project Management and Coordination	Written Summary	Weekly once onsite work begins	I	CE	CDMS		
01 31 19-4	Project Management and Coordination	Off ROW Land Use Coordination	6 months prior to use of land	A	CE	CDMS		
01 31 30-1	Contract Document Management System	Approval Data	Within 7 days after receipt of Notice of Award	A	CE	1	1	1
01 31 30-2	Contract Document Management System	Final Data	Within 14 days of completion of work	I	CE	1	1	1
01 32 10-1	Design and Construction Program	Representative Information	Within 7 days after receipt of Notice of Award	A	CE	CDMS		
01 32 10-2	Design and Construction Program	Baseline Schedule – Design	Within 21 days after receipt of Notice to Proceed	A	CE	CDMS		
01 32 10-3	Design and Construction Program	Baseline Schedule - Construction	With the first early work package, 60 days before mobilizing onsite, or with the 90 Percent Design, whichever occurs first	A	CE	CDMS		
01 32 10-4	Design and Construction Program	Updated Schedule Reports	Monthly or with Progress Payments	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 *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 32 10-5	Design and 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	CE	CDMS		
01 35 10-1	Safety Data Sheets	Complete LHM and SDS	14 days before jobsite delivery of hazardous material	I	CE	CDMS		
01 35 10-2	Safety Data Sheets	Updated LHM and SDS	14 days before jobsite delivery of hazardous material not previously listed	I	CE	CDMS		
01 35 20-1	Safety and Health (WBR 1452.223-81)	Safety Program	Submitted and accepted before commencing onsite work See Section 3 of RSHS	A	CE	CDMS		
01 35 20-2	Safety and Health	Job Hazard Analysis (JHA) List	At least 30-days before beginning onsite work	I	CE	CDMS		
01 35 20-3	Safety and Health	Monthly Accident Summary Report	First day of each month. See paragraph 3.8 of RSHS	I	CE	CDMS		
01 35 20-4	Safety and Health	Documentation and Records	At least 30-days before beginning onsite work	I	CE	CDMS		
01 35 30-1	Contractor's Onsite Safety Personnel	Resume	28 days before beginning onsite construction work	A	CE	CDMS		
01 35 30-2	Contractor's Onsite Safety Personnel	Safety Inspection Reports	Once each week during onsite work	I	CE	CDMS		
01 46 00-1	Quality Procedures	Contractor Quality Control Plan (QC)	28 days before beginning onsite work	A	CE	CDMS		
01 46 00-2	Quality Procedures	Contractor's Daily Report	No later than the end of the following work day	I	CE	CDMS		
01 46 00-3	Quality Procedures	Quality Control Supervisor (QCS) Resume	28 days before beginning onsite work	A	CE	CDMS		
01 46 00-4	Quality Procedures	Contractor's Quality Testing Plan	28 days before beginning onsite work	A	CE	CDMS		

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 46 00-5	Quality Procedures	Summary of Monthly Test Results	Monthly	I	CE	CDMS		
01 46 20-1	Testing Agency Services	Qualifications and Testing Agency Services Plan	42 days before testing is required	I	CE	CDMS		
01 55 00-1	Vehicular Access and Parking	Pre-Construction Digital Recording	21 days before beginning onsite work	A	CE	CDMS		
01 55 00-2	Vehicular Access and Parking	Post Construction and Post Repair Digital Recording	21 days before release of final payment	A	CE	CDMS		
01 56 15-1	Protection of Existing Utilities	Utility Owner Acknowledgment	28 days before start of onsite construction work	I	CE	CDMS		
01 56 15-2	Protection of Existing Utilities	Utility Crossing Investigation	7 days after completing investigation	I	CE	CDMS		
01 56 15-3	Protection of Existing Utilities	Work Plan within Utility Easement	28 days before start of onsite construction work	I	CE	CDMS		
01 57 20-1	Environmental Controls	Copy of Applicable Air Quality Permit	14 days before beginning onsite work	I	CE	CDMS		
01 57 30-1	Water Pollution Control	Updated Stormwater Pollution Prevention Plan (SWPPP)	28 days before start of onsite work	A	CE	CDMS		
01 57 30-2	Water Pollution Control	Spill Prevention, Control, and Countermeasure (SPCC) Plan	28 days before delivery or storage of oil	I	CE	CDMS		
01 57 90-1	Preservation of Historical and Archeological Data	Alternate Use Area or Borrow Area	6 months prior to use of land	A	CE	CDMS		
01 71 20-1	Surveying	Surveying Plan	28 days before start of survey work	A	CE	CDMS		
01 71 20-2	Surveying	Resumes	28 days before start of survey work; 28 days before personnel change	A	CE	CDMS		
01 71 20-3	Surveying	Accuracy Check Results	28 days before start of survey work	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	Sets to be Sent: **		
						CO	CE	TSC
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	21 days prior to onsite work	A	CE	CDMS		
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	28 days before beginning environmental assessment	A	CE	CDMS		
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	No more than 14 days after completion of work	A	CE	CDMS		
01 78 30-1	Project Record Documents	Progress As-built	Within 28-days of Government issued substantial completion of work	A	CE	0	2	0
						CDMS		
01 78 30-2	Project Record Documents	Draft O&M Manuals	60-days prior to completion of project	A	CE	0	2	2
						CDMS		
01 78 30-2	Project Record Documents	Record Drawings	Within 14-days of approval of RSN 01 78 30-1	A	CE	0	2	0
						CDMS		
01 78 30-4	Project Record Documents	O&M Final, Approved Manuals	Within 14-days of completion of project	A	CE	0	2	2
						CDMS		
01 79 20-1	Training	Final Acceptance Testing Phase	Per Contractor's baseline schedule	I	CE	CDMS		
01 81 05	General Performance Requirements	Design Proposal	Refer to Section L &M					
01 81 05-1	General Performance Requirements	Schedule of Values	Within 21 days after receipt of Notice to Proceed	A	CE	CDMS		
01 81 05-2	General Performance Requirements	30 Percent Design	Per Contractor's baseline schedule	I	CE	CDMS		

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 81 05-3	General Performance Requirements	30 Percent Comment Response	10 days after Government transmits comments and 3 business days prior to the Design Review	I	CE	CDMS		
01 81 05-4	General Performance Requirements	60 Percent Design	Per Contractor's baseline schedule	I	CE	CDMS		
01 81 05-5	General Performance Requirements	60 Percent Design Reconciled Submittal Table	With 60 Percent Design	I	CE	CDMS		
01 81 05-6	General Performance Requirements	60 Percent Comment Response	10 days after Government transmits comments and 3 business days prior to the Design Review	I	CE	CDMS		
01 81 05-7	General Performance Requirements	90 Percent Design	Per Contractor's baseline schedule	I	CE	CDMS		
01 81 05-8	General Performance Requirements	90 Percent Comment Response	10 days after Government transmits comments and 3 business days prior to the Design Review	I	CE	CDMS		
01 81 05-9	General Performance Requirements	100 Percent Design	Per Contractor's baseline schedule	I	CE	CDMS		
01 81 05-10	General Performance Requirements	Construction Progress Submittals	28 days prior to associated onsite work	I	CE	CDMS		
01 81 05-12	General Performance Requirements	100 Percent Construction	Per Contractor's baseline schedule	I	CE	CDMS		
01 81 13-1	Sustainable Design Performance Requirements	Energy Use Benchmark Data	Within 21 days after completing Extended Demonstration Test	I	CE	CDMS		
01 86 25-1	System Control and Monitoring Performance Requirements	Approval Data	40 days prior to equipment manufacture	I	CE	CDMS		
01 86 25-2	System Control and Monitoring Performance Requirements	Factory Acceptance Test Plan	84 days prior to test	I	CE	CDMS		

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RSN	Clause or Section Title	Submittals Required	Due Date or Delivery Time	Type *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 86 25-3	System Control and Monitoring Performance Requirements	Factory Test Notification	56 days prior to test	I	CE	CDMS		
01 86 25-4	System Control and Monitoring Performance Requirements	Factory Test Report	14 days after test completion	I	CE	CDMS		
01 86 26-1	Electrical Performance Requirements	Construction Approval Drawings	28 days prior to associated onsite work	I	CE	CDMS		
01 86 26-2	Electrical Performance Requirements	Electrical System Calculations	60 days prior to electrical equipment energization	I	CE	CDMS		
01 86 27-1	Instrumentation Performance Requirements	Construction Approval Drawings	28 days prior to associated onsite work	I	CE	CDMS		
01 86 27-2	Instrumentation Performance Requirements	Factory Calibration Sheets	28 days prior to installation	I	CE	CDMS		
01 86 30-1	Information System Security Performance Requirements	Contingency Plans	28 days before start of facility commissioning	I	CE	CDMS		
01 86 30-2	Information System Security Performance Requirements	Approval Drawings	28 days before start of facility commissioning	I	CE	CDMS		
01 86 30-3	Information System Security Performance Requirements	Preliminary Configuration Documentation	28 days before start of facility commissioning	I	CE	CDMS		
01 86 30-4	Information System Security Performance Requirements	Preliminary Asset and Account Management Lists	Per Contractor's baseline schedule	I	CE	CDMS		
01 86 30-5	Information System Security Performance Requirements	Pre-testing Documentation	Per Contractor's baseline schedule	I	CE	CDMS		
01 86 30-6	Information System Security Performance Requirements	Final System Documentation	Per Contractor's baseline schedule	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 *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 86 30-7	Information System Security Performance Requirements	Final Asset and Account Management Lists	Per Contractor's baseline schedule	I	CE	CDMS		
01 86 30-8	Information System Security Performance Requirements	Final Configuration Documentation	Per Contractor's baseline schedule	I	CE	CDMS		
01 86 46-1	Water Treatment Performance Requirements	Emergency Action Plan	Submitted and accepted before commencing onsite work	I	CE	CDMS		
01 86 46-2	Water Treatment Performance Requirements	Testing Protocol	21 days prior to acceptance and functional testing	I	CE	CDMS		
01 86 46-3	Water Treatment Performance Requirements	Completed Testing Protocol	7 days prior to functional testing	I	CE	CDMS		
01 86 46-4	Water Treatment Performance Requirements	Testing Phase	14 days after completion of applicable test	I	CE	CDMS		
01 86 46-5	Water Treatment Performance Requirements	Operation Phase	Per Contractor's baseline schedule	I	CE	CDMS		
01 91 13-1	Building Commissioning	Operation Phase	Per Contractor's baseline schedule	I	CE	CDMS		
01 91 16-1	Facility Commissioning	Qualifications	Per Contractor's baseline schedule	I	CE	CDMS		
01 91 16-2	Facility Commissioning	Test Plan	28 days before start of facility commissioning	I	CE	CDMS		
01 91 16-3	Facility Commissioning	Test Procedures	28 days before start of facility commissioning	I	CE	CDMS		
01 91 16-4	Facility Commissioning	System Turnover Books	Within 21 days after completing Demonstration Test	I	CE	CDMS		
01 91 16-5	Facility Commissioning	Discrepancy List	Monthly	I	CE	CDMS		
01 91 16-6	Facility Commissioning	Preliminary SOPs	28 days before start of facility commissioning	I	CE	CDMS		
01 91 16-7	Facility Commissioning	Final SOPs	Within 21 days after completing Demonstration Test	I	CE	CDMS		
01 91 16-8	Facility Commissioning	Outline of Operations Plan	56 days before start of facility commissioning	I	CE	CDMS		
01 91 16-9	Facility Commissioning	Operations Plan	28 days before start of facility commissioning	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 *	Responsible Code	Sets to be Sent: **		
						CO	CE	TSC
01 91 16-10	Facility Commissioning	Operation Documentation	Within 21 days after completing Monitored Test	I	CE	CDMS		
01 91 16-11	Facility Commissioning	Issues and Resolution Log	Weekly	I	CE	CDMS		
01 91 16-12	Facility Commissioning	Maintenance Log	Monthly	I	CE	CDMS		
01 91 16-13	Facility Commissioning	Monitored Test Report	Within 21 days after completing Monitored Test	I	CE	CDMS		
01 91 16-14	Facility Commissioning	Demonstration Test Report	Within 21 days after completing Demonstration Test	I	CE	CDMS		
01 91 16-15	Facility Commissioning	Extended Demonstration Test Report	Within 21 days after completing Extended Demonstration Test	I	CE	CDMS		
01 91 16-16	Facility Commissioning	Operation and Maintenance Manual	Within 42 days after completing Extended Demonstration Test	I	CE	CDMS		

END OF SECTION

SECTION 01 33 26
ELECTRICAL AND CONTROL DRAWINGS AND DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. Drawings: As used in this Section, means ‘shop drawings’ as defined in Clause FAR 52.236-21, Specifications and Drawings for Construction.

1.03 REFERENCE STANDARDS

- A. Institute of Electrical and Electronic Engineers (IEEE)
1. IEEE 315 Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Class Designation Letters)
- B. International Society of Automation
1. ISA 5.1 Instrumentation Symbols and Identification
 2. ISA 5.4 Instrument Loop Diagrams
- C. National Electrical Manufacturers Association (NEMA)
1. NEMA ICS 19) Diagrams, Device Designations, and Symbols
- D. National Institute of Building Sciences (NIBS)
1. NIBS NCS United States National CAD Standard - Version 5

1.04 SUBMITTAL PROCEDURES

- A. In addition to the requirements of Section 01 33 00 - Submittals, prepare electrical and control drawings and data as follows:
- B. Drawings, General:
1. Provide title block as described in Section 01 33 00 - Submittals.
 2. Drafting conventions: In accordance with NIBS NCS, unless otherwise specified.
 3. Indicate changes on revised drawings to distinguish them from previous submittals. Describe reasons for significant changes in submittal letters.

4. Identify all symbols, abbreviations, and similar, used on the drawing either on the drawing or on drawing legend sheets. If drawing legend sheets are used they should be referenced on each drawing.
 5. All drawings, regardless of native drawing size, shall be legible when scaled and printed to 11-inch by 17-inch size on standard office printers.
 6. Drawing boundaries shall be chosen to allow for logical groupings of components on drawings, without excessive fragmentation or piping and instrumentation diagrams, loop diagrams, or electrical schematic diagrams.
 7. Installation elevations and coordinates, where required, shall be shown in feet using facility elevation and reference coordinate system. If either facility elevation or reference coordinate system is unavailable the elevation and reference coordinate system used shall be submitted for approval to the COR.
 8. Provide list of reference drawings and notes on drawings, as appropriate.
 9. Conform to IEEE 315, ISA 5.1, and NEMA ICS 19.
 10. Develop unique component and equipment identifiers used on drawings in accordance with Section 01 81 05 - General Performance Requirements.
- C. Wire Designations: Show and label each conductor (wire) with a designation developed in accordance with Section 01 81 05 - General Performance Requirements.
- D. Electrical Schematic Drawings:
1. General Requirements:
 - a. Describe unusual or nonstandard operation.
 - b. Devices:
 - 1) Include device designations.
 - 2) Indicate device terminal designations.
 - c. Indicate functional operation.
 - d. Indicate test switch and terminal block designations.
 - e. Include switch developments for control, selector, and limit switches.
 - f. Typical references to devices or wiring will not be acceptable. Each device shall have a unique designation and shall be shown on the diagrams as a unique device.
 - g. Indicate contacts, including spare contacts, for motor contactors, auxiliary relays, timers, and protective relays.
 - h. Indicate cross-referencing between schematic drawings, and other associated drawings and diagrams.
 - i. Indicate ratings and values of devices.
 - 1) Provide ampere rating for fuses and circuit breakers.

- 2) Provide ohm rating and power rating for resistors.
- 3) Provide timer setting and range.
- 4) Provide capacitor and inductor ratings.

E. Loop Diagrams:

1. General:

- a. In accordance with ISA 5.4.
- b. Devices, including instruments:
 - 1) Include device designations.
 - 2) Indicate device terminal designations.
- c. Indicate functional operation.
- d. Indicate test switch and terminal block designations.
- e. Indicate cross-referencing between loop diagrams, and other associated drawings and diagrams.
- f. Typical references to devices or wiring will not be acceptable. Each device shall have a unique designation and shall be shown on the diagrams as a unique device.
- g. Indicate ratings and values of devices.
 - 1) Provide ampere rating for fuses and circuit breakers.
 - 2) Provide ohm rating and power rating for resistors.
 - 3) Provide timer setting and range.
 - 4) Provide capacitor and inductor ratings.

F. Wiring Diagrams:

1. General:

- a. Match with schematic diagram drawings, (show device designations; use same wire designations, and similar).
- b. Indicate point-to-point wiring.
- c. Indicate equipment as mounted on back, side, swing, and door panels.
- d. Indicate wiring of devices and items of equipment including terminal and test switch numbers.
- e. If individual wiring diagrams show a partial portion of the panel or section, provide a legend indicating relative physical location corresponding to drawing titles and cabinet designations.
- f. Indicate cables and individual wire designations and connections to external circuits.

- G. Piping and Instrumentation Diagrams (P&IDs): Refer to Section 01 33 28 - Process Flow Diagrams and Piping and Instrumentation Diagrams.
- H. Approval Drawings and Data: Furnish with manufacturer's standard format, except where noted below.
1. Device designations and symbols: Conform to IEEE 315, ISA 5.1, and Section 01 81 05 - General Performance Requirements.
 2. Equipment and cabinet, board, or panel layout drawings:
 - a. Indicate dimensions of equipment.
 - b. Indicate location of devices and items of equipment including nameplates, terminal blocks, test switches, wiring ducts, bus, conduit entries, and other features in their relative physical location.
 - c. Indicate method of securing equipment to deck, floor, or wall.
 - d. Identify each device and item of equipment with a bill of material reference number.
 - e. Provide data sheets with pertinent structural performance ratings of anchors and mounting hardware for busway, conduit, and other major equipment.
 3. Equipment nameplate drawings:
 - a. Showing nameplate information as required by the referenced equipment standards in the equipment specifications sections.
 - b. If more than one piece of equipment, show serial numbers for equipment in a table or list on the drawing.
 4. Bill of Material list or drawing:
 - a. Provide information on manufacturer, style, type, rating, quantity supplied, and other identifying information for each device or item of equipment.
 - b. Provide unique reference number for each device or item of equipment listed on bill of material.
 5. Nameplate lists or drawing: Provide information on type of material, size, and engraved lettering.
 6. When electrical schematic drawings, loop diagrams, piping and instrumentation diagrams, and wiring diagrams are required to be submitted under the Approval Drawings and Data submittal, provide them in accordance with these requirements.
 7. Manufacturer's technical catalog product data:
 - a. Provide technical data for each device or item of equipment.
 - b. Include manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions.

- c. Where several items are listed on same sheet, indicate (mark) items being submitted for approval.
 - d. Strike through items that do not apply.
 - e. Demonstrate proposed device or item of equipment meets specifications requirements.
 - f. Mark catalog data sheet with appropriate bill of material (BOM) item number.
 - g. Assemble catalog data sheet into one enclosing cover with bill of material (BOM) index.
- 8. Time-Current Characteristic and Equipment Coordination Curves:
 - a. Provide time-current characteristic curves for adjustable and non-adjustable protective devices.
 - 1) Molded-case circuit breakers.
 - 2) Fuses.
 - b. Provide equipment coordination curves for:
 - 1) Transformer inrush current.
 - 2) Transformer full load current.
 - 3) Transformer thermal and mechanical damage.
 - c. Original plot on log-log graph paper and electronic file(s) such as spreadsheet or pdf.
 - d. Illustrate degree of selectivity being provided.
- 9. Factory test plans: Provide list of tests to be performed on equipment at manufacturer's facilities. Include following:
 - a. Location of tests.
 - b. List tests sequentially as performed in the factory.
- I. Wire Termination Sheets:
 - 1. Provide one wire termination sheet for each cable provided by the Contractor.
 - 2. Provide wire termination sheets in computer generated typed format using Microsoft Word.
 - 3. Provide one searchable, consolidated PDF of all wire termination sheets.
 - 4. Wire termination sheets to include the following information:
 - a. Name of project.
 - b. Date terminations were verified.
 - c. Include data and personnel initials for the following:
 - 1) Personnel who performed the terminations.

- 2) Personnel who checked the terminations and termination sheets. Shall be different from the personnel who performed the terminations.
 - 3) Personnel who performed the testing.
 - 4) Government personnel who witnessed the testing.
 - d. Cable designation.
 - e. Quantity and size of wires in the cable.
 - f. Length of cable.
 - g. Cable routing information:
 - 1) Equipment designation at origin of cable.
 - 2) Equipment designation at destination of cable.
 - h. List of wires in cable including spares.
 - 1) Conductor number in the cable. Sequential order.
 - 2) Color insulation for each wire.
 - 3) Termination locations for each wire:
 - a) Equipment designation.
 - b) Terminal block designation.
 - c) Terminal number.
 - 4) Individual wire designations as indicated on approved Government format wiring diagrams. List spare wires as SPARE.
 - 5) Continuity Check: Mark as PASSED for each wire after verification.
 - 6) Insulation Resistance Test: Insulation Resistance in Megaohms.
- J. Final Drawings:
 - 1. Provide for drawings that were submitted under approval drawings and check prints RSN's.
 - 2. Provided on Government title block.
 - 3. Revised to reflect approval comments and as-built conditions.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 35 10

SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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.
 2. Comply with 29 CFR 1910.1200 (g) App D, including Sections 12 through 15 to meet intent of GHS.

1.03 REFERENCE STANDARDS

- A. Code of Federal Regulations (CFR)
1. 29 CFR 1910.1200 (g) App D Safety Data Sheets (Mandatory)
- B. United Nations
1. GHS-13 Globally Harmonized System of Classification and Labelling of Chemicals

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- 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 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.

1.06 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. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (USBR)
1. RSHS Reclamation Safety and Health Standards including revisions posted at:
<https://www.usbr.gov/safety/rshs/index.html>
 2. FIST 1-1 (2019) Hazardous Energy Control Program available at:
https://www.usbr.gov/power/data/fist_pub.html
- B. Applicable Tribal and State Safety and Health Regulations for Construction.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittals.
- B. RSN 01 35 20-1, Safety Program:
1. Written safety program in accordance with of RSHS.
 2. Cover aspects of onsite and applicable off-site operations and activities associated with this contract.
 3. Follow 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. For items in the outline that do not apply to this contract write “Not applicable to Contract” next to number/letter.
 5. Generic company safety program is not acceptable. Safety Program must be site specific for this contract.
 6. Submitted and accepted prior to commencing onsite work, including mobilization.
- C. RSN 01 35 20-2, Job Hazard Analysis (JHA) List:
1. Provide list of JHA’s that shall be submitted throughout project.

- D. RSN 01 35 20-3, Monthly Accident Summary Report:
 - 1. In accordance with RSHS.
- E. RSN 01 35 20-4 Documentation and Records
 - 1. Submit documentation of medical qualifications less than 12-months old for all respirator users at site.
 - 2. Submit results of fit tests less than 12-months old for all users of tight-fitting negative pressure respirators at site.

1.04 DOCUMENTATION AND RECORDS

- A. Prepare and retain all safety plans, programs, training content, and training records that are applicable to scope of work and make them available to COR unless they are already included in the written safety program. Some examples include but are not limited to:
 - 1. Confined Space and when deemed necessary by existing and/or introduced hazards of Permit Required Confined Space through the Written Program and Training Records.
 - 2. Forklifts and Other Industrial Trucks Training Records.
 - 3. Electrical Safety Requirement Training Records.
 - 4. Emergency Action Plans Written Program and Training Records.
 - 5. Fall Protection Written Program and Training Records.
 - 6. Fire Protection and Prevention Written Program and Training Records.
 - 7. Flammable and Combustible Liquids Written Spill Control Plan.
 - 8. General Safety and Health Provisions, Written Safety Program, and Regular Safety Inspection Records.
 - 9. Hazard Communication Written Program and Training Records.
 - 10. Ladder Written Compliance Program and Training Records.
 - 11. Lockout/Tagout: Refer to RSHS Section 15 Hazardous Energy Control Program (HECP) Training Records.
 - 12. Occupational Noise Exposure Written Program and Training Audiometric Testing Records.
 - 13. Personal Protective Equipment (PPE) Hazard Assessments and Training Records.
 - 14. Power Operated Hand Tools Training Records.
 - 15. Respiratory Protection Written Program and Training Records.
 - 16. Safety Training and Education Written Program and Training Records.
 - 17. Steel Erection Training Records, if applicable.
 - 18. Welding, Cutting, and Brazing Written Program and Training Records.]

1.05 SAFETY AND HEALTH

- A. Provide and maintain work environment and procedures that:
 - 1. Safeguard public, Government 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.
- B. Do not begin onsite work, including mobilization, until COR accepts Safety Program.
- C. Participate in Contractor Safety Program Review meeting prior to mobilization.
- D. Minimum work crew shall consist of no less than two (2) people, unless approved by COR.
- E. Develop Job Hazard Analyses (JHAs) for each distinct phase of work under the contract:
 - 1. Do not begin a phase of work until JHA is acceptable to COR and shared with construction employees.
 - 2. Activities involving hazardous materials shall have appropriate Safety Data Sheet(s) attached to JHA.
- F. Comply with RSHS 29 CFR 1926 “Accident Prevention and WAC:
 - 1. Construction Safety and Health Standards promulgated by the Secretary of Labor may be obtained from any regional or area office of the Occupational Safety and Health Administration of the U.S. Department of Labor.
- G. Correct safety and health violations identified by CO or COR.
- H. When Contractor fails or refuses to correct a compliance directive, CO may issue an order to stop all or part of the 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, to claim for damage or additional compensation by reason of either directive or stop order.
 - 3. Failure of CO to order discontinuance of Contractor’s operations shall not relieve Contractor of responsibility for safety of personnel and property.
- I. Maintain accurate records of and report to CO the following occurrences during performance of this contract:
 - 1. Death.
 - 2. Occupational disease.
 - 3. Traumatic injury to employees or public.
 - 4. Property damage in excess of \$2,500.
- J. Provide appropriate safety barricades, signs, and warnings.

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. In accordance with Section 01 81 05 - General Performance Requirements.

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 Representative.
- 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 current safety and health related training, experience, and duties on at least three projects of similar nature, size, complexity.
 2. OSHA Construction 30-Hour Training Course including applicable elective subjects, for example Concrete and Masonry Construction; Confined Space Entry; Cranes, Derricks, Hoists, Elevators, and Conveyors; Ergonomics; Excavations; Fire Protection and Prevention; Materials Handling, Storage, Use and Disposal; Motor Vehicles, Mechanized Equipment and Marine Operations; Rollover Protective Structures and Overhead Protection; and Signs; Signals and Barricades; Powered Industrial Vehicles; Safety and Health Programs; Scaffolds; Steel Erection; Tools - Hand and Power; Welding and Cutting. Current first aid CPR certification.
 3. Include resume with current telephone numbers of references, description of safety representative responsibilities, and copies of training certifications.
 4. Contractor's onsite safety representative shall have no other duties.

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 46 00

QUALITY PROCEDURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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. 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 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.
- 4. QCS shall work for prime contractor and report to company executive, not the project manager.

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 devices available for use by Government for verification tests.
- B. Contractor's QCS:
 - 1. Effectiveness of the QCS in prosecuting QC Program will be subject to continued review and approval by CO.
 - 2. Should QCS's efforts be deemed insufficient Contractor may be required to replace 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. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM C1077 Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
 2. ASTM D3666 Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
 3. ASTM D3740 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 Agencies Engaged in Construction Inspection, Testing, or Special Inspection
 5. ASTM E543 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**

3.02 GOVERNMENT CONTRACT QUALITY ASSURANCE

- ### **A. During 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

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C2 National Electrical Safety Code (NESC)

1.03 TEMPORARY ELECTRICITY

- A. Furnish electric power required for construction and commissioning.
1. Navajo Tribal Utility Authority (NTUA)
P.O. Box 170
Fort Defiance, AZ 86504
www.ntua.com
Telephone: 800-528-5011
 2. Contact NTUA for applicable rate during construction through the Extended Demonstration Test.
 3. Refer to Section 01 86 26 – Electrical Performance Requirements.
- B. Furnish 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 arrangements and payments to the utility companies for 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.

1.04 TEMPORARY WATER

- A. Provide water required for construction purposes. Obtain required permits.

1. Navajo Agricultural Products Industry
P.O. Drawer 1318
Farmington, NM 87499
www.navajopride.com
Telephone: 505-566-2636
Fax: 505-599-0572
 2. Navajo Nation Department of Water Resources / Navajo Nation Water Code Administration
P.O. Box 678
Fort Defiance, AZ 86504
www.nndwr.navajo-nsn.gov, www.watercode.navajo-nsn.gov
Telephone: 928-729-4132
Fax: 928-729-4421
 3. Navajo Tribal Utility Authority (NTUA)
P.O. Box 170
Fort Defiance, AZ 86504
Telephone: 928-729-5721
 4. Reclamation – Four Corners Construction Office (FCCO)
2200 Bloomfield Highway
Farmington, NM 87401
Telephone: 505-325-1794
1235 La Plata Highway
Farmington, NM 87401
Telephone: 505-325-1794
- B. Arrange, pay, and transport water for use during construction.
- C. Use water which meets specified requirements for water used in concrete, soil-cement, masonry, grouting, and other permanent work.
- D. Furnish means of conveying water to points of use.
- E. Government will provide water for commissioning by December 30, 2027.

1.05 TEMPORARY TELEPHONE

- A. Not available from Government.
- B. Provide temporary telephone service for Contractor's use.
- C. No existing land lines available.

1.06 SANITARY FACILITIES

- A. Provide and maintain 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. In accordance with Section 01 81 05 - General Performance Requirements.

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 and Section 01 12 16 - Work Sequence.
- B. RSN 01 55 00-1, Pre-Construction Digital Recording:
1. Include roads, driveways, corrals, cattle guards, fences, and other improvements and areas as required by COR.
- C. RSN 01 55 00-2, Post Construction and Post Repair Digital Recording.

1.04 SITE CONDITIONS

- A. Rights-of-way for access to work from existing roads shall be established by Contractor. 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.

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 the jobsite.

3.02 RECORDS

- A. Make pre-construction, post construction, and post repair digital recordings as accepted by COR.
- B. COR shall 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 all-weather surfaced 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.

3.05 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 the public where haul routes cross public highways or roads.

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 in a smooth condition 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. Navajo Nation Division of Transportation
Construction Section
Blue Canyon Road, Building 40
Fort Defiance, AZ 86504
Telephone: 928-729-7222

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

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SECTION 01 55 20

TRAFFIC CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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,
http://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:
1. If required from BIA.
- C. RSN 01 55 20-2, Permits:
1. Provide copy of signed and approved permits if required by BIA.

1.04 PROJECT CONDITIONS

- A. BIA has approved project in concept, but Government has not applied for or obtained permits for work.
- B. Contractor shall obtain permits required by BIA.
- C. BIA Contact Information:
Shiprock Agency, Branch of Road Maintenance
304 N Auburn Ave, Suite E
Farmington, NM 87401
(505) 258-7172

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 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.

END OF SECTION

SECTION 01 56 10
PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

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. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards including revisions posted at <https://www.usbr.gov/safety/rshs/index.html>
- B. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C2 National Electrical Safety Code (NESC)

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- 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 may not show all utilities existing at the jobsite.
- B. Obtain location of buried conduit, pipe, cable, ground mat, and other buried items before excavating.

- C. Unknown existing utility lines may cross WTP site.
- D. Location of known existing utilities shown on drawings are not exact. Contractors shall determine actual location of and make provision for 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 rights-of-way with all owners. Comply with 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 rights-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 Investigation:
 - 1. Determine height and voltage of overhead utility lines. Clearances in accordance with RSHS, OSHA, and IEEE-C2 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.
 - a. Test pits may be used when approved by COR.
 - b. Submit in accordance with Contractor's approved schedule.
 - 3. Obtain permission from utility or gasline owner before performing physical utility 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.
- 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 shall 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 rights-of-way.
- H. Repair existing utilities damaged during construction as approved by COR and utility owner.

3.02 CLEARANCE

- A. Obtain and provide clearances required for construction operations 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. Provide 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. In accordance with Section 01 81 05 - General Performance Requirements.

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. In accordance with Section 01 81 05 - General Performance Requirements.

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: 90 to 100 percent.
 5. Postconsumer Recycled Content: 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 the COR.
- B. Space posts 10 feet, 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 the COR.
- B. Remove fence when no longer required.

END OF SECTION

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SECTION 01 57 20

ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards, including revisions posted at:
<https://www.usbr.gov/safety/rshs/index.html>
 2. Navajo OSHA Navajo OSHA, Dr. Perphelia Fowler;
PerpheliaFowler@navajo-nsn.gov
(928) 871-6375

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. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards, including revisions posted at:
<https://www.usbr.gov/safety/rshs/index.html>
 2. Navajo OSHA Navajo OSHA, Dr. Perphelia Fowler;
PerpheliaFowler@navajo-nsn.gov
(928) 871-6375
- 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-22 Stormwater Discharge Permit associated with a Construction Site including revisions.
<https://www.epa.gov/npdes/proposed-2022-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 2022.
 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 EPS'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 Proposed 2022 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 Certifications:

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 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-laden 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 10 mils thick covered with 2- to 4-inches of soil.

END OF SECTION

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SECTION 01 57 60

PROTECTED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 PROJECT CONDITIONS

- A. Certain native plant and animal species on the Navajo Nation are protected under Federal and Tribal laws. Government has ascertained that special status species (e.g. threatened or endangered species) including the Mesa Verde cactus, raptors, burrowing owl, and prairie dog, as well as migratory birds may exist in areas to be disturbed by construction activities.
- B. Project is designed to comply with the Biological Opinion for the Navajo-Gallup Water Supply Project as issued by the U.S. Fish and Wildlife Service on September 21, 2022 as well as the associated Biological Resources Compliance Form issued by the Navajo Nation Department of Fish and Wildlife on August 30, 2022.
- C. Project is designed to comply with Final Biological Opinion for Navajo-Gallup Water Supply Project as issued by U.S. Fish and Wildlife Service on February 26, 2009.
- D. Insert this section in subcontracts.
- 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 MIGRATORY BIRDS

- A. Nesting may occur in area between March 15th and August 15th:
1. Government will survey for nesting birds in vegetated areas to be disturbed. Surveys shall be performed no more than 5 days before an area is to be disturbed.
 2. Notify COR 10-days before disturbing an area.
 3. Do not disturb a nesting pair of birds with eggs.

1.04 MESA VERDE CACTUS

1. If Mesa Verde cactus is found in construction area, halt construction activities immediately.
2. Contractor shall coordinate work in these areas with COR.

1.05 RAPTORS

- A. Raptor Safe Utility Poles: Per Navajo Nation specifications, above ground utility poles shall conform to a design standard(s) that comply with the Raptor Electrocution Prevention Regulations, RCS-43-08, September 10, 2008 to avoid unintentional electrocution of raptors that may perch on utility poles.

1.06 BURROWING OWL

- A. Nesting may occur in area between March 15th and August 31st:
- B. Government will survey for burrowing owls if any work is proposed during the species' active season (March 15th to August 31st, of any year). Surveys shall occur within 0.4 km (1/4 mile) of the project location and follow appropriate protocols.
- C. Notify COR 10-days before disturbing an area.

1.07 PRAIRIE DOGS

- A. Active prairie dog colonies are present in project area.
- B. Government will survey for prairie dogs in project area if any work is proposed in the species' breeding and reproduction season (March 1st to June 1st).
- C. Notify COR 10-days before disturbing an area.
- D. Do not disturb prairie dogs during breeding and reproduction season.
- E. Modify construction activities as directed by COR.

1.08 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 the Navajo Nation Department of Fish and Wildlife and U.S. Fish and Wildlife Service, 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

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SECTION 01 57 90

PRESERVATION OF HISTORICAL AND ARCHEOLOGICAL DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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. Sacred Sites (Traditional Cultural Properties): Native American traditional ceremonial locations identified for Native American practice of traditional Native American religious activities.
- H. 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 or borrow areas other than those approved are 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 and cleared of cultural resources for construction within Right-of-Way (ROW) by agencies having jurisdiction (e.g., Navajo Nation Historical Heritage and Historical Preservation Department (NNHHPD), State Historical Preservation Office (SHPO) and/or Bureau of Indian Affairs (BIA), etc.).
- B. Government will retain an Archeologist to monitor ground disturbing activity work within 50-feet of identified sites:
 - 1. Coordinate work at minimum weekly with OGR and Government Archeologist.
 - 2. Provide a request for an Archaeologist to conduct monitoring within identified Required Monitoring Areas at least 48-hours ahead of anticipated work in those areas.
- C. Onsite Contractor personnel shall undergo cultural resource sensitivity awareness training to inform onsite personnel of cultural resource requirements and expectations during pre-construction meeting before initial groundbreaking takes place:
 - 1. Government will provide training:
 - a. Training will take approximately 1-hour.
 - b. Schedule for training will be mutually agreed upon.
 - c. CD and/or PowerPoint of Cultural Sensitivity Training will be provided to Contractor.
 - 2. Contractor shall:
 - a. Require onsite personnel to complete required cultural sensitivity awareness training before being allowed to work in project area.
 - 3. Require onsite personnel added after completion of required cultural sensitivity awareness training to view Cultural Sensitivity Training CD/or PowerPoint provided to Contractor at Cultural Sensitivity Training before being allowed to work in project area:
 - a. 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 artifacts, objects of antiquity, or archeological resources on private, State and Tribal lands of the United States are subject to arrest and penalty of United States, Navajo Nation, and New Mexico Cultural Resource Protection laws. Offenders will be subject to Navajo Nation and New Mexico Cultural Resource Protection laws and civil penalties.
- F. Comply with Federal, State and Tribal laws when operating on Federal, State, and 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 within 50-feet of discovery location:
 - 1) Place temporary safety fence in accordance with 01 56 32 – Temporary Safety Fence to prevent disturbance until archaeologist can investigate to avoid inadvertent disturbance by construction activities.
 - b. Verbally notify CO and OGR within 2-hours, giving location and nature of findings.
 - c. Verbally notify Reclamation staff archaeologist within 2-hours. Name of assigned staff archaeologist and telephone number will be provided at pre-construction meeting.
 - 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. Upon completion of concurred upon discovery treatment by Cultural Resources Contractor, a 48-hour consultation period will be conducted:
 - a. When discovery mitigation has been completed CO will be notified that work can resume as recommended by Cultural Resources Contractor and OGR will notify Contractor work can resume in discovery area.
 - 4. 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 the contract in accordance with applicable clauses of the contract.

- J. Mitigate cultural resources as directed by Government on lands outside of Permanent or Construction ROW, including private lands:
 - a. Specifically comply with cultural resource stipulations as shown on drawings.
- 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 CULTURAL MONITORING AREA

- A. 48-hour notice must be provided to OGR, Government Archeologist and Cultural Resources Contractor prior to approaching or entering a cultural monitoring area for construction activities.
- B. Install temporary fencing of the ROW extents at identified required monitoring areas and/or in constricted width ROW segments before site disturbance including surveying activities begin in these areas. Refer to Section 01 56 32 – Temporary Safety Fence.
- C. An archeological monitor is required for all new ground disturbing construction activities within identified required monitoring areas.

END OF SECTION

SECTION 01 71 20

SURVEYING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

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 verified by notes and computations including:
 - a. Surface comparisons of original topography and earthwork performed for requested progress payment, along with all calculations necessary to demonstrate work completed.
 - b. Electronic files that support calculations (e.g. dwg, ASCII, dems, landXML).
2. When progress payment invoice includes unit priced pay items that requires surveys 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 benchmarks 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 back charge reestablishment cost to Contractor.

1.05 QUALIFICATIONS

- A. Surveyors:
 1. Experienced construction surveyors under supervision and direction of Professional Engineer (PE) or licensed Professional Land Surveyor (PLS) with minimum 5-years' experience in charge of construction surveys for construction 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.
 - 2. Type and brand of surveying equipment including serial numbers (GNSS Systems, Total Stations, and Data Collectors) to be used onsite.

PART 3 EXECUTION

3.01 GENERAL

- A. Surveyor shall be onsite during construction activities requiring vertical and horizontal control to assure constructed features meet specified tolerances:
 - 1. Contracted surveyor will use FCCO Survey Group code list for entire duration of the project. Surveyor Chief of FCCO office will provide code list to contracted surveyor.
- B. Cultural Resources:
 - 1. Obtain COR approval before entering a work site with a vehicle.
 - 2. If vehicular travel through an archaeological site is required, an archaeologist must flag a route that avoids features within the site.
 - 3. 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.
- D. GPS/GNSS work shall be performed using North American Datum 1983 (NAD 83) State Plane New Mexico West Feet (EPSG 2259).
- E. All work shall be performed using North American Vertical Datum of 1988 (NAVD 88) in vertical units of U.S. Survey Feet.

- F. As of Dec. 31, 2022, the US Survey foot as well as NAD83 have been deprecated. Reclamation intends project to be documented in the legacy datums and units as stated.
- G. All georeferencing shall employ Geoid 09 (GEOID09).
- H. All ground-to-grid conversions, where necessary, will be performed utilizing site calibration factors (k-factors for combined horizontal and vertical scaling) supplied to Contractor by FCCO Survey Chief. Independent site calibration factors will be provided for each plant site (designated as Pumping Plant No. 2 or Pumping Plant No. 3) and appear on Construction Plan and Profile drawings.
- I. All Terrestrial work shall be tied to and reference provided State Plane coordinate “CP1”
- J. Collect as-built data in coordinate format to remain in and be delivered in State Plane coordinates (NAD 83, NAVD 88).

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 Rights-of-Way (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 and Service Yards: Blue tops each 50-feet on tangent and each 25-feet on curves. Blue tops on 25-feet grid for service yards.
- 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: Certified by Surveyor as required for structures and other features of work.
- G. 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. In accordance with Section 01 81 05 - General Performance Requirements.

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:
<https://www.usbr.gov/safety/rshs/index.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.
 2. Certification's waste was properly disposed.
 3. Recycled waste materials verification.
 4. Hazardous wastes manifests.
- C. RSN 01 74 00-2, Environmental Consultant Resume:
1. Describe experience on similar project.
- D. RSN 01 74 00-3, 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.
- D. Comply with local regulations for pre-suppression, suppression, and prevention of fires when burning wastes.

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.
 4. Identified clean-up sites.
- 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. Submit written report with sampling locations, findings, manifests, photos, and other pertinent information.

3.05 RECORDS

- A. Keep records of types and amounts of waste materials produced.
- B. Keep records of waste material disposal.

END OF SECTION

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SECTION 01 78 30
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. Progress As-built Drawings (Also known as “Red-line” Drawings):
1. Set of full size, hard-copy drawings, that contain both Government informational drawings supplied with the Specifications and Contractor produced drawings that have been submitted for approval.
 2. Incorporate manufacture or subcontractor drawings for Electrical, SCADA, Security, Fire Detection, Packaged Treatment systems and loop drawings.
 3. Update progress As-built drawings to document work or services performed for progress payments in accordance with the clauses at FAR 52.232-27 - Prompt Payment for Construction Contracts. The CO will retain from progress payments if project drawings are not updated.
 4. At a minimum, meet monthly with COR to review and approve progress made to full-sized record drawings prior to the submittal for progress payment. Meeting location to be approved by COR.
 5. Verify with the COR that mark-ups to the drawings are current with the progress of the work prior to submitting invoice for progress payment.
- B. Final As-Built Drawings:
1. Complete electronic set of drawings produced by Contractor updated to reflect all changes made in the field through installation and commissioning of each plant.
- C. Operations and Maintenance (O&M) Manuals:
1. Final documentation package delivered containing information necessary for Government to operate and maintain equipment in a safe, effective, and efficient manner. Transmitted both in bound hard-copy and electronic form. Divided into volumes with a main volume common to each building and unit volumes containing documentation specific to each system
 2. Step by step maintenance procedures including start up, operation and shutdown. Supported by pictures and illustrations
 3. Tabulated section with maintenance procedures and schedule

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittals.
- B. RSN 01 78 30-1, Progress As-built:
 - 1. Certified marked sets. Progress as-built drawings that have been certified by Contractor as being up to date and accurate as shown in the description of work.
 - 2. Submit to COR for approval and release following commission of each system and prior to training and/or Government possession.
- C. RSN 01 78 30-2, Draft O&M Manual.
 - 1. Include Standard Operating Procedures.
- D. RSN 01 78 30-3, Record Drawings:
 - 1. Submit to COR for Government approval no later than 14 calendar days following approval of RSN 01 78 30-1, As-built drawings.
 - 2. Updated with all changes as marked on As-built drawings to reflect approval need comments.
- E. RSN 01 78 30-4, O&M Final, Approved Manuals:
 - 1. Incorporate Government's comments on Draft O&M.
 - 2. Password tab in the O&M Manual with passwords included with that system

1.04 PROGRESS AS-BUILT DRAWINGS

- A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of As-built conditions or a Government approved electronic version. 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 progress as-built construction.
- C. Mark Progress 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 and prior to training and/or Government possession, submit to COR for review and acceptance:
1. One set will be made available to the Government:
 - a. For maintenance of changes to Government provided information drawings.
 - b. For verification of Final Drawings.
 2. Sign marked prints as certified correct:
 - a. Sign and date each drawing as certified correct. Do not include or certify Information Only drawings.
 - b. If no revisions were necessary to illustrate As-built conditions, mark drawing with “No Changes.”
 - c. Provide As-built drawings as outlined in Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data, and as required in other Sections.

1.05 DRAFT O&M MANUALS

- A. Information needed by Government, at final completion to operate, maintain, and troubleshoot equipment including at minimum:
1. Index sheet at front of each book which provides page or index tab number information for each device or item of equipment in book.
 2. Bill of Materials.
 3. Manufacturer’s product data sheets, operation, and maintenance procedures.
 4. Spare parts inventory list. Include additional recommended spares not required by these specifications.
 5. Maintenance schedule and procedures including instructions on dismantling, replacing, installing, calibrating, configuring, and troubleshooting provided equipment.
 6. Description of System operating procedures.
 7. Software connection procedures.

1.06 FINAL AS-BUILT DRAWINGS

- A. Update drawings and diagrams either generated by Contractor or impacted by Contractor performed work with modifications made during design and construction process,

- including modifications made during testing and commissioning. Include Final As-built drawing modifications.
- B. Drawings shall represent final installed condition of facility at completion turnover of system to Government.
 - C. Drawings supplied as Final As-Built Drawings shall meet requirements of Final As-Built Drawings included in Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data.
 - D. Computer drafted drawings provided in electronic file format, compatible with AutoCAD, 2018 or later.
 - E. Upon completion, sign prints as certified correct:
 - 1. Sign and date each drawing as certified correct.
 - 2. If no revisions were necessary, mark drawing with “No Changes.”

1.07 O&M MANUAL WITH FINAL COMPONENT DRAWINGS

- A. Complete and finalized prior to Government use or acceptance of systems.
- B. Developed in standardized and electronic data format.
- C. In addition to documents required in Draft O&M Manual include:
 - 1. SCADA and Communications software connection procedures.
 - 2. Performance shop test reports.
 - 3. Wiring and cable test reports.
 - 4. Operational field test reports.
 - 5. Final Drawings.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONSTRUCTION DOCUMENTATION

- A. Maintain at least 2 copies of Progress and Component As-built Drawings and manufacturer’s installation instructions at jobsite upon equipment shipment: Drawings shall be in ‘Progress As-built condition at time of equipment shipment and reflect Government approval comments.

- B. Mark drawings with changes and revisions made during installation and checkout of equipment following Progress As-built marking procedures:
 - 1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.
 - 2. Mark to define construction actually provided:
 - a. Where choice of materials or methods is permitted in specifications.
 - b. Where variations in scope or character of methods is permitted in specifications.
 - c. Where variations in scope or character of work from that of original contract are authorized.
- C. Upon completion of work:
 - 1. Sign marked prints Final as-builts as certified correct.
 - 2. Submit to COR for approval within 14-days following commissioning test completion:
 - a. One set to be retained by COR.
 - b. One set to be used in preparation of Final Drawings: Due no later than 14 calendar days following approval of As-built Drawings.

END OF SECTION

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SECTION 01 79 20

TRAINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence:
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. RSN 01 79 20-1, Final Acceptance Testing Phase:
1. Training plan revisions.
 2. End of Final Acceptance Testing Phase: Training package.

1.03 QUALIFICATIONS

- A. Training Staff:
1. Training sessions shall be conducted by qualified, experienced, factory-trained representatives of the project's equipment manufacturers.
 2. Familiar with the specific treatment process equipment.
 3. Previous experience training WTP staff.

1.04 COORDINATION

- A. The O&M manuals shall be submitted and accepted in accordance with Section 01 81 05 - General Performance Requirements before on-site training may start.
- B. Training shall occur in accordance with the Training Plan, begin at the start of the Monitored Test, and continue until Final Acceptance Testing is completed. Refer to Section 01 91 16 - Facility Commissioning.
- C. Coordinate instruction schedule with COR.
- D. Schedule: Monday through Friday.
- E. Duration: Arrange to have the training conducted on consecutive days, with no more than six (6) hours of classes scheduled for any one day.

- F. Location: On-site.
- G. Concurrent classes shall not be allowed.

1.05 PERFORMANCE REQUIREMENTS

- A. Training shall include instruction in both operation and maintenance of the subject equipment.
- B. Provide training as described in Table 01 79 20A - Training Matrix.

Table 01 79 20A - Training Matrix

Feature	Intended Audience				
	WTP Operators	Lateral Operators	Electricians	IT and SCADA Staff	Facilities Staff
WTP Process Equipment	x		x	x	
WTP Building Systems	x		x	x	x
WTP Site Utilities <ul style="list-style-type: none">– Domestic water– Wastewater– Stormwater management– Primary power– Emergency power– Communication systems– Cathodic protection systems– Security and site access control	x		x	x	x
San Juan Lateral <ul style="list-style-type: none">– River Intake– Pumping Plants– Valves– Primary power– Communication systems– Cathodic protection systems		x	x	x	x

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TRAINING

- A. Train staff to:

1. Operate and maintain the WTP and Lateral
- B. Trainings shall consist of:
 1. Formal scheduled trainings, including training on individual equipment and treatment systems prior to the Demonstration Test start.
 2. Informal training accomplished while working side by side during Final Acceptance Testing.
- C. Develop a training plan that identifies:
 1. Training needs.
 2. Number and type of trainings.
 3. Schedule.
 4. Level of effort.
 5. Methods.
 6. Training staff list and resumes.
- D. Training materials shall be applicable for the intended audience. Staff from the WTP, an Electrician, and a WTP Operator may require separate trainings on some topics.
- E. Include classroom lectures, demonstrations, and hands-on experience including physical inspection of the installed onsite equipment.
- F. Training Materials:
 1. PowerPoint presentations.
 2. Generic and customized handouts.
 3. Personal experience examples.
 4. Drawings.
 5. O&M manuals.
 6. Thumb drives with programming and interface software for microprocessor based equipment.
- G. For each scheduled training session, provide documentation including:
 1. Typed agenda prior to the start of each training session.
 2. Presentation notes.
- H. Video operation and maintenance training of: Camera feed system, alarm systems, HVAC, and Pumping plants HMI.
- I. Review HMI displays of generator, transfer switch, and HVAC server.

- J. Where manufacturer instructions are insufficient, develop and provide procedures for WTP and conveyance system operation.
- K. For process equipment, cover:
 - 1. Equipment purpose and capabilities.
 - 2. Operation.
 - 3. Optimizing performance.
 - 4. Adjustments.
 - 5. Maintenance.
 - 6. Repair.
 - 7. Troubleshooting.
 - 8. Inventory of spare parts.
 - 9. Operational safety.
 - 10. Emergency situation response.
 - 11. Takedown procedures (disassembly/assembly).
 - 12. Laboratory equipment.
 - 13. Instrumentation.
 - 14. System integration and electrical interlocks, if applicable.
 - 15. Adjustable frequency drives.
 - 16. Routine record keeping.
- L. For process procedures, cover:
 - 1. Startup.
 - 2. Monitoring.
 - 3. Correlations between water quality indicators and operational changes.
 - 4. Shutdown.
 - 5. Water sampling.
 - 6. Compliance reporting.
 - 7. Maintenance tracking software use.
 - 8. Security.
 - 9. Chemical delivery, including spill management.
 - 10. Residuals management.
- M. For each building, cover:
 - 1. HVAC operation and maintenance.

2. Lighting operation.
 3. Security operation.
 4. Waste management including recycling.
 5. Power distribution systems, including:
 - a. Metal-clad switchgear.
 - b. Motor control equipment.
 - c. Switchboards.
 - d. DC distribution equipment.
 - e. Emergency generator.
 - f. Microprocessor protection and transfer switch relays.
 - g. Surge protection.
 6. Communications, including telephony.
 7. Fire protection.
 8. Lightning protection equipment.
- N. For the HMI/SCADA system, cover the following topics:
1. HMI.
 2. Historian and trending.
 3. Alarm and events.
 4. Web access.
 5. PLC programming software.
 6. HMI and SCADA software, if not part of PLC programming software.
- O. Training Package: At the end of the Final Acceptance Testing, include:
1. Training materials in pdf and original file format.
 2. Summary document identifying formal training sessions, purposes, and associated materials.
 3. Original attendance pages documenting attendees of each training session.
 4. Original training certification pages for each training session signed by the Contractor's representative, manufacturer's representative, and Construction Engineer.
 5. Certification shall document that training was in compliance with the Contract and met the project's requirements for operation, maintenance, and warranty.
 6. Method for updating and maintaining passwords. Including list of up-to-date passwords.

- P. Government will retain training materials.
- Q. Operator to provide hands on training to in-coming operator, 3 months prior to completion of operation portion of the contract.

END OF SECTION

SECTION 01 81 05
GENERAL PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Partnering (50 percent of total price of partnering)
 - 1. Payment: Lump-sum price offered in Price Schedule B.
 - a. Includes preparing for, attending, and providing facilitator for meetings.
- B. Design of Water Treatment Plant (WTP)
 - 1. Payment: Lump-sum price offered in Price Schedule B.
 - a. Design of entire system through 100 Percent Design including but not limited to 30 Percent Design, 30 Percent Comment Response, 60 Percent Design, 60 Percent Comment Response, 90 Percent Design, and 90 Percent Comment Response.
 - b. Features include but not limited to:
 - 1) WTP, pumping plant, connections to existing pipelines, utility connections, and SCADA Integration.
 - 2) Operation, regulatory and permitting approvals.
 - 3) Developing a Schedule of Values:
 - 4) Breakdown, in sufficient detail, for lump sum Contract Line-Item Numbers listed in Price Schedule 1 to determine the value of progress payments:
 - 5) Do not include mobilization and preparatory work item.
 - 6) Determining repairs needed to San Juan Lateral for commissioning, operation, and maintenance.
 - 7) Fire and rescue reviews.
 - 8) Associated infrastructure and services.
- C. Construction of Water Treatment Plant:
 - 1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Construction of entire facility including but not limited to:
 - 1) Water treatment plant, pumping plant, connections to existing pipelines, site piping and improvements, utility connections and SCADA Integration.
 - 2) Regulatory and permitting approvals.

- 3) Training.
- 4) Associated infrastructure and services.
- 5) Includes Section 01 91 13 - Building Commissioning.

D. San Juan Lateral Repair:

1. Payment: Time and Materials in accordance with FAR 52.232-7.
 - a. Includes repairs required to commission and operate lateral.

E. Startup and Commissioning of San Juan Lateral for Initial 6-Month Period:

1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Start-up, testing, commissioning, and operation and maintenance of San Juan Lateral including but not limited to flushing, disinfection and delivering treated water from WTP to delivery points.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate pumping plants, intake, pipes, chlorine injection, valves, tanks, and associated appurtenances.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, and laboratory testing,
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.
 - c. At the end of the period, fill fuel and chemical tanks.

F. Startup and Commissioning of WTP for Initial 6-Month Period:

1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Start-up, testing, commissioning, and operation and maintenance of WTP including but not limited to flushing, disinfection and delivering treated water to San Juan Lateral.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate and maintain treatment processes and equipment, and site infrastructure.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, laboratory testing, and sludge management.
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.
 - c. At the end of the period, fill all fuel and chemical tanks.

G. Operation and Maintenance of San Juan Lateral for 6-Month Period after Startup and Commissioning 6 Month Period:

1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Operation and maintenance of San Juan Lateral.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate pumping plants, intake, pipes, chlorine injection, valves, tanks, and associated appurtenances.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, and laboratory testing,
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.
 - 6) Extended Demonstration Test (EDT) requirements apply, refer to Section 01 91 16 - Facility Commissioning.
 - c. At the end of the period, fill fuel and chemical tanks.

H. Operation and Maintenance of WTP for 6-Month Period after Startup and Commissioning 6 Month Period:

1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Operation and maintenance of the WTP.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate and maintain treatment processes and equipment, and site infrastructure.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, laboratory testing, and sludge management.
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.
 - 6) Extended Demonstration Test (EDT) requirements apply, refer to Section 01 91 16 - Facility Commissioning.
 - c. At the end of the period, fill all fuel and chemical tanks, dispose of sludge and clean sludge drying basin if storage volume exceeds 75 percent for any given basin.

I. Standard Tools and Maintenance Equipment:

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

- a. Unit price in the Price Schedule is an allowance to furnish project standard tools and equipment to the project site. Tools will be selected by the Government during the construction phase.
 - b. Include standard tools and maintenance equipment necessary to operate the facility, such as a standard tool kit for a toolbox, drills, drill bits, drill gage, oiler, jig saw, grinder, plasma cutter, striking wrench set, confined space fan and duct, ladders, gas cans, solder station, crimping tools, infrared camera, vibration monitor, and other similar items.
 - c. Does not include special tools and equipment necessary for project-specific equipment, refer to individual specification sections.
 - d. If the actual purchase cost is more or less than the specified allowance amount, the contract amount will be modified for the difference.
- J. Optional Extended Operation and Maintenance of San Juan Lateral for 12-Month Period:
 - 1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Operation and maintenance of San Juan Lateral.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate pumping plants, intake, pipes, chlorine injection, valves, tanks, and associated appurtenances.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, and laboratory testing,
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.
 - c. At the end of the period, fill fuel and chemical tanks.
- K. Optional Extended Operation and Maintenance of WTP for 12-Month Period:
 - 1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Operation and maintenance of the WTP.
 - b. Includes but is not limited to:
 - 1) Equipment, materials, and labor to operate and maintain treatment processes and equipment, and site infrastructure.
 - 2) Trouble shooting SCADA Integration and water delivery issues.
 - 3) Utilities, fuel, chemicals, consumables, laboratory testing, and sludge management.
 - 4) Associated insurance, fees, and services.
 - 5) Meeting regulatory and permitting requirements.

- 6) Extended Demonstration Test (EDT) requirements apply, refer to Section 01 91 16 - Facility Commissioning.
- c. At the end of the period, fill all fuel and chemical tanks, dispose of sludge and clean sludge drying basin if storage volume exceeds 75 percent for any given basin.

1.02 DEFINITIONS

A. Water Types:

1. River Water: From the San Juan River.
2. Raw Water: From San Juan Generating Station Reservoir.
3. Process Water: Water associated with treatment process within WTP property line.
4. Treated Water:
 - a. Water that has undergone Safe Drinking Water Act treatment requirements and contract requirements.
 - b. Except for providing a chlorine residual of at least 0.2 mg/L.
5. Finished Water: Treated Water that has undergone disinfection and maintains a chlorine residual of at least 0.2 mg/L.
6. Treated Water and Finished Water are used interchangeably throughout this contract. Final use of these terms in the design depends on the Contractor's final treatment process and disinfection strategy.

B. San Juan Lateral:

1. Raw water delivery system from San Juan Intake to San Juan Generating Station Reservoir, to the San Juan Lateral WTP.
2. Treated/finished water delivery system from WTP property to community turn outs.

1.03 REFERENCE STANDARDS

A. For all Specification Sections, use most recent code at the time of award.

B. American Concrete Institute (ACI)

1. ACI 318 Building Code Requirements for Structural Concrete
2. ACI 350 Code Requirements for Environmental Engineering Concrete Structures

C. American Society of Civil Engineers (ASCE)

1. ASCE 7 Minimum Design Loads for Buildings and Other Structures

- D. ASTM International (ASTM)
1. ASTM D4832 Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinder
 2. ASTM E2516 Cost Estimate Classification System
- E. American Water Works Association (AWWA)
1. Water Treatment Plant Design.
 2. Water Quality and Treatment: A Handbook on Drinking Water.
- F. Bureau of Land Management (BLM)
1. CC001 Standard Environmental Color Chart
- G. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards including revisions posted at <https://www.usbr.gov/safety/rshs/index.html>
 2. FIST 1-1 Hazardous Energy Control Program available at: www.usbr.gov/power/data/fist_pub.html
 3. FIST 5-4 Chlorine Gas System Safety Program
- H. International Code Council (ICC)
1. IBC International Building Code
 2. IECC International Energy Conservation Code
 3. IFC International Fire Code
 4. IFGC International Fuel Gas Code
 5. IMC International Mechanical Code
 6. IPC International Plumbing Code
- I. National Fire Protection Association (NFPA)
1. NFPA 70 National Electric Code
 2. NFPA 101 Life Safety Code
 3. NFPA 70E Electrical Workplace Safety
- J. NSF International (NSF)
1. NSF 61 Drinking Water System Components – Health Effects

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 - Electrical and Control Drawings, and Section 01 12 16 - Work Sequence.
- B. Include design review comments in applicable submittals:
 - 1. Review by Navajo Nation Department of Fire & Rescue Services (NNFD):
 - a. Contact: PO Box 3360, Window Rock, AZ 86515, Phone: 928-871-6915, E-mail: larrychee@navajo-nsn.gov.
 - 2. Review by Brown & Associates, Inc.:
 - a. Brown & Associates provides third party engineering consulting review services to NNFD. Contract with Brown & Associates for the NNFD review.
 - b. Contact: 15601 N. 40th Street Building 130, Phoenix, AZ 85032, Phone: 480-991-3751, E-mail: info@brownandassociates.net.
- C. Section L and M: Design Proposal: At a minimum:
 - 1. Preliminary Drawing List.
 - 2. Overview of major site features including ponds, drying beds, siting and orientation of buildings, major tank locations, drainage patterns, parking provisions, traffic circulation, delivery access.
 - 3. Explanation of objectives and factors influencing siting decisions.
 - 4. Examples of equipment and materials, to show that a high level of quality is being provided.
 - 5. General arrangement of Future Installation Plan.
 - 6. Preliminary Equipment List for Pumps and motors. Include function, horsepower, voltage, phases, frequency, and power factor.
 - 7. Operations staffing plan for San Juan Lateral and WTP.
 - 8. Risk Management Plan, and Initial Schedule Risk Analysis including Risk Register in accordance with Section 01 20 10 - Risk Management Requirements.
 - 9. Method of addressing expansive soils in accordance with Section 01 82 13 - Geotechnical and Foundation Performance Requirements:
 - 10. In accordance with Section 01 83 00 - Building Performance Requirements:
 - a. Drawings for each building:
 - 1) Architectural floor plans, roof plans, building sections and building elevations.
 - 2) Architectural renderings, study models, and perspective sketches.
 - b. Preliminary selection of major building systems and construction materials.

11. Superstructure descriptions for buildings in accordance with Section 01 83 13 - Superstructure Performance Requirements. Identify major structural materials and systems for superstructures such as pre-engineered metal building system, concrete or steel, cast-in-place vs pre-stress.
12. Internal building plans in accordance with Section 01 84 13 - Interior Performance Requirements.
13. Proposed equipment in accordance with Section 01 85 00 - Material Handling Equipment Performance Requirements:
14. In accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements:
 - a. System architecture drawing, including communications links, showing major components, including network switches and converters.
 - b. Recommended redundancy requirements.
15. Preliminary Facility Single-Line Diagram in accordance with Section 01 86 26 - Electrical Performance Requirements.
16. In accordance with Section 01 86 30 - Information System Security Performance Requirements:
 - a. Documentation for Contractor supplied information systems network and communication connections between components:
 - 1) Document for each internal connection, external, connection, interface characteristics, security requirements, and nature of information communicated.
 - b. Provide summary of security features of digital and information system components.
 - c. Documentation disclosing existence of known methods for bypassing computer authentication in procured products, often referred to as backdoors including:
 - 1) Documentation on backdoors created or intended to be used by Contractor.
 - 2) Documentation on methods of accessing system through offsite network.
 - d. List audit log management capabilities that Contractor supplied digital and information system components are capable of as well as format of audit logs. Identify which logs shall be enabled on supplied systems.
 - e. Complete Government supplied supply chain risk questionnaire.

17. System architecture drawing, including communications links, showing major components, including network switches and converters for communications systems or networks in accordance with Section 01 86 33 - Electronic Safety and Security Performance Requirements.
18. In accordance with Section 01 86 46 - Water Treatment Performance Requirements:
 - a. Basis of Design Report:
 - 1) Water treatment process evaluation concerns and solutions, including Raw Water quality concerns.
 - 2) Water treatment and residuals handling equipment:
 - a) Identify unit operations and associated design criteria.
 - b) Number of units.
 - 3) Design calculations:
 - a) Hydraulic calculations including pressure, head loss, and velocity.
 - b) Mass balance through the treatment process at Maximum, Average and Minimum Day Demand. Account for chemicals added and removed.
 - c) Chemical systems and dose requirements.
 - d) Log inactivation/removal through the treatment process.
 - 4) Manufacturer's datasheets for major equipment items.
 - 5) Anticipated service life of equipment.
 - 6) Required permits.
 - b. Drawings:
 - 1) Process Flow Diagrams.
 - 2) Hydraulic profile through WTP at Maximum and Minimum Day Demand.
 - 3) Plan views of treatment processes and piping.
19. Drawings in accordance with Section 01 89 16 - Site Performance Requirements. Include:
 - a. Existing site conditions showing existing topography, overhead and underground utilities, roads, drainage features, and structures.
 - b. Proposed site improvements including structures, proposed building locations, staging areas, pavement locations, site grading, drainage, and utility locations with clearance offsets.

20. General elevations of tank features, maximum and minimum water surfaces, and other pertinent information regarding tank operation in accordance with Section 01 89 35 - Storage Tank Performance Requirements.
- D. RSN 01 81 05-1, Schedule of Values:
1. Breakdown, in sufficient detail, for lump sum Contract Line-Item Numbers listed in Price Schedules to determine the value of progress payments. Do not include mobilization and preparatory work item.
- E. RSN 01 81 05-2, 30 Percent Design. At a minimum provide:
1. Refined Proposal design.
 2. Security Vulnerability Assessment and Security Plan Outline.
 - a. Identification and assessment of site and building/structure vulnerabilities and risks.
 - b. Includes planned physical and electronic features that address and remediate identified vulnerabilities.
 3. Naming and Identification Development Policy: Includes guidelines for generating component names and identification numbers, including the development of identification within control logic.
 4. Building Information Model (BIM).
 5. List of standard tools and maintenance equipment necessary to operate the facility. Include a cost for each item.
 6. Lists of extra materials including special tools and spare parts.
 7. Qualifications in accordance with Section 01 20 10 - Risk Management Requirements.
 8. Draft Training Plan in accordance with Section 01 79 20 - Training.
 9. Repair Plan in accordance with Section 01 81 07 – San Juan Lateral Performance Plan.
 10. In accordance with Section 01 81 13 - Sustainable Design Performance Requirements:
 - a. Proposed Sustainable Design Coordinator resume.
 - b. Sustainable Design Plan.
 - c. Description of significant sustainable design elements to meet code and reduce energy use.
 11. In accordance with Section 01 82 13 - Geotechnical and Foundation Performance Requirements:
 - a. Name and credentials of Geotechnical Engineer of Record with a minimum of 10 years of experience dealing with expansive soils and rock.

- b. Summary of available geological and geotechnical data, preliminary assumptions and analysis, and geotechnical exploration plan including boring location plan and laboratory testing plan.
 - c. Method of excavation.
- 12. Drawings for each building in accordance with Section 01 83 00 - Building Performance Requirements. Include:
 - a. Building code analysis including occupancy summary, construction type, allowable areas and heights, fire resistance ratings, egress, hazardous materials summary, and other pertinent items.
 - b. Indicate sizes and locations of building architectural features.
 - c. Structural design data drawing consistent with IBC.
 - d. Explanation of objectives and factors influencing siting decisions. Compliance with accessibility standards and security requirements.
- 13. Internal building plans in accordance with Section 01 84 13 - Interior Performance Requirements. Include:
 - a. Room size and door locations.
 - b. List of Furniture, Fixtures, and Equipment.
 - c. List rooms by building, and room name and number.
- 14. In accordance with Section 01 84 16 - Exterior Performance Requirements:
 - a. Architectural aesthetic plan describing the proposed materials and colors and explaining the approach rationale.
 - b. Location of bullet resistant materials and assemblies and protected critical elements.
- 15. Identify proposed finishes in accordance with Section 01 84 19 - Interior Finishes Performance Requirements.
- 16. Equipment size, speed, and load ratings in accordance with Section 01 85 00 - Material Handling Equipment Performance Requirements.
- 17. In accordance with Section 01 86 13 - Fire Suppression Performance Requirements:
 - a. Description of systems required, sources, input-side capacities, and means of distribution.
 - b. Fire protection areas.
 - c. Fire protection zones on drawings with riser locations.
 - d. Preliminary sizes of fire pumps and distribution elements.
 - e. Locations of standpipes.
 - f. Water source (treated water pipeline, clearwell, or separate tank).

- g. Water supply and maintenance activities which impact supply and impact durations
 - h. List of standards and codes utilized.
- 18. In accordance with Section 01 86 16 - Plumbing and Valves Performance Requirements:
 - a. Description of each system required, sources, input-side capacities, and means of distribution.
 - b. Preliminary size of distribution elements for each system.
 - c. Plan view drawing showing location of equipment and major piping of each system.
 - d. If using booster systems or elevated storage tanks for water supply:
 - 1) Pressure and flow requirements. Verify source availability.
 - 2) Preliminary equipment including pump curves.
- 19. In accordance with Section 01 86 19 - HVAC Performance Requirements:
 - a. Design narrative.
 - b. Plan view drawing showing the location of the major pieces of equipment.
 - c. Equipment schedule with the capacity information.
- 20. Component Data in accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements including identification of model or catalog number proposed.
- 21. Instrument list in accordance with Section 01 86 27 - Instrumentation Performance Requirements. Including:
 - a. Designation tag.
 - b. Type and model.
 - c. Design and Operating Points.
- 22. Preliminary motor list in accordance with Section 01 86 28 - Induction Motor Performance Requirements:
 - a. For motors larger than 5 HP.
 - b. Include function, horsepower, voltage, phases, frequency, and power factor.
- 23. In accordance with Section 01 86 30 – Information System Security Requirements:
 - a. Provide an inventory of information system components for Contractor supplied information systems or information system components. Include device tag, manufacturer and model number in the inventory.
 - b. Provide file format and example for Asset Management List and Account Management Lists.

24. In accordance with Section 01 86 34 - Fire Detection and Alarm Performance Requirements:
 - a. Plan view showing location of fire protection system equipment.
 - b. Equipment technical datasheets.
25. Clearwell sump design in accordance with Section 01 89 44 - Treated Water Pump Performance Requirements.
 - a. Sump volume calculations.
 - b. Maximum and design storage volume and elevation.
 - c. Pump minimum runtime volume band and maximum elevation see NEMA MG 1.
 - d. Manufacturer's datasheets for major equipment items.
26. Drawings in accordance with Section 01 86 46 - Water Treatment Performance Requirements:
 - a. Pipe Schedule: Materials, coating/liners, dimension ratios, and other specific design criteria for process, chemical and other piping services.
 - b. Process Instrumentation and Sampling Plan Schematics: Refer to Information Drawing - Process Instrumentation and Sampling Plan Schematic.
 - 1) Three sheets maximum.
 - 2) Clearwell sump: General arrangement showing sump dimensions and geometry relative to pump bell diameter and submergence requirements.
 - 3) Plan views of treatment processes, and process, chemical, and utility pipes.
27. Pipe Schedule in accordance with Section 01 89 19 - Process and Utility Pipe Performance Requirements.
28. In accordance with Section 01 89 34 - Treated Water Piping and Valves Performance Requirements:
 - a. Piping: Preliminary schematic identifying the pipe sizes and materials.
 - b. Identify valves on preliminary schematic.
29. In accordance with Section 01 89 35 - Storage Tank Performance Requirements:
 - a. Proposed tank options.
 - b. Designer qualifications.
 - c. General arrangement of tanks, tank material, associated piping, and equipment. Include future tanks with piping.
30. Sketch showing general air chamber locations and piping connections in accordance with Section 01 89 37 - Air Chambers Performance Requirements.

31. Pump curves in accordance with Section 01 89 44 - Treated Water Pump Performance Requirements:
 - a. Typical pump performance curves that show efficiency, horsepower, total head, and NPSHR with reference to flow capacity and operating speed:
 - b. Plot the system curve intercept for
 - 1) Selected guaranteed condition.
 - 2) Maximum and minimum: Static head, estimated friction over the life of the system, and number of pumps operating in parallel.
 - c. Indicate Preferred Operating Region.
 - d. Performance curves at maximum and minimum speeds for variable speed pumps.
 - e. Pumps operating in parallel plot:
 - 1) Typical pump performance curves that show total head with reference to flow capacity and operating speed.
 - 2) System curves for maximum static head and estimated friction over life of system.
32. Pre-Design Phase Commissioning Documentation in accordance with Section 01 91 13 - Building Commissioning:
33. Information System Security Plan in accordance with Section 01 86 30 - Information System Security Performance Requirements:
 - a. Information system security, control locations (if applicable) and their implementation. Include identification of which information system security controls are used for which information systems.
 - b. Include mitigation strategies for information system vulnerabilities and provide approach for meeting network security and access control requirements.
 - c. Identify which components won't be able to implement user account access control.
 - d. Perform a risk assessment of the likelihood and magnitude of harm from unauthorized access, use, disclosure, disruption, modification, or destruction for each of the Information Systems.
- F. RSN 01 81 05-3, 30 Percent Comment Response:
 1. Respond to Government comments on 30 Percent Design package.
- G. RSN 01 81 05-4, 60 Percent Design:
 1. Refine 30 Percent Design.
 2. Underground utility coordination plan including footings, plumbing fixtures and lines, underground electrical lines with elevations.

3. Future installation design drawing details of the interface between Phase 1 and Phase 2 installations.
4. Plan for Protecting Existing Installations in accordance with Section 01 56 10 - Protection of Existing Installations.
5. San Juan Lateral Repair, Flushing/Commissioning, Community Delivery Plan and Operations Plan in accordance with Section 01 81 07 – San Juan Lateral Performance Requirements.
6. Sustainable Design Plan with CWMP in accordance with Section 01 81 13 - Sustainable Design Performance Requirements
7. In accordance with Section 01 82 13 - Geotechnical and Foundation Performance Requirements:
 - a. Foundation investigation report:
 - 1) Results of additional explorations at specific structure locations, detailed listing of design criteria, analyses, prepared by a registered professional engineer.
 - 2) Minimum additional borings for major structures.
8. Building drawings in accordance with Section 01 83 00 - Building Performance Requirements:
 - a. Architectural floor plans, roof plans, reflected ceiling plans, building elevations, building sections, wall sections and details, interior elevations, door schedules, window and louver schedules.
 - b. Partition types and details; finish schedule and details: Include door, window, and storefront system details.
 - c. Space/room names and numbers, dimensions, column lines, and detail references.
 - d. Structural floor and roof plans, indicating columns, beams, bearing and shear walls, slabs, decks, and other major structural elements, with sizes and locations of structural elements.
 - e. Structural sections for buildings, indicating columns, beams, bearing and shear walls, slabs, decks, and other major structural elements, with all sizes and locations of structural elements indicated.
 - f. Structural details that accommodate building movement and fire separation.
 - g. Lab layout and equipment list.
 - h. Door and Window Schedules: Indicate sizes, types, and details.
 - i. Wall/Partition Schedule: Include construction type and fire ratings, keyed to the plans.
 - j. Fire Protection Plans and Analysis: Include exit capacities, travel paths and distances, and fire extinguisher locations.

- k. Interior and exterior draft material sample boards showing samples of primary construction materials and colors.
 - l. Updated BIM model for each building.
- 9. Calculations and computer analyses for floor, roof, and supporting members, in accordance with Section 01 83 13 - Superstructure Performance Requirements:
- 10. In accordance with Section 01 83 19 - Roofing Performance Requirements:
 - a. Roof configuration showing openings, fall protection system, and ladders.
 - b. Roof leak inspection plan.
- 11. In accordance with Section 01 84 13 - Interior Performance Requirements:
 - a. List of Furniture, Fixtures, and Equipment by building, room name and number.
 - b. Cut sheets for specified items and other proposed items.
- 12. In accordance with Section 01 84 16 - Exterior Performance Requirements:
 - a. Show protection devices for doors, windows, and other openings.
 - b. List and description of critical elements.
- 13. Manufacturer's product data in accordance with Section 01 84 19 - Interior Finishes Performance Requirements.
- 14. In accordance with Section 01 85 00 - Material Handling Equipment Performance Requirements:
 - a. Commercial product data, including ratings, options, and model numbers.
 - b. General layout, detail, and electrical schematic drawings.
- 15. In accordance with Section 01 86 13 - Fire Suppression Performance Requirements: Engineering calculations showing input- and output-side capacities and loads and sizes of distribution elements.
- 16. In accordance with Section 01 86 16 - Plumbing and Valves Performance Requirements:
 - a. Water supply source and flow conditions with calculations for: Input and output side capacities and loads and sizes of distribution elements.
 - b. Sewer discharge method and locations with riser diagrams of sanitary waste and vent systems.
 - c. Compressed air source and flow conditions with evaluation of Service Air requirements.
 - d. Piping schematics for drain, waste, and vent piping.
 - e. Piping and instrumentation diagrams for service air and water, and process & Instrument Air.
- 17. Initial load and ventilation calculations in accordance with Section 01 86 19 - HVAC Performance Requirements.

18. In accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements:
 - a. Manufacturer's technical data and catalog sheets on proposed system components.
 - b. Schematic Diagrams.
 - c. Example Graphic Display Drawings.
 - d. Example Logic diagrams: Functional and binary logic drawings for the entire control system.
 - e. Software information, including HMI, Historian, Alarm and Events, and Web Server applications.
19. In accordance with Section 01 86 26 - Electrical Performance Requirements:
 - a. Panelboard Schedules.
 - b. Preliminary Equipment Layouts.
 - c. Grounding System Layouts: Ground resistance measurements and engineering analysis of ground terminal design, if grounding in very shallow or dry soil, or in rock.
 - d. Lighting scheme, including types of luminaires and lamps.
 - e. Manufacturer's cut sheets.
 - f. Electrical distribution system reliability evaluation calculated using the "minimal cut-set method" described by IEEE 493.
 - g. Electrical System Calculations:
 - 1) Load Flow and Short Circuit Analysis performed for all Contractor supplied electrical distribution components.
 - 2) Generator sizing calculations.
20. In accordance with Section 01 86 27 - Instrumentation Performance Requirements:
 - a. Component Data:
 - 1) Manufacturer's technical data and catalog sheets on proposed system components.
 - 2) Identification of model or catalog number proposed.
 - 3) Highlight options to indicate what is being included.
 - 4) Cross out models not applicable.
 - b. Updated Instrument List, including:
 - 1) Instrument designation tag and description.
 - 2) Instrument type, model, and manufacturer.
 - 3) Location within the process/plant.

- 4) Power.
 - 5) Signal type.
 - 6) Design and Operating Range.
 - 7) Alarm set point.
 - 8) Calibration Range.
 - 9) Accuracy.
 - c. Instrument Datasheets (ISA 20 and TR20.00.01 format).
21. Motor list in accordance with Section 01 86 28 - Induction Motor Performance Requirements. Include function, horsepower, voltage, phases, frequency, and power factor.
22. In accordance with Section 01 86 29 - Communications Performance Requirements:
- a. Layout Drawings:
 - 1) Rack, enclosure, and cabinet layout drawings showing locations of components.
 - 2) Location drawings showing locations of components within the structures and the site.
 - b. Network Diagram:
 - 1) Includes communications links, showing major components, including network switches and converters.
 - 2) Identify points of interface with systems supplied by others.
 - c. Bill of Materials.
 - d. Manufacturer's product data.
 - e. Software information.
 - f. Ambient temperature range, relative humidity, altitude, maximum sustained wind speed and maximum wind gust.
23. In accordance with Section 01 86 33 - Electronic Safety and Security Performance Requirements:
- a. Device location plan layout drawings.
 - b. Manufacturer's product data. Provide information on ambient temperature range, relative humidity, altitude, maximum sustained wind speed and maximum wind gust.
24. In accordance with Section 01 86 34 - Fire Detection and Alarm Performance Requirements:
- a. Draft Fire Protection Project Scope and Narrative Report.

- b. Layout Drawings:
 - 1) Floor plan layout drawings showing the location of devices and control equipment. Show mounting elevation for wall mounted devices.
 - 2) Cabinet and panel layout drawings showing internal and external layout of each enclosure.
 - c. Riser Diagram.
 - d. Progress set of fire protection system drawings.
 - e. Class of fire protection circuits and pathway survivability.
25. In accordance with Section 01 86 46 - Water Treatment Performance Requirements:
- a. Report on status of permits. Reclamation will provide Source Water Quality Assessment required by NNEPA.
 - b. Pilot Scale or Bench Scale Test Plan.
 - c. Pilot Scale or Bench Scale Testing Results Report.
 - d. Drawings including sections for process, chemical, and utility pipe. Process Sections.
 - e. Piping and Instrumentation Diagrams.
26. In accordance with 01 89 09 - Coating Performance Requirements:
- a. Applicable tabulation number from Coating Tabulations.
 - b. Identification of items to be coated.
 - c. Manufacturer's product data, application, and SDS sheets.
 - d. Paint Chip Samples.
 - e. NSF 61 Certifications coating systems in contact with potable water.
27. In accordance with Section 01 89 16 - Site Performance Requirements:
- a. Layout and design rationale for roadways and driveways, parking areas, earthwork, utilities, and other related site improvements.
 - b. Drainage requirements, design, and design rationale. Include:
 - 1) Drainage and stormwater runoff analysis.
 - 2) Permitting requirements.
 - 3) Conveyance and storage features:
 - c. Site improvement calculations. Include:
 - 1) Earthwork cut and fill volumes with cross sections.

- 2) Roadway and driveway layout including plan, profile, stationing, horizontal and vertical alignment, curve data, super elevation, minimum sight distances, plan, and pavement design.
 - d. Drawings:
 - 1) Boundary and topographic survey.
 - 2) Temporary construction facilities plan including site access, fencing, trailers, staging, laydown, and storage areas.
 - 3) Site construction phasing.
 - 4) Grading plan(s):
 - a) Existing and proposed grades.
 - b) Finish floor elevations for structures, tanks, and other site features.
 - 5) Site plan(s):
 - a) Structures, proposed and future buildings, tanks, and other site features.
 - b) Site ingress and egress.
 - c) Site vehicular access, parking areas, and emergency access, and other circulation improvements.
 - d) Site visitor and personnel walkways.
 - e) Fencing, lighting, and revegetation areas.
 - f) Utilities: Locations of water valves, electric manholes and other utility structures visible at grade.
 - 6) Site drainage plan:
 - a) Conveyance features and ponds.
 - b) Elevations and inverts in plan and profile.
 - 7) Typical site details.
 - e. Revegetation narrative compliant with Bare Soil Reclamation Procedures.

28. In accordance with Section 01 89 19 - Process and Utility Pipe Performance Requirements:

 - a. Design specifications for process and utility pipe systems. Include On-Site Sewage Disposal System.
 - b. Percolation test or permeability evaluation on disposal and replacement areas; absorption field size calculations.

29. In accordance with Section 01 89 27 - Cathodic Protection Performance Requirements:

- a. Cathodic protection design for buried metallic components of pipe, fittings, and tank bottoms, and metallic surfaces in immersion service in tank interiors including:
 - 1) Number of anodes to be used for each structure.
 - 2) Design data, assumptions, and design documentation.
 - 3) Pre-construction drawings including cathodic protection installation details and isolation kit details and installation locations.
 - 4) Manufacturer's data sheets for system components.
- 30. In accordance with Section 01 89 34 - Treated Water Piping and Valves Performance Requirements:
 - a. Pipe drawings, including:
 - 1) Pipe material, sizes, thicknesses, and dimensions.
 - 2) Labeled pipe supports and anchoring details.
 - 3) Flow direction.
 - 4) Cross reference drawing numbers of connecting piping.
 - b. Valve List, including ID number, location, size, piping system, type, design pressure and temperature, pressure rating, connection type, actuation type, power or pneumatic requirements, control and output signal(s). Group valves in the same piping system together in the schedule.
 - c. Show valve sizes and pressure classes on drawings.
- 31. In accordance with Section 01 89 35 - Storage Tank Performance Requirements:
 - a. Design drawings and calculations of reinforced concrete foundation, if applicable.
 - b. Commercial product data including catalog illustrations, sizes, material, pressure ratings, manufacturer's installation instructions, and parts lists for commercial products provided.
- 32. In accordance with Section 01 89 37 - Air Chambers Performance Requirements:
 - a. Hydraulic transient analysis of the system.
 - 1) Verification of air chamber volumes.
 - 2) Determine pressure vessel control levels.
 - 3) Show transient results that air chamber system provides at least 5 psi in Reach 4A under power failure with all pumps on.
 - 4) Design calculations, design considerations, and referenced publications and standards used in the design of the air chamber.

- 5) Commercial products data for equipment associated with the air chamber.
 - b. Air compressors and compressed air filtration system data and drawings:
 - 1) Commercial products data.
 - 2) Compressor sizing data and calculations showing the air compressor unit shall deliver the minimum specified rate of air flow.
 - 33. In accordance with Section 01 89 44 - Treated Water Pump Performance Requirements:
 - a. Provide pump data sheets, including:
 - 1) Pump manufacturer and model.
 - 2) Bell diameter, if applicable.
 - 3) Impeller or propeller:
 - a) Trim and or pitch.
 - b) Material selection.
 - 4) Bowl or case material selection.
 - 5) Shaft material selection.
 - 6) Number of stages.
 - 7) Motor selection including:
 - a) Horsepower.
 - b) Enclosure type.
 - c) Efficiency.
 - d) Speed in RPM.
 - b. Calculations for the NPSH Margin in accordance with ANSI/HI 9.6.1 and submergence in accordance with ANSI/HI 9.6.6, ANSI/HI 9.8, and pump manufactures requirements.
 - c. Pumping unit shown in general arrangement drawings including intake structure, suction and discharge piping, and valves.
 - 34. Design Phase Commissioning Documentation in accordance with Section 01 91 13 - Building Commissioning.
- H. RSN 01 81 05-5, 60 Percent Design Reconciled Submittal Table:
- 1. Reconciled submittal table in Section 01 33 00 - Submittals.
 - a. Include “To”, “From”, and “Copy” columns.
 - 1) Include builder to designer submittals and design-builder to Government submittals.

- 2) Proposed changes to required design and construction submittals.
 - b. Modify due date or delivery time column in submittal table. Replace “Per Contractor’s proposed baseline schedule” with approximate due dates tied to construction of applicable item.
- I. RSN 01 81 05-6, 60 Percent Comment Response:
 1. Respond to Government comments on 60 Percent Design package.
- J. RSN 01 81 05-7, 90 Percent Design:
 1. Refine 60 Percent Design.
 2. Construction drawings and specifications at the level of detail needed to construct the project. Including a list of equipment, fixtures, and materials, submittals and a submittal register.
 3. Design report with analysis verifying conformance with the requirements of the project.
 4. Final staffing plan.
 5. Plan for customizing maintenance software for project.
 6. List of operation and maintenance manuals to be submitted during construction.
 7. Designer’s operating criteria for the facility.
 8. Design cost estimate in accordance with Section 01 20 05 - Cost Estimating Requirements.
 9. Updated Schedule Risk Analysis and Register in accordance with Section 01 20 10 - Risk Management Requirements
 10. Final training plan in accordance with Section 01 79 20 – Training.
 11. In accordance with Section 01 82 13 - Geotechnical and Foundation Performance Requirements:
 - a. Updated concrete outline drawings.
 - b. Foundation and vault reinforcement drawings.
 - c. Design analysis and reports by registered professional engineer.
 12. In accordance with Section 01 83 00 - Building Performance Requirements:
 - a. Final material sample boards for each building.
 - b. Details of roof equipment support types and locations, as well as details for applicable roof mounted fall protection safety equipment.
 13. In accordance with Section 01 84 13 - Interior Performance Requirements:
 - a. Details of non-electrical lighting control mechanisms, including windows and window treatments.
 - b. Sign Plan including location, type, content and lettering.

14. In accordance with Section 01 84 16 - Exterior Performance Requirements:
 - a. Detailed door, window, and louver schedule.
 - b. Manufacturers' product data.
15. In accordance with Section 01 86 13 - Fire Suppression Performance Requirements:
 - a. System equipment locations on drawings and manufacturer's product data.
 - b. Complete system details.
16. In accordance with Section 01 86 16 - Plumbing and Valves Performance Requirements:
 - a. Water piping design calculations and entrance locations.
 - b. Drainage design calculations and documentation of piping outlets.
 - c. Piping design calculations and drawings.
 - d. Compressed air unit(s) and piping design calculations.
17. Drawings in accordance with Section 01 86 19 - HVAC Performance Requirements. Include:
 - a. Plan view showing HVAC equipment and associated ductwork, piping, and similar.
 - b. Schematics of HVAC-related piping as well as ventilation systems.
 - c. Details sheet showing typical HVAC construction details (e.g., duct takeoffs, and similar) as well as detailed view of mechanical spaces.
 - d. Equipment schedules that detail characteristics (e.g., capacity, nomenclature, electrical characteristics, control methodology, and similar) for HVAC equipment.
 - e. Control schematic (including digital points) and sequence of operation statement for electronically controlled (local or direct digital control) HVAC equipment.
 - f. Ventilation calculations showing compliance with ASHRAE 62.1 and IFC. For chemical ventilation include assumed chemicals and conditions and material compatibility requirements.
 - g. Refrigerant calculations showing type and amount compared to that allowable by IMC.
18. In accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements:
 - a. Preliminary I/O List, including at a minimum the following information:
 - 1) Point designation.
 - 2) Card location.
 - 3) Type and rating information.

- 4) Termination data.
 - b. Provide component life cycle support information, including at a minimum the following:
 - 1) Automation controllers.
 - 2) I/O cards.
 - 3) Network and communication cards.
 - 4) Backplanes and components mounted on backplanes.
 - c. SCADA System UPS and battery sizing calculations, including summary of calculated electrical load supplied from the UPS.
- 19. In accordance with Section 01 86 26 - Electrical Performance Requirements: Schematic Drawings.
- 20. In accordance with Section 01 86 27 - Instrumentation Performance Requirements:
 - a. Flow Element Sizing Calculations (where applicable).
 - b. Panel and Enclosure Layout Drawings:
 - 1) Front, rear and internal layout.
 - 2) Identification of wireways or cable anchorage points
 - 3) Dimensions.
 - 4) Component identification.
 - 5) Nameplate schedule.
 - c. Instrument Location Drawings with unique tag identifier.
 - d. Instrument Installation Drawings.
- 21. In accordance with Section 01 86 28 - Induction Motor Performance Requirements.
 - a. Motor list including efficiency, service factor, design letter, locked rotor code, Insulation Class, Motor Maximum kVAR, Power Factor Correction Capacitor Size (as applicable). Unique tag designation.
 - b. Schematic diagrams:
 - 1) Armature winding connection.
 - 2) Indicating and protective devices.
 - 3) Space heaters.
 - c. Wiring diagrams: Low-voltage terminal box.
- 22. In accordance with Section 01 86 29 - Communications Performance Requirements:
 - a. Schematic and wiring diagrams.

- b. Spare parts list.
 - c. List of recommended equipment that may be used to expand the telephone system, including original manufacturer's equipment, or a list of other vendor's phone system equipment, where applicable.
- 23. In accordance with Section 01 86 33 - Electronic Safety and Security Performance Requirements:
 - a. Wiring and connection drawings for Contractor installed components. Show information on wire termination location for each circuit at each device.
 - b. Schematic diagrams.
- 24. In accordance with Section 01 86 34 - Fire Detection and Alarm Performance Requirements:
 - a. Documentation to meet NFPA 72 Chapter 7 documentation requirements
 - b. Floor plan layout drawings showing the location of devices and control equipment indicating device circuits with device labels and notification appliance circuits with current draw.
 - c. Wiring and Connection Diagrams:
 - 1) Include complete wiring point-to-point diagrams for internal and external connections.
 - 2) Include connections for communications circuits.
 - d. Final Fire Protection Project Scope and Narrative Report.
- 25. In accordance with Section 01 86 46 - Water Treatment Performance Requirements: Drawing with details of processes and process, chemical, and utility pipes.
- 26. In accordance with Section 01 89 09 - Coating Performance Requirements: Product schedule, color, location, data pages, care and cleaning instructions, touch-up procedures, and color samples.
- 27. In accordance with Section 01 89 27 - Cathodic Protection Performance Requirements:
 - a. Type of system to be used.
 - b. Structure-to-anode connection details.
 - c. Parts and materials list.
- 28. Power and control wiring diagrams for valves in accordance with Section 01 89 34 - Treated Water Piping and Valves Performance Requirements.
- 29. Pump specification paragraphs in accordance with Section 01 89 44 - Treated Water Pump Performance Requirements.
- 30. Pre-Construction Phase Commissioning Documentation in accordance with Section 01 91 13 - Building Commissioning.

- K. RSN 01 81 05-8, 90 Percent Comment Response:
1. Respond to Government comments on 90 Percent Design package.
- L. RSN 01 81 05-9, 100 Percent Design:
1. Refine 90 Percent Design.
 2. Drawings and specifications sealed by an engineer/architect licensed in the state of New Mexico.
 3. Final Schedule Risk Analysis including Risk Register in accordance with Section 01 20 10 - Risk Management Requirements.
 4. In accordance with 01 83 00 - Building Performance Requirements:
 - a. BIM model for each building:
 - 1) Primary architectural and structural elements, finish grades, simulated materials, colors, textures, shade and shadow.
 - 2) Human sized scaling reference.
 5. In accordance with Section 01 83 13 - Superstructure Performance Requirements:
 - a. Pre-engineered metal building systems:
 - 1) Refine 90 Percent Design.
 - 2) Product Data: Include construction details and material descriptions.
 - 3) Drawings:
 - a) Plans, elevations, sections, details, and attachments to other work.
 - b) Anchor-Bolt Plans: Include location, diameter, embedment, and projection of anchor bolts required to attach metal building to foundation.
 - c) Structural-Framing:
 - i. Show fabrication of primary and secondary framing; include provisions for openings.
 - ii. Welds and bolted connections, distinguishing between shop and field applications.
 - iii. Transverse cross-sections.
 - d) Show provisions for attaching collateral loads to primary and secondary framing members.
 - e) Layouts of metal and roof panels including methods of support.
 - f) Roof-mounted items including roof hatches and equipment supports.

- g) Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - h) Translucent panels.
- 6. Submit the following in accordance with Section 01 84 19 - Interior Finishes Performance Requirements: Detailed schedule of finish locations and manufacturer's product data.
- 7. In accordance with Section 01 86 16 - Plumbing and Valves Performance Requirements: Functional performance testing plans of each system.
- 8. In accordance with Section 01 86 34 - Fire Detection and Alarm Performance Requirements:
 - a. Approved of final design package from authority having jurisdiction.
 - b. Including design and drawings.
- 9. In accordance with Section 01 89 27 - Cathodic Protection Performance Requirements:
 - a. Final design data, assumptions, and design documentation.
 - b. Final construction drawings.
 - c. Design summary.
- 10. In accordance with Section 01 89 35 - Storage Tank Performance Requirements:
 - a. Manufacturer's catalog data and shop drawings:
 - 1) Checked, detailed shop drawings which include dimensions and tolerances, material data, joint details, welding requirements, appurtenances, and other pertinent tank construction information.
 - 2) Manufacturer's installation instructions.
 - 3) Tank surface finishes and coating materials.
- M. RSN 01 81 05-10, Construction Progress Submittals:
 - 1. As specified in other specification sections.
 - 2. Customary construction submittals to ensure an audit path record.
 - 3. Confirm adherence to approved Testing Agency Services Plan submitted in Section 01 46 20 - Testing Agency Services.
- N. RSN 01 81 05-11, 100 Percent Construction:
 - 1. Standard Operating Procedures. Refer to Section 01 91 16 - Facility Commissioning.
 - 2. Maintenance software customized for this project with electronic operation and maintenance manuals uploaded.
 - 3. Major inventory list with associated costs.

4. In accordance with Section 01 81 16 - General Pump Performance Requirements:
 - a. Certified pump curves showing head/flow, bhp, efficiency, net positive suction head curves. Certified factory test report including test data sheets and curves of test results.
 - b. Certify pump horsepower demand shall not exceed the rated motor horsepower beyond a 1.15 service rating at any point on the curve.
5. In accordance with Section 01 83 19 - Roofing Performance Requirements:
 - a. Reports of first 3 significant rainfalls after completion of roof, including rainfall amount and intensity, wind speed and direction, and results of inspection of roof and underside.
 - b. Water conduction tests in accordance with ASTM E1646.
 - c. Air leakage tests in accordance with ASTM E1680.
 - d. Fire rating identification numbers recognized by code authorities on the construction drawings.
6. Field test of lighting levels verifying compliance with performance requirements. in accordance with Section 01 84 13 - Interior Performance Requirements. Coordinate with Section 01 86 26 - Electrical Performance Requirements.
7. Final test data and reports for cathodic protection systems in accordance with Section 01 89 27 - Cathodic Protection Performance Requirements.
8. In accordance with Section 01 89 44 - Treated Water Pump Performance Requirements:
 - a. Results from Pump Shop Test:
 - a) Dimensioned test set-up drawing showing pumping unit assembly (pump and motor) and instrumentation set-up for pumping unit performance shop performance test.
 - b) Certified calibration records for test equipment.
 - c) Test equipment uncertainty calculations and test equipment data sheets.
 - d) Factory Functional and Performance Test Reports and Log.
 - e) Pump performance test report including tabulation of raw test data collected.
 - f) Performance curves showing wire to water efficiency, pump efficiency, horsepower input to the pump, and pump discharge head.
 - 2) Hydrostatic test report.
 - 3) Installation instructions.
 - 4) Short- and long-term pump storage/maintenance instructions.

- 5) List of special tools and accessories for assembly and disassembly of the pumping unit.
- b. Pumping Unit Field Test Reports.
- c. Motor Final Data and Drawings:
 - 1) Assembly and sectional drawings with parts and materials lists, and component weights.
 - 2) Motor outline drawing including thrust bearings and dimensioned location of terminal boxes.
 - 3) Motor nameplate drawings complete with nameplate data.
 - 4) Standard Drawing 40-D-6032 completed for each size motor.
 - 5) As-built schematic and wiring diagrams for motor approval drawings.
 - 6) Field test reports.
 - 7) Installation, operation, and maintenance information including tools and accessories for assembly and disassembly of the motor:
 - a) Mounting details including the motor manufacturer's recommended tightening torques for all bolts.
 - b) Spare parts list.
 - c) Maintenance schedule.
 - d) Bill of materials.
 - e) Include the manufacturer's vibration limits, maximum bearing and stator temperatures and lockouts settings, and maximum seal leakage rate.
- 9. Post-Construction Phase Commissioning Documentation in accordance with Section 01 91 13 - Building Commissioning.
- O. Early Work Packages: Refer to Sections 01 12 16 - Work Sequences and 01 33 00 - Submittals.

1.05 TEAM

- A. Project Manager(s)/Director: Minimum 10 years' relevant experience.
- B. Lead Construction Manager: Minimum 10 years' relevant experience.
- C. General Superintendent.
- D. Lead Designer-of-Record:
 - 1. Registered professional engineer or registered architect.

2. Principal Designer of Record may have collateral duties as Architect of Record or as one discipline's Engineer of Record.
 3. Lead Architect / Architect of Record: Sign, stamp, and date final architectural design drawings and specifications.
 4. Engineers of Record: Sign, stamp, and date 100 Percent Design drawings, specifications, calculations, and technical reports as applicable per discipline.
- E. Lead Operation and Maintenance Manager.
- F. Lead Water Treatment Designer/Manager.
- G. Sustainable Design Coordinator: 3-years with sustainable design and coordination.
- H. Contractor and designer representative shall be collocated on-site during construction.
- I. Design location will be reviewed and approved by the Government.
- J. Assist Government in outreach meetings. Refer to Section 01 31 19 - Project Management and Coordination.

1.06 DESIGN

- A. General:
1. Design project in accordance with the contract documents using industry standard materials and efficient practices.
 2. Use high quality, durable and easily maintainable materials.
 3. Final drawings, specifications and required construction submittals at level for construction and installation.
 4. Provide engineering analysis and assessment to size the ponds, tanks, pumps, piping, treatment process, buildings, and associated items.
 5. Design WTP to continuously deliver water to communities once WTP is online. Include redundant systems to take equipment off-line for maintenance without stopping delivery to communities.
 6. Refer to the WTP Process Diagram in Section 52 00 00 - Drawings.
 7. Coordinate final design requirements with Reclamation.
- B. The requirements of Section 01 81 05 - General Performance Requirements apply to the other Sections unless the other Sections have more stringent requirements.
- C. Where features fall under multiple design and construction requirements, meet the more stringent requirement.

D. BIM:

1. Central multi-disciplined model that encompasses major discipline features for project coordination associated with design and construction reviews.
2. Provide human sized scaling reference.
3. Perform interference management. Identify areas where interferences need to be addressed in design and construction reviews.

E. Process Flow Diagrams (PFDs):

1. In accordance with PIP PIE001.
2. Illustrate relationship between major equipment, equipment names, equipment identifiers, major pipes, bypass lines, recirculation lines, control valves, valves required to demonstrate routing, major valves, interconnections to other systems, and equipment ratings and capacities.
3. Indicate flow direction.
4. Process flow table identifying process conditions at each major flow stream. Process Conditions including minimum, normal, and maximum:
 - a. Design Pressure.
 - b. Design Temperature.
 - c. Design Material Density.
 - d. Composition of Fluid.
 - e. Design Flow Rate.
 - f. Mass Balance.

F. Piping and Instrumentation Diagrams (P&IDs):

1. In accordance with ISA 5.1 and PIP PIC001.
2. Include equipment, motors, piping, valves, tubing, sample lines, sensing lines, drains, vents, test points, solenoid valves, limit switches, position indicators, speed switches, instrumentation components, control and interface signals, and alarms and set points.
3. In general, the main direction of flow proceeds from left to right and from top to bottom. Avoid unnecessary crossing of lines.
4. Provide inlet and outlet arrows to indicate flows into or out of the diagram page. Include drawing reference numbers with grid location, equipment, and line identifiers wherever the flow leaves the diagram.
5. Show arrows within the flow diagram to indicate the direction of the flows. If necessary to aid readability of the diagram arrows may be used at the inlets to equipment and upstream of pipe branches.
6. Indicate points at which pipe size or pipe specification changes.

7. Size and diameter of piping and tubing segments, as well as designation, pipe material, media, design capacity and design pressure.
8. Size of valves. For pressure relief valves include setpoint.
9. Equipment flanges, reducers and expanders, and non-standard fittings, such as expansion bellow, flexible tubes, orifice plates, strainers, and similar.
10. If a diagram consists of several sheets, the incoming and outgoing flow lines or piping should be drawn in such a manner that the lines continue at the same level when the individual sheets are horizontally aligned.
11. Equipment designation, including instrumentation.
12. Equipment description and capacities for motors, vessels, tanks, pumps, fans, compressors, and similar.
13. Instrument, control, and interface signals shall terminate using appropriate symbology, including identification of the terminating device.
14. Utilize dashed or dotted boxes around components to show packaged equipment, or equipment mounted in the same enclosure. Include enclosure, or packaged equipment, identification on the drawings.
 - a. Packaged mechanical and instrumentation equipment shall not be shown utilizing a “black box” approach.
 - b. Individual components and instrumentation within the packaged mechanical equipment shall be identified.
15. Show identification of freeze protected, insulation, jacketing or heat traced of piping and other components.
16. Specific line types to indicate future equipment, major process pipe, minor process pipe, pneumatic pipe, hydraulic pipe, capillary tubing, electrical, software and data links.

G. Life Safety:

1. Following requirements cover basic life safety requirements not otherwise addressed in other specification sections. If a conflict exists between sections, use most stringent.
2. Comply with NFPA 1 and 101, IBC and IFC.
 - a. Gas and chemical detection systems: Stand alone and independent of other instrumentation and control systems.
 - b. Laboratory: Comply with NFPA 45.
 - c. Systems containing fuel gas: Comply with NFPA 30 and 54.
 - d. Flammable and combustible liquids to comply with NFPA 430.
 - e. Storage, use, and handling of hazardous materials to comply with NFPA 400.
 - f. Ozone generation to comply with NFPA 53 and 55.

- g. If an activated carbon system is used, comply with NFPA 654 and 69.
- h. Electrical equipment to comply with NFPA 70.

H. Design Life:

- 1. Building: High-quality building components utilizing durable materials with an emphasis on product and system longevity.
- 2. Piping: 50 years.
- 3. Other: Consistent with industry standards.

I. Turndown Capability:

- 1. Design WTP to operate at Turndown flow over 24 hours except for the Treated Water Pumps.
- 2. Phase 1 and Phase 2 operations at maximum day demand expected to be 24 hours per day.
- 3. Treated Water Pump Station and WTP shall have turndown capacity necessary to fill San Juan Lateral at a reduced rate.

J. Treated Water Flow Criteria:

- 1. Startup and Phase 1 flow requirements in Table 01 81 05A - WTP Treated Water Flow Requirements.
- 2. Phase 2 flow requirements as described in “Future Installation Criteria” and as required below.

Table 01 81 05A - WTP Daily Treated Water Flow Requirements (MGD)

Phase	Turndown	Minimum Day Demand	Average Day Demand	Maximum Day Demand
Startup ¹	3.0	6.0	8.427	11.6
Phase 1	--	11.6	14.469	18.8
Phase 2 ²	--	23.2	28.938	37.6

1 - Actual flow shall vary depending on Contractor startup plan and bringing communities online.

2 – Phase 2 flow occurs after Year 50 and is used for buildout design purposes. See Table 01 81 05C for OM&R design over the 50-year WTP design life.

- 3. Average Day Flow in Table 01 81 05B - WTP Treated Water Average Day Flow (MGD).

Table 01 81 05B - WTP Treated Water Average Day Flow (MGD)

Year #	Year	Average Day Demand	Year #	Year	Average Day Demand
1*	2028	8.427	26	2053	15.057
2*	2029	8.651	27	2054	15.251
3	2030	8.880	28	2055	15.448
4	2031	9.113	29	2056	15.649
5	2032	9.349	30	2057	15.853
6	2033	9.590	31	2058	16.061
7	2034	9.835	32	2059	16.272
8	2035	10.085	33	2060	16.487
9	2036	10.340	34	2061	16.707
10	2037	10.599	35	2062	16.930
11	2038	10.863	36	2063	17.157
12	2039	11.132	37	2064	17.388
13	2040	11.406	38	2065	17.624
14	2041	11.685	39	2066	17.864
15	2042	11.970	40	2067	18.109
16	2043	12.261	41	2068	18.359
17	2044	12.557	42	2069	18.613
18	2045	12.859	43	2070	18.873
19	2046	13.167	44	2071	19.137
20	2047	13.482	45	2072	19.407
21	2048	14.277	46	2073	19.683
22	2049	14.421	47	2074	19.964
23	2050	14.568	48	2075	20.251
24	2051	14.717	49	2076	20.566
25	2052	14.869	50	2077	20.889

* - Actual flow varies depending on Contractor startup plan and bringing communities online.

4. Shiprock Distribution System:

- a. Shiprock distribution flow is a subset of WTP treated water flow shown in Table 01 85 05B - WTP Daily Treated Water Flow Requirements.
- b. Shiprock treated water flow requirements in Table 01 81 05C – Shiprock Treated Water Flow Requirements at Full Buildout.

Table 01 81 05C – Shiprock Distribution System Daily
Treated Water Flow Requirements at Full Buildout (MGD)

Phase	Minimum Day Demand	Average Day Demand	Maximum Day Demand
Phase 2	2.68	3.34	4.34

5. Shiprock water demands and Shiprock Distribution System daily treated water flow in Table 01 81 05D – Shiprock System Water Demands and Distribution System Daily Treated Water Flow from WTP.
6. Shiprock includes Navajo Nation Farmington and NN Shiprock communities. “Shiprock Demands” shown for reference.
7. 8.40 MGD of Shiprock demand met by external source. SJLWTP supplies demand greater than 8.40 MGD.
8. Maximum flow to Shiprock from SJL is 4.34 MGD (6.72 cfs). Demand beyond 4.34 MGD met with external source.

Table 01 81 05D - Shiprock Water Demands and Distribution System Daily Treated Water Flow from WTP (MGD)

Year #	Year	Shiprock ¹ Demands (Total) [MGD]		Shiprock Distribution Flow from SJLWTP [MGD] ²		Year #	Year	Shiprock ¹ Demands (Total) [MGD]		Shiprock Distribution Flow from SJLWTP [MGD] ²	
		Avg.	Max.	Avg.	Max.			Avg.	Max.	Avg.	Max. ³
1	2028	3.57	5.05	--	--	26	2053	7.28	10.91	--	2.51
2	2029	3.79	5.34	--	--	27	2054	7.36	11.05	--	2.65
3	2030	3.94	5.56	--	--	28	2055	7.43	11.19	--	2.79
4	2031	4.09	5.79	--	--	29	2056	7.50	11.34	--	2.94
5	2032	4.24	6.01	--	--	30	2057	7.57	11.48	--	3.08
6	2033	4.40	6.25	--	--	31	2058	7.65	11.63	--	3.23
7	2034	4.56	6.49	--	--	32	2059	7.72	11.78	--	3.38
8	2035	4.72	6.73	--	--	33	2060	7.80	11.94	--	3.54
9	2036	4.88	6.98	--	--	34	2061	7.87	12.09	--	3.69
10	2037	5.05	7.23	--	--	35	2062	7.95	12.25	--	3.85
11	2038	5.22	7.49	--	--	36	2063	8.03	12.41	--	4.01
12	2039	5.39	7.76	--	--	37	2064	8.11	12.57	--	4.17
13	2040	5.57	8.03	--	--	38	2065	8.19	12.73	--	4.33
14	2041	5.74	8.31	--	--	39	2066	8.27	12.90	--	4.34
15	2042	5.92	8.59	--	0.19	40	2067	8.35	13.07	--	4.34
16	2043	6.11	8.88	--	0.48	41	2068	8.43	13.24	0.03	4.34
17	2044	6.29	9.17	--	0.77	42	2069	8.51	13.41	0.11	4.34
18	2045	6.48	9.47	--	1.07	43	2070	8.60	13.58	0.20	4.34
19	2046	6.68	9.78	--	1.38	44	2071	8.68	13.76	0.28	4.34
20	2047	6.87	10.09	--	1.69	45	2072	8.77	13.94	0.37	4.34
21	2048	7.07	10.41	--	2.01	46	2073	8.85	14.12	0.45	4.34
22	2049	7.28	10.74	--	2.34	47	2074	8.94	14.30	0.54	4.34
23	2050	7.08	10.49	--	2.09	48	2075	9.03	14.49	0.63	4.34
24	2051	7.14	10.63	--	2.23	49	2076	9.12	14.68	0.72	4.34
25	2052	7.21	10.77	--	2.37	50	2077	9.21	14.87	0.81	4.34

9. Consecutive Public Water System Demands provided in Table 01 81 05E – SJL
Consecutive Public Water System Startup Demands.

Table 01 81 05E – SJL Consecutive Public Water System Startup Demands

				Demand (MGD)		
Reach	Reach Name	cPWS PWSID	Community Water System	Minimum	Average	Maximum
3.1	Shiprock and NN Farmington	NN3500245	Shiprock and NN Farmington	-	-	-
			Shiprock	-	-	-
			NN Farmington	-	-	-
4C	Sanostee		Sanostee	0.12	0.22	0.32
		NN3503059	Sanostee	0.10	0.18	0.27
		NN3503057	Mittenrock	0.02	0.04	0.05
6	Newcomb	NN3503016	Newcomb	0.04	0.06	0.10
7	Sheep Springs N		Sheep Springs N	0.09	0.14	0.20
		NN3503028	Toadlena (Two Grey Hills)	0.06	0.09	0.14
		NN3503031	Sheep Springs N	0.03	0.04	0.06
8	Naschitti		Naschitti	0.12	0.20	0.29
		NN3500268	Naschitti	0.09	0.15	0.23
			Sheep Springs S	0.03	0.04	0.06
9	BBN9 Sublateral		BBN9	0.39	0.61	0.86
		NN3500274	Coyote Canyon	0.03	0.06	0.10
		NN3503029	Standing Rock	0.04	0.09	0.19
		NN3503039	Dalton Pass (Nahodishgish)	0.03	0.04	0.06
		NN3503039	Crownpoint	0.18	0.29	0.41
			Little Water	0.02	0.04	0.06
			Becenti	0.03	0.05	0.10
		NN3500269	Lake Valley	0.01	0.03	0.05
10	Tohatchi		White Rock	0.00	0.01	0.01
			Tohatchi	0.19	0.30	0.42
		NN3500237	Tohatchi	0.08	0.15	0.22
			Buffalo Springs	0.01	0.01	0.01
11 / 12	Twin Lakes	NN3500267	Mexican Springs	0.08	0.15	0.25
		NN3500261	Twin Lakes	0.15	0.24	0.34
12.1 / 12.2	Navajo Code Talkers Sublateral		Navajo Code Talkers	1.04	1.72	2.51
		NM3500302	Rock Springs	0.05	0.10	0.17
		NN3500278	Tsayatoh	0.02	0.06	0.10
		NN0436011	Hunters Point	0.01	0.02	0.02
		NN0403000	Fort Defiance	0.35	0.60	0.89
			Window Rock	0.20	0.31	0.46
			Saint Michaels	0.36	0.59	0.86
			Coal Mine (AZ)	-	-	-
			Navajo, NM	0.13	0.21	0.31
14	NN		NN Gallup Chapter	0.57	0.93	1.33

Table 01 81 05E – SJL Consecutive Public Water System Startup Demands

	Gallup Chapter	NN3500211	<i>Mariano Lake</i>	0.06	0.09	0.13
			<i>Pinedale</i>	0.08	0.14	0.24
			<i>Church Rock</i>	0.20	0.35	0.55
		NN3500258	<i>Iyanbito</i>	0.05	0.09	0.14
		NN3500277	<i>Manuelito</i>	0.01	0.02	0.04
		NN3500335	<i>Red Rock</i>	0.13	0.23	0.40
		NN3500292	<i>Bread Springs</i>	0.04	0.09	0.14
			<i>Chichiltah</i>	0.09	0.15	0.22
		NN0400282	<i>Lupton</i>	-	-	-
		NN3500256	<i>Smith Lake</i>	-	-	-
		NN3500256	<i>Casamero</i>	-	-	-
27	City of Gallup Regional System		City of Gallup Regional System	2.88	3.60	4.68

K. Freeze Protection and Process Heating:

1. Prevent damage to equipment or facility and maintain operations. At a minimum consider:
 - a. Components containing fluid exposed to temperatures at or below the freezing point.
 - b. Accessories at or on a tank or basin such as valves, instruments, tubing, taps, or other connecting components subject to freezing require freeze protection.
 - c. Provide thermostatically controlled heated instrument enclosures for instruments.
2. Show freeze protection and process heating on drawings.
3. Provide freeze protection without the need for supplemental equipment specific and pipe heating systems (e.g. heat tracing).
 - a. Exemptions to allow heat tracing may be granted by the Government. Use heat tracing when freezing could not be addressed by other means.
 - b. Provide insulation for components with heat tracing.
4. Powered freeze protection or process heating systems shall include signals to the SCADA system to report its status, including alarm on failure.

L. Hazardous Wastes: Provide means of safely disposing of hazardous waste utilized or created during normal operations of the facility.

M. Future Installation Criteria:

1. Design and install Phase 2 features where future installations to meet Phase 2 flow requirements require major expensive modifications infrastructure such as buried pipe near structures, utilities under buildings, and major electrical feed conductors.

2. Accommodate land space for Phase 2 flow requirements including sludge management. Set fenced perimeter for Phase 2 flow requirements.
 3. For Phase 2 features not installed, provide:
 - a. Site layout and general arrangement drawings and process flow diagrams identifying future installations such as ponds, facilities and or building expansion, equipment, and equipment foundations.
 - b. Design drawing details of the interface between Phase 1 and Phase 2 installations such as electrical and mechanical systems, and water treatment process equipment.
 4. Future Installation Plan:
 - a. Develop installation schedule for features not included at Startup.
 - b. Includes site access points and connections to offsite improvements such as the future Shiprock connection.
 - c. Provide cost estimate for deferred facility, equipment, and installation costs for features installed in future years. Provide cost estimate consistent with a minimum of a Class 3 estimate in accordance with ASTM E2516.
- N. Design buildings and structures to applicable portions of the IBC, NFPA 101, and ASCE 7 unless otherwise specified.
- O. Design substructures and foundations to applicable portions of the IBC and ASCE 7 unless otherwise specified.
- P. Provide Interior and exterior floor or slab mounted equipment with housekeeping pads to prevent inundation with water or snow.
- Q. Design and provide digital and information systems in accordance with Section 01 86 30 – Information System Security Performance Requirements.
- R. Physical Security:
1. Bullet Resistance: Level 4, minimum, in accordance with UL 752 or approved equal at areas containing critical elements.
 - a. Critical Elements: Main electrical distribution center, exterior electrical distribution equipment, generators, electrical control centers, Control Room, IT/server rooms, electrical rooms, communication rooms, fuel storage, and chemical storage.
 - b. Prioritization for protecting critical elements shall be on projectiles from Highway 36.
 - c. Utilize earthen berms along WTP perimeter along with other bullet resistant devices necessary to provide a Level 4 rating to protect critical elements.

2. Implement Vulnerability Assessment and Security Plan detailed below.
- S. Security Vulnerability Assessment and Security Plan:
1. Address: Deterrence, Detection, Denying Access, and Delaying Access.
 2. Site plan with security features including earthen berms, fences, hatch protection, doors with card readers, motion detection, and camera locations.
 3. Determine and design additional protection needed for buildings and equipment.
 4. Address exterior tanks, chemical tanks, and electrical equipment.
 5. Include locations listed in Section 01 81 20 - Programming Performance Requirements.
 6. Refer to Section 01 86 26 - Electrical Performance Requirements for exterior lighting requirements.
 7. Other elements reviewed and approved by COR.
 8. Do not file Security Vulnerability Assessment and Security Plan with the USEPA.
- T. Safety and Health Design Criteria:
1. Adhere to RSHS.
 2. Chemical storage and handling.
 3. Does not use permit required confined spaces when technically reasonable alternatives are available.
- U. Water treatment and conveying equipment shall operate by local manual and local automatic control as well as fully automatic control from the WTP control room.
- V. Surfaces in contact with raw, process, treated, finished, or potable water or process chemicals meet NSF 61.
- W. Staffing Plan:
1. Detailed list of personnel anticipated to work on site for Startup, Phase 1, and Phase 2.
 2. Include position title, position description, full- or part-time status and work hours per week, phases, building assignment, and office location and type of and work space.
 3. Describe how facilities provided shall accommodate differing personnel levels during the life of the WTP.
- X. Minimize noise pollution.
- Y. Exterior Colors: Refer to Section 01 84 16 – Exterior Performance Requirements.

Z. Engineering Analysis and Report:

1. Organization:
 - a. Sequential binding number and bound under a cover indicating the name of the facility and project number, if applicable.
 - b. Title page: Designate submittal.
 - c. Design analysis: Applicable review on the title page.
2. Design Calculations:
 - a. Bound separately from narrative design analysis if voluminous.
 - b. Title page and index for each volume.
 - c. Table of Contents if more than one volume.
 - d. Identify source of loading conditions, supplementary sketches, graphs, formulae, and references.
 - e. Explain assumptions and conclusions.
 - f. List design references including Government design documents and industry standards.

AA. Drawings:

1. Refer to Section 01 33 00 - Submittals.
2. Stamped by applicable designer of record.

BB. Specifications: CSI Manual of Practice and Master Format.

CC. Design Integration:

1. Schedule Design Charrettes to ensure Government concurs with design in accordance with Section 01 31 19 - Project Management and Coordination.
2. Include recommendations from Section 01 24 13 - Value Engineering.

DD. 60 and 90 Percent Design Packages:

1. Refer to Section 01 12 16 - Work Sequence.
2. Government will comment on the design packages to ensure compliance with contract requirements. Review comments are considered part of the design-build process and shall be incorporated at no additional cost to the Government.
3. Comments:
 - a. Government's review will be for compliance with contract requirements and not technical adequacy.
 - b. Identify action taken with citation of location within the relevant document.

- c. Provide reasons if Contractor does not intend to comply with the comment.
 - d. Flag comments considered outside design scope and notify the Government in writing immediately.
- 4. Refer to Section 01 31 19 - Project Management and Coordination for design review meetings.

1.07 COMPONENT IDENTIFICATION

- A. Develop ‘Naming and Identification Policy’ using following as guidelines, in order of precedence:
 - 1. ISA 5.1.
 - 2. Standard industry practices.
 - 3. San Juan Lateral pumping plant P&IDs.
 - 4. Convention to include as a minimum:
 - a. Location, area, or building designator.
 - b. Equipment/instrument type or function identification.
 - c. Equipment tag/loop identification.
- B. Provide unique designations of equipment on facility drawings, onsite, and in San Juan SCADA System graphics.
 - 1. Mechanical component and accessories to include but not limited to:
 - a. Valves.
 - b. Instruments.
 - c. Tanks and Vessels.
 - 2. Electrical equipment to include but not limited to
 - a. Switchgear.
 - b. Switchboards
 - c. Panelboard.
 - d. Control Panels.
 - 3. Process equipment components and skids utilized for treatment system.
 - 4. Use tags or equipment designations applied to components consistently throughout project documentation and onsite installation.
 - 5. SCADA and Control Components
 - a. Provide names and unique identifiers for each piece of equipment supplied by the Contractor, displayed on the graphics, or associated with datapoints in the Control System.

- b. Control logic, I/O, and related functions in the control system.
- C. Field identification shall meet the following minimum requirements:
 - 1. Match designations as shown on drawings.
 - 2. Piping components and accessories:
 - a. Permanently attached stainless steel tags.
 - 1) Attachment method to be suitable for the environment.
 - 2) Corrosion resistant braded cable or wire.
 - 3) Plastic zip-ties are not acceptable.
 - b. Include at minimum:
 - 1) Component designation.
 - 2) Manufacturer's model number.
 - 3. Thermocouple and Test Wells.
 - a. Include at minimum:
 - 1) Component designation.
 - 2) Material of construction stamped on the well
 - 4. Electrical Panels, Enclosures, and Components Mounted in Enclosures:
 - a. Nameplates material:
 - 1) Indoor – Phenolic-type material
 - 2) Outdoor (exposed to sunlight) – Stainless steel or brass.
 - b. Nameplates shall include individual component designation, for each component or enclosure.
 - c. Attach nameplates with pan head self-tapping screws. Do not use adhesives to attach nameplates.
 - 1) Attach nameplates to pushbuttons, indicating lights, and selector switches in accordance with component manufacturer's instructions. Use of self-tapping screws is not required.
 - 2) Size of letters and figures shall be approximately 7/16 inch for cabinet internal device nameplates and 1 inch for cabinet designations.
 - d. Cables and Raceway: Permanently affix tag with individual component designation. Cable shall include tags for overall cable as well as individual conductor.

1.08 LICENSES

- A. Provide software licenses required to operate, maintain, and program systems.

- B. Coordinate with the Government to make copies of software for backup purposes.
- C. The Government shall be able to copy displays, configuration drawings, and database files developed without limit.

PART 2 MATERIALS

2.01 CONCRETE

- A. In accordance with IBC, ACI 318, and ACI 350 as applicable.
- B. In accordance with Sustainable Design Performance Requirements for materials.

2.02 CONTROLLED LOW STRENGTH MATERIALS (CLSM)

- A. Minimum Strength: 50 pounds psi.
- B. Maximum Strength:
 - 1. Pipe Trenches, if used: 150 psi.
 - 2. Other: Maximum as recommended by the designer.
- C. Determine strength in accordance with ASTM D4832.

2.03 EXTRA MATERIALS

- A. Provide spare parts as appropriate for reliable operation as recommended by the equipment manufacturers. Replace components used during installation, testing, commissioning, and maintenance activities.
- B. Provide special tools required for normal operation and maintenance of WTP equipment as identified by applicable manufacturers.

2.04 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS) SOFTWARE

- A. S/4HANA as manufactured by SAP, www.SAP.com, or equal with the following essential characteristics:
 - 1. Include Geographical Enablement Framework (GEF) with necessary components for integration with ArcGIS Enterprise Client.
 - 2. On premise version. Not cloud-based.
 - 3. Capable of creating and tracking component workorders for San Juan Lateral and Water Treatment Plant, to include raw water delivery components.
 - 4. Current version at time of award.

- B. ArcGIS Enterprise as manufactured by ESRI, <https://www.esri.com/en-us/arcgis/products/arcgis-enterprise/overview> , or equal with the following essential characteristics:
1. Provide geospatial data platform for display of project assets in a map environment.
 2. On premise (enterprise) version. Not cloud-based.
 3. Database attributes: Include attributes of and be compatible with NTUA legacy ArcGIS system.
 4. Current version at time of award.
- C. Hardware and components necessary to locally host CMMS software.
1. Servers and workstations as required to allow local storage of the CMMS data and a viewing and management location for the system.
 - a. Operating System: Microsoft Operating System. Current version at time of award.
 - b. Minimum one workstation for the facility.
 - c. Minimum one 24-inch LED monitor with mouse and full function QWERTY keyboard for each employee workstation.
 - d. For each server or workstation provide: Spare capacity of 50 percent of its base memory, memory utilization, addressable points, and other factors that affect memory utilization.
 - e. Software:
 - 1) CMMS software.
 - 2) Adobe Acrobat Pro.
 - 3) Microsoft office suite.
 - 4) Other software as necessary for performing described functions.
- D. On-premise one year subscription license for each operator and each maintenance employee at WTP at the end of the Extended Demonstration Test, refer to Section 01 91 16 - Facility Commissioning.
- E. Provide one additional one-year subscription license to be turned over to the facility operator at the end of the performance period in accordance with Section 01 78 30 - Project Record Documents.
- F. Submit an electronic copy of the database and passwords at the end of the performance period in accordance with Section 01 78 30 - Project Record Documents.

PART 3 EXECUTION

3.01 GENERAL

- A. Install components in accordance with the manufacturer's written instructions unless otherwise specified.
- B. Construct in accordance with NFPA 101.
- C. Fence off excavations at the end of the day to prevent accidents.

3.02 INSPECTION AND TESTING

- A. In accordance with referenced codes unless otherwise specified.

3.03 MAINTENANCE

- A. Maintenance Plan: List and schedule for equipment maintenance.
- B. Customize maintenance software tool for project including maintenance information, reminders, and tracking for items needing maintenance and inspections.
- C. Maintain materials, equipment, building components and facility as necessary to provide them in a clean, undamaged and operational condition and in accordance with manufacturer's recommendations and requirements.
 - 1. Maintain appropriate climate for materials and components. Includes providing temporary storage shelters, covers, climate control components, and connections to component heaters to prevent equipment degradation and corrosion.
 - 2. Perform required inspection and maintenance for components, including components in storage.
 - 3. Furnish consumables, tools, test equipment, and miscellaneous material required for these activities, including lubricants, fuels, liquids, and gases.
 - 4. Maintain testing and inspection records in accordance with Section 01 78 30 - Project Record Documents and Section 01 91 16 - Facility Commissioning.

END OF SECTION

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SECTION 01 81 07
SAN JUAN LATERAL PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. Raw Water Lateral: From intake on San Juan River, to SJGS Reservoir ending at Water Treatment Plant, including Intake Pumping Plant, and Pumping Plant 1.
- B. Treated Water Lateral: From Water Treatment Plant to Southern end of Reach 14.8 Refer to Drawing 1695-529-60185 and Table 01 11 00A - San Juan Lateral Facilities in Section 01 11 00 – Summary of Work.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PROJECT REQUIREMENTS

- A. Background:
1. Reclamation Facilities:
 - a. Reclamation installed facilities listed in Table 01 11 00A – San Juan Lateral Facilities in Section 01 11 00A – Summary of Work.
 - b. Pipelines deliver well water for construction water via gravity to Reach 4B.
 - c. Pumping plants and pipelines have been tested, but not under full flow conditions.
 - d. Lateral may deliver potable well water from Twin Lakes Well to communities south of and including BBN9 sublateral.
 2. NTUA installed and tested facilities to working pressures, but systems have not operated under full flow conditions.
- B. Repair: Develop plan for determining, implementing, and verifying required repairs.
- C. Commission and Operate Lateral.
1. At a minimum obtain following permits to:

- a. Discharge testing/flushing water.
 - b. Deliver drinking water to communities.
 - c. SWMP for improvements if necessary.
2. Flush and disinfect lines.
3. Operate communication systems to and from facilities.
4. Measure flows coming into WTP and leaving at turnouts.
- D. Develop plan for delivering waters to communities.
 1. Work with Reclamation, City of Gallup and NTUA to sequence water deliveries.
 2. NTUA will have completed blending studies for the communities listed.
 3. To mitigate DBP concerns Gallup needs to be one of the first communities brought online.
 4. No more than 2 NTUA communities per month can be brought on-line.
 5. Coordinate introduction of surface water to Consecutive Public Water Systems being supplied with well water to manage blended water quality impacts with Reclamation, City of Gallup and NTUA.
 6. Refer to Section 51 00 30 - Basis of Design: Startup and Future Flow Determination for estimated community flows.
- E. 2 years prior to WTP commissioning: Hold monthly status meetings with Reclamation, NTUA, Gallup, and Regulators.
- F. 2 months prior to WTP commissioning: Hold weekly status meetings with Reclamation, NTUA, Gallup and Regulators.
- G. Operate Raw Water and Potable Water Lines during commissioning and operation period (s).
 1. Replace equipment as needed.
 2. Provide chemicals to Pumping Plants.
 3. Incorporate status updates and reports in meetings listed in Section 01 91 06 – Facility Commissioning.

PART 2 QUALIFICATIONS

- A. Operator Certification meeting Navajo Nation EPA to operate Water Treatment Plants and Potable Water Distribution Systems.

PART 3 PRODUCTS

Not Used

PART 4 EXECUTION

Not Used

END OF SECTION

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SECTION 01 81 10
GENERAL PIPE PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Society of Testing and Materials (ASTM)
1. ASTM D882 Tensile Properties of Thin Plastic Sheeting
 2. ASTM D2103 Polyethylene Film and Sheeting
 3. ASTM C150/C150M Portland Cement
 4. ASTM F2164 Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems using Hydrostatic Pressure.
- B. American Society of Mechanical Engineers (ASME)
1. ASME A13.1 Scheme for Identification of Piping Systems
 2. ASME B31.3 Process Piping Code
- C. American Water Works Association (AWWA)
1. AWWA C651 Disinfecting Water Mains
 2. AWWA C653 Disinfection of Water Treatment Plants
 3. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100mm) and Larger - Shop Applied
 4. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances
 5. AWWA C604 Installation of Steel Water Pipe 4 In. (100mm) and Larger
 6. AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

D. Bureau of Reclamation (Reclamation)

1. M-25 Method for Prediction of Flexible Pipe Deflection available at <https://www.usbr.gov/tsc/techreferences/manuals/manuals.html>
2. RSHS Reclamation Safety and Health Standards including revisions posted at <https://www.usbr.gov/ssle/safety/RSHS/rshs.html>

E. New Mexico Environment Department (NMED) Construction Programs Bureau

1. NMED Water Facilities Standards-2006 Recommended Standards for Water Facilities

F. National Sanitation Foundation (NSF)

1. NSF Standard 61-16 Drinking Water System Components - Health Effects

1.03 BASIC FUNCTIONS

A. Connect to existing pipes listed in Table 01 81 10A – Existing Pipe Locations.

B. Connecting pipe locations at site boundaries are in Table 01 81 10A.

Table 01 81 10A - Existing Pipe Locations

Location	Northing	Easting	Nominal Pipe Dia, inches	Pipe Design Head (ft)
Raw Water – Reach 3	2076597.98	2499570.36	36	300
Treated Water – Reach 4A	2074026.03	2498600.95	42	325
Treated Water – Future Shiprock Connection*	2076913.48	2498691.52	18	325

Note: 1. Northings and Eastings listed are for property line crossing, refer to Drawing 1695-529-60242.
2. Provide buried blind flange with a buried isolation valve immediately upstream for the Treated Water – Future Shiprock Connection approximately 40 feet inside of site perimeter fence near listed connection location. Coordinate final location with Government. This pipeline will require a future flow meter vault on the WTP site.

1.04 PERFORMANCE REQUIREMENTS

A. Refer to applicable section listed in Table 01 81 10B – General Pipe Specifications.

01 81 10B – General Pipe Specifications

Section 01 86 13 - Fire Suppression Performance	Building Fire Suppression System Piping, valves, instrumentation, and appurtenances inside the building and less than five feet of a building exterior.	
Section 01 86 16 - Plumbing and Valves Performance Requirements.	Piping, valves, fixtures, and appurtenances inside the building and less than five feet of a building exterior.	<ul style="list-style-type: none"> -Fuel gas. -Potable water. -Non-potable service water. -Sanitary sewer. -Compressed and instrument air. -Drain, waste and vent, including floor drains, rainwater piping, and pumped drains. -Deionized water.
Section 01 89 19 - Process Piping Performance Requirements.	Inside the building and less than five feet of a water treatment building exterior or process not addressed by other pipe categories	<p>Water</p> <ul style="list-style-type: none"> -Supply. -Collection. -Residuals. -Vents. -Drains. -Overflows. -Sample taps. <p>Chemical</p> <p>Air</p>

01 81 10B – General Pipe Specifications

Section 01 89 23 - Yard Piping and Valves Performance Requirements	Greater than five feet from a building exterior not addressed by other pipe categories	<ul style="list-style-type: none"> - Drain & vent. - Potable and non-potable water lines, including but not limited to: <ul style="list-style-type: none"> - Service water lines (non-potable). - Domestic water (potable). - Fire service lines. - Fuel gas. - Process piping. - On-site sewage, sanitary sewer, and septic disposal field piping. - Storm sewer pipe and appurtenances - Sub-surface Drainage
Section 01 89 34 - Treated Water Piping and Valves Performance Requirements.	From the Treated Water discharge flanges. Connect to Reach 4A pipe, Reach 3 and Shiprock Connection.	

B. Buried Pressure Pipe:

1. Pipe trench design and pipe deflection calculations in accordance with M-25 for flexible pipe, along with 40-D-6551 and 40-D-6552.
2. CLSM as defined in Section 01 81 05 - General Performance Requirements.
3. Metallic warning tape.
4. Cover:
 - a. Minimum: 3.5 feet.
 - b. Road Crossings or in Water Treatment Plant Yard Minimum: 5 feet.
5. Vertical separation between pipes: 2 feet from outside of pipe to outside of pipe where possible; provide sleeves and insulation for all other crossings.

C. Separate treated water source from non-potable water source in accordance with IPC.

D. Appurtenances, including but not limited to:

1. Markers.
2. Labelling.
3. Pipe supports.
4. Couplings.
5. Restraint harnesses.

6. Taps.
 7. Injection assemblies.
 8. Access ports.
- E. Brace exposed pipe sections to avoid deflection/deformation. See M-25 for methods for predicting maximum deflection.
- F. Use restrained joints as needed to oppose thrust forces.
- G. Freeze Protection: Protect piping from freezing with heat tracing or insulation as required.
- H. Design, size, and space supporting devices to maintain pipelines, appurtenances and equipment in proper position and alignment under operating and testing conditions with allowances for expansion and contraction.
1. Design supporting devices to minimize interference with access and movement.
 2. Eliminate potential injuries due to protruding support devices.
- I. Use gaskets and lubricants in accordance with applicable standards and compatibility requirements.
- J. Paint and label exposed pipes:
1. Color code in accordance with NMED Recommended Standards for Water Facilities.
 2. Label including flow direction.
 3. For pipe not covered by NMED, refer to ASME A13.1 and B31.3.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Refer to applicable Section.
- B. Gaskets: Non-asbestos materials.

2.02 ACCESSORIES

- A. Metallic Warning Tape:
1. Compliant with ASTM D882 and ASTM D2103.
 2. Thickness: 7 mils, minimum.
 - a. Width: 6 inches.
 - b. Message and color to be determined during submittal approvals.

2.03 CONTRACTOR SOURCE QUALITY TESTING

- A. Government may witness pipe manufacturing. Provide 30 days' notice to Government prior to pipe manufacture.

PART 3 EXECUTION

3.01 GENERAL

- A. Install piping systems in accordance with the applicable specification section.
- B. Repair damaged pipe per manufacturer's instructions and approved by engineer of record and COR.
- C. Perform earthwork in accordance with RSHS.
- D. Government may inspect or test pipe, trench, or appurtenances.
- E. Handle pipe carefully and avoid contamination.
- F. Contractor is responsible for any damage to pipe while stored.
- G. Store and transport pipe in accordance with manufacturer's instructions. Store pipe above grade, not on ground.
- H. Pipe shall not come in contact with stones, rocks, or similar while laid on ground during installation.
- I. Cover open pipe ends when exposed longer than 6 hours or use plugs as needed for protection and cleanliness.

3.02 EXTERIOR PIPING AT STRUCTURES

- A. Provide two flexible joints where a pipe enters or leaves a structure.
 - 1. First flexible joint within 2 feet from structure.
 - 2. Second flexible joint not more than 6 feet nor less than 4 feet from first joint.
 - 3. Balance of piping with standard laying lengths.

3.03 TESTS AND INSPECTIONS

- A. Test and inspect as required in specification, applicable reference standard, or as approved by Engineer of Record.
- B. Government may attend any performance testing or inspections of the pipe or piping system.
- C. Notify COR a minimum of 14 days prior to any field inspections or performance tests.

- D. Do not start leak testing when snow or standing water is on the ground. Suspend testing as directed by OGR if precipitation accumulates on the ground.
- E. Flushing, Disinfection, and Testing: In accordance with AWWA C653 or AWWA C651 as applicable.
 - 1. Except hydrostatic test allowances and duration:
 - a. Shall not exceed 240 gallons per inch diameter per mile of pipe being tested.
 - b. Pressurize pipe for a minimum of 24 hours prior to testing.
 - c. Test duration: Minimum of 96 hours.
 - 2. Dispose of flush water in accordance with permits detailed in Section 01 57 30 - Water Pollution Control.
 - 3. Do not drain water from Treated Water piping after meeting AWWA C651 requirements until authorized by the COR.

3.04 EXCAVATION

- A. Slope ends of open trench with a 3:1 slope at the end of work day.

END OF SECTION

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SECTION 01 81 13

SUSTAINABLE DESIGN PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Bureau of Reclamation (Reclamation)
1. WBR 1423.103-1 Green Procurement
- B. Institute for Sustainable Laboratories
1. Labs21 Labs21 Took Kit, (www.i2sl.org)

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. RSN 01 81 13-1, Energy Use Benchmark Data.

1.04 OBJECTIVE

- A. Use sustainable design, construction, and material selection strategies.

1.05 INTEGRATED DESIGN

- A. Sustainable Design Coordinator: Refer to Section 01 81 05 - General Performance Requirements.
- B. Sustainable Design Plan:
1. Request for Proposal through 100 Percent Design.
 - a. Integrated design team demonstrates input and consideration from each design discipline impacting the sustainable design, including the sustainable design plan.
 - b. Develop Performance Goals:
 - 1) Integrated design.
 - 2) Sustainable sites.

- 3) Energy performance.
- 4) Water protection and conservation.
- 5) Sustainable materials.
- 6) Indoor environmental quality.
- c. List sustainable design features and strategies. Include:
 - 1) Electrical and water use metering plan.
 - 2) Meet requirements of WBR 1423.103-1.
 - 3) Describe how design allows for disassembly and recycling of building materials at end of life.
- d. Energy Model:
 - 1) Energy model input and output files for current level of design.
 - 2) Discuss how the energy model impacted the design of the buildings and site layout at each phase of design (Schematic Design, Design Development) through 100 Percent Design.

1.06 WATER PROTECTION AND CONSERVATION

- A. Site Hydrology: Refer to Section 01 89 16 - Site Performance Requirements.
- B. Water Meters: Refer to Sections 01 86 16 - Plumbing and Valves Performance Requirements and Section 01 86 25 - Systems Controls and Monitoring.
- C. Water Efficient Fixtures: Refer to Section 01 86 16 - Plumbing and Valves Performance Requirements.

1.07 ENERGY PERFORMANCE

- A. Requirement: Meet ASHRAE 90.1.
- B. Goal: Minimize energy demands for the buildings, site, and water treatment processes through optimized cost-effective methods using lifecycle cost analysis. There is no specific energy target below ASHRAE 90.1.
- C. Energy Models:
 - 1. Create an ASHRAE 90.1 baseline.
 - 2. Model energy use and provide both expected energy use and percent below baseline achieved.
- D. Lab space: Use Labs21 to help ensure an energy efficient design.
- E. Electric Meters: Refer to Sections 01 86 26 - Electrical Performance Requirements and 01 86 25 - Systems Controls and Monitoring Performance Requirements.

- F. Benchmarking: Record and submit documentation of building and process energy use during operation period to establish a facility benchmark.

1.08 SUSTAINABLE MATERIALS

A. Materials Purchasing:

1. Select materials and construction methods to attain acceptable Indoor Air Quality (IAQ) in accordance with Section 01 86 19 - HVAC Performance Requirements. Include products with a low VOC.
2. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy, minimize amounts of pollution to produce, and employ recycled or recyclable materials.
3. EPA's five Guiding Principles:
 - a. Guiding Principle 1: Environment + Price + Performance = Environmentally Preferable Purchasing.
 - b. Guiding Principle 2: Pollution Prevention.
 - c. Guiding Principle 3: Life Cycle Perspective/Multiple Attributes.
 - d. Guiding Principle 4: Comparison of Environmental Impacts.
 - e. Guiding Principle 5: Environmental Performance Information.
4. Conform to EPA Comprehensive Procurement Guidelines.
5. COR may approve exemptions for:
 - a. Unreasonable Cost:
 - 1) More than a 15 percent increase, unless otherwise specified, in the material cost including delivery over a baseline (non-sustainable) product.
 - 2) Delivery service: Use same delivery method/class (e.g. ground shipping).
 - b. Unreasonable Performance Requirements:
 - 1) Exceeds industry standard / industry average for the product.
 - 2) Example: Sustainable material has excessive maintenance costs or replacement rates compared to a baseline product.
 - c. Not available in the U.S.A.
 - d. Not available in a reasonable time period. Demonstrate how purchase impacts critical path.
 - e. Inadequate competition: No similar products and is only available from a single source.
 - f. Exemption Requests: Submit documentation, with U. S. market research, to COR for approval.

- B. Regional Materials: Regionally extracted, processed, and manufactured within 500-mile radius of site.
 - 1. Maximize Use:
 - a. Determine percent regional materials on a cost basis.
 - b. If a product contains partial regional materials, count percentage of regional materials.
 - c. Do not include labor and delivery costs.
- C. Refrigerants: Refer to Section 01 86 19 - HVAC Performance Requirements.
- D. Rigid Foam Insulation Blowing Agents:
 - 1. Use material with lowest global warming potential (GWP) that meets requirements.
 - 2. Determine through blowing agent used in manufacturing process (blowing agent used for extruded polystyrene (XPS) has a GWP of 1300 while the blowing agent for expanded polystyrene (EPS) has a GWP of 7).

1.09 INDOOR ENVIRONMENTAL QUALITY

- A. Thermal Comfort: Refer to Section 01 86 19 - HVAC Performance Requirements.
- B. Ventilation: Refer to Section 01 86 19 - HVAC Performance Requirements.
- C. Lighting Controls: Refer to Section 01 86 26 - Electrical Performance Requirements.
- D. Daylighting: Refer to Section 01 86 26 - Electrical Performance Requirements and Section 01 84 13 - Interior Performance Requirements.
- E. IAQ During Construction: Refer to Section 01 86 19 - HVAC Performance Requirements.
- F. No Smoking: Refer to Section 01 84 13 - Interior Construction Performance Requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 81 16
GENERAL PUMP PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association (ABMA)
1. ABMA 9 Load Ratings and Fatigue Life for Ball Bearings
 2. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings
- B. Hydraulic Institute (HI)
1. A151 Water Treatment Plant Pumps: Guidelines for Selection, Application, and Operation

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTIONS

- A. Pre-Treated and Treated Water Pumps: Refer to Section 01 89 44 - Pre-Treated and Treated Water Pump Performance Requirements.
- B. Process Pumps in accordance with HI Water Treatment Plant Pumps: Guidelines for Selection, Application, and Operation Appendices A, B, and C unless otherwise specified or as approved by the COR.
- C. Chemical Metering Pumps: Refer to Section 01 86 46 - Water Treatment Performance Requirements.
- D. Submersible Pumps:
1. Provide manual hoist with accessories for each submersible pumps.

2. Platform or wall socket assemblies for each pump.
 - a. Provide easy hoist removal around any hand railing.
 - b. Maintain the same distance from each pump so hoists can be used interchangeably at each pump without adjustment.

1.05 PERFORMANCE REQUIREMENTS

- A. Suitable for continuous, 24 hours per day, service.
- B. All components shall be designed to handle forces and pressures resulting from flow reversals up to 125 percent of the maximum speed and maximum transient pressures.
- C. Bearings:
 1. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified.
 - a. Each bearing shall be rated in accordance with the latest revisions of ABMA standards for Load Ratings and Fatigue Life for Ball and Roller Bearings.
 - b. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours.
 - c. Permanently lubricated.
 - d. Rating life: Determined using the maximum equipment operating speed.
 2. Grease Lubricated Bearings:
 - a. Fitted with easily accessible grease supply, flush, drain, and relief fittings, except those specified to be factory sealed and lubricated.
 - b. Extension tubes shall be used when necessary.
 - c. Grease supply fittings shall be standard hydraulic alemite type.
 3. Oil Lubricated Bearings:
 - a. Equipped with either a pressure lubricating system or a separate oil reservoir type system.
 - b. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with a filler pipe and an external level indicator gage.
 4. Bearings easily accessible for maintenance and repairs without removal of equipment or structures.
 5. Incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or appropriate shielding shall be provided to prevent inadvertent human contact.

- D. Provide air vent on the highest point of the casing volute for appropriate pump types such as horizontal split case centrifugal.
- E. Provide drain connection on the lowest point of the casing volute or pipe connection nearest the pump for appropriate pump types such as horizontal split case centrifugal.
- F. A variable frequency drive or variable speed drive should be utilized as needed for varying demand.
- G. Pump Shaft Seals:
 - 1. Self-contained single cartridge mechanical seals:
 - a. Seal shall be of a nondestructive (nonfretting) type which requires no wearing sleeve for the shaft. Shafts for pumps with mechanical seals shall be furnished with no reduction in size through the seal.
 - b. Mechanical Seals: Cartridge type requiring no field assembly other than insertion in the pump.
 - c. Metal Parts: Type 316 or 316L stainless steel.
 - d. Springs: Hastelloy C or equivalent.
 - e. Rotary Faces: Tungsten carbide or silicon carbide.
 - f. Stationary Faces: Ceramic, tungsten carbide, or silicon carbide.
 - 2. Seal water regulating and monitoring system for each seal:
 - a. Complete component that controls all aspects of the seal water system for pumps with a mechanical or packing gland type shaft seal.
 - b. Single control unit component, mounting stand or bracket and associated hardware, and all accessories required for a complete and functioning system.
 - c. Push button test and clean system for its flow meter that can be activated while unit is operating.
 - d. Allow large particles of dirt and debris to pass through without obstructing any amount of flow.
 - e. Pressure Gauge: Glycerin filled.
 - f. Low-flow alarm sensor that outputs a signal to the process control system.

1.06 QUALIFICATIONS

- A. Installer: Millwright with a minimum of 5 years of pumping unit installation and alignment experience.

PART 2 MATERIALS

- A. Components in contact with water shall comply with NSF/ANSI 61.

- B. Material selection for the pump system should not have any interfacing components that create a voltage potential difference of more than 0.7 V. Otherwise, they should be coated or given a dielectric coupling to prevent galvanic corrosion.

PART 3 EXECUTION

3.01 TESTS AND INSPECTIONS

- A. Factory inspect pumps for required construction, mechanical connections, and intended function.
- B. Place pumps on grouted baseplates.
- C. Vibration levels not to exceed the acceptable field vibration limits established by the Hydraulic Institute standards.
- D. Performance test pumps over operating range and design points.
- E. Hydrostatically factory test pumps to 150 percent of shutoff head. Maintain test pressure for 5 minutes.
- F. If necessary, realign, adjust, or modify units and retest in accordance with Hydraulic Institute standards.

END OF SECTION

SECTION 01 81 20
PROGRAMMING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. International Code Council, Inc. (ICC)
- | | | |
|----|------|--|
| 1. | IBC | International Building Code |
| 2. | IECC | International Energy Conservation Code |
| 3. | IFC | International Fire Code |
| 4. | IPC | International Plumbing Code |
- B. National Fire Protection Association (NFPA)
- | | | |
|----|----------|------------------|
| 1. | NFPA 101 | Life Safety Code |
|----|----------|------------------|
- C. United States Access Board
- | | | |
|----|---------|--|
| 1. | ADA/ABA | American with Disabilities Act and
Architectural Barriers Act Accessibility
Guidelines |
|----|---------|--|

1.03 GENERAL

- A. Provide spaces listed in Table 01 81 20A - Main Process Area, Table 01 81 20B - Operation and Maintenance Area, Table 01 81 20C - Ancillary Process Structures, and Table 01 81 20D - Outdoor Use Areas.
- B. Provide spaces in accordance with applicable portions of the IBC, IFC, IECC, NFPA 101, ADA/ABA, and Section 51 30 10 - Space Utilization Requirements.
- C. Main Process Area and the Operation and Maintenance Area may be combined into one building if specified functionality and adherence to applicable codes and standards can be maintained. If these two facilities are combined, duplicative spaces in Tables 01 81 20A and 01 81 20B may also be combined.
- D. Areas indicated as “Integrated” in the tables below shall have a finished look, suitable for an office environment.
- | | |
|----|--|
| 1. | No exposed cables, raceway or piping. |
| 2. | Power panels, outlets, receptacles and switches should be flush mount. |

Space	Equipment	Size	Other
Entry Vestibule			-Provide natural daylight. -Refer to Sections 01 84 13 - Interior Performance Requirements and 01 84 16 - Exterior Performance Requirements. Secured entry to rest of the facility, refer to Section 01 86 33 - Electronic Safety and Security Performance Requirements.
Office Area	-Office Furniture, Fixtures, and Equipment, refer to Section 01 84 13 - Interior Performance Requirements.	-Accommodate personnel and functions identified in the Staffing Plan, refer to Section 01 81 05 - General Performance Requirements.	-Window(s) with view to outdoors. -Hard walled office for supervisors.
Conference Room	-Tables and chairs to accommodate up to six personnel -Wired with power, network, and video cabling in wall for one wall-mounted flat panel monitor. Coordinate location with the COR. -One 60-inch flat panel monitor	-Allocated space or closet for audio-visual equipment storage.	-Window(s) with view to the outdoors. -Refer to Section 01 84 13 - Interior Performance Requirements.
Break Room / Kitchen	-Countertop, cabinets, refrigerator(s), sink with garbage disposal, dishwasher, oven, range, microwave(s), dedicated recycling area with receptacles. Sizes and quantities of equipment to accommodate personnel identified in the Staffing Plan (refer to Section 01 81 05 - General Performance Requirements). -Tables and chairs to accommodate up to six personnel.	-	-Provide window(s) with view to the outdoors. -Refer to Section 01 84 13 - Interior Performance Requirements.
Lab	-	-	-Refer to Section 01 86 46 - Water Treatment Performance Requirements.

Space	Equipment	Size	Other
Control Room	-SCADA and Control equipment. -San Juan Lateral SCADA System, Workstations (by Others) -San Juan Lateral SCADA System, 2 Large Ceiling Mounted Display Minimum 36 in (by Others)-Office Furniture, Fixtures, and Equipment, refer to Section 01 84 13 - Interior Performance Requirements.	-SCADA and Control equipment plus a minimum of two operators.	-Refer to Section 01 86 25 - System Control and Monitoring Performance Requirements.
Server Rooms	-SCADA servers -San Juan Lateral SCADA System Servers (by Others) -City of Gallup SCADA Cabinet (by Others) -NTUA SCADA Cabinet (by Others)	-SCADA servers -San Juan Lateral SCADA System Servers (Minimum 10 ft by 10 ft space with room for future equipment). -City of Gallup Cabinet (Minimum 2 ft by 2 ft floor mounted cabinet). -NTUA Cabinet (Minimum 2 ft by 2 ft floor mounted cabinet).	-
Restrooms / Locker Rooms	-Minimum one water closet, one vanity, one shower in each restroom, minimum one urinal in men's restroom; provide lockers in each locker room, one ADA-compliant bench per locker room.	-Sized for plant personnel and tour groups.	-Separate male and female restrooms and locker rooms. -Refer to Section 01 84 13 - Interior Performance Requirements. -Shower rooms directly connected to restrooms, but separated by an interior partition. -Visual privacy wall between restrooms and corridors or other areas.
Janitor Closet	-Mop sink. -Storage for cleaning equipment.	-	-
Storage – Administrative & Building Maintenance	-Shelving.	-	-Refer to Section 01 84 13 - Interior Performance Requirements.

Space	Equipment	Size	Other
Process Equipment Area	-Process equipment , -eyewash stations, emergency showers, .	-Demarcate accessible public walkway for tour groups, refer to Section 01 84 13 - Interior Performance Requirements. -Provide necessary equipment clearances.	-Provide natural daylight. -Refer to Section 01 86 46 - Water Treatment Performance Requirements.
Maintenance Access Areas around Process Equipment	-Provide forklift access where monorail, portable crane, or other means to move heavy process equipment does not reach.	-Storage for forklift.	-Refer to Section 01 85 00 - Material Handling Equipment Performance Requirements.
Storage – Process Equipment Area Maintenance	-Shelving.	-	-Refer to Section 01 84 13 - Interior Performance Requirements. -Roll-up access doors capable of receiving a low boy truck
Storage – Lab Chemical	-	-	-Refer to Section 01 86 46 - Water Treatment Performance Requirements.
Vehicle Bay	-	-Minimum 30 ft long by 20 ft wide.	No vehicle maintenance.
Mechanical Room	-	-	-
Electrical Room	-	-	-
Communications Room	-	-	-

Space	Equipment	Size	Other
Maintenance Area / Vehicle Bays	-Space for minimum two vehicles for maintenance, two work benches, solvent wash station, emergency shower and eyewash station. -Pressure washer. -Provide means to move heavy process equipment, 2 tons minimum. For example, a portable engine hoist. Refer to Section 01 85 00 - Material Handling Equipment Performance Requirements for engine hoist requirements. -Two tool boxes, tool chest and rolling cabinet combination with 6-outlet power strip, 100-pound drawer weight capacity, 18-inch depth, lockable. -Two 8 to 12 ft instrument calibration benches. Refer to Section 01 84 13 - Interior Performance Requirements.	-Minimum vehicle bay sizes of 30 ft long by 20 ft wide.	-Space should be flexible to maintain different types/sizes of vehicles and equipment. -Provide natural daylight.

Space	Equipment	Size	Other
Maintenance Shop	-Tools needing ventilation to the outdoors, two work benches, two stools.	-Minimum 12 ft by 15 ft.	-Configured for maintenance of equipment typical of a water treatment plant.
Storage – Process Maintenance Equipment & Parts	-Shelving and storage bins. -Desk and two chairs.	-To accommodate process maintenance equipment plus recommended spare parts plus 20 percent of total. -Minimum of 16 ft by 20 ft.	-To store parts and equipment for water treatment process, shelving along walls. -Roll-up access doors capable of receiving a low boy truck
Storage – Administrative & Building Maintenance	-Shelving.	-	-Refer to Section 01 84 13 - Interior Performance Requirements.
Janitor Closet	-Mop sink. -Storage for cleaning equipment.	-	-
Mechanical Room	-	-	-
Electrical Room	-	-	-

Notes: 1. Minimum total area of 5,000 square feet for the Operation and Maintenance Area spaces.
2. Minimum total area of 1,600 square feet for Maintenance Area / Vehicle Bays and Maintenance Shop.

Space	Equipment	Size	Other
Treated / Finished Water Pump Station	-Pumps	-	-Provide access for pump removal. -Refer to Section 01 83 19 - Roofing Performance Requirements.
Air Chamber Building	-Air chamber	-	-Enclosed facility. -May be combined with Treated / Finished Water Pump Station.
Chemical Facility	-Chemical storage tanks, chemical pumps	-	-

Space	Equipment	Size	Other
Covered outdoor break/eating area	-Picnic table	-Accommodate minimum of six personnel	-
Hidden or enclosed trash collection area	-	-	-Accommodate trash and recycling.

1.04 ADJACENCY

A. Main Process Area:

1. Adjacent spaces: Entry Vestibule, Office Area, Conference Rooms, Break Room / Kitchen, Restrooms / Locker Rooms, Janitor Closet, Storage – Administrative & Building Maintenance.
 2. Office Area, Control Room, and other administrative areas physically separated from the Process Equipment Area.
 3. Server Room adjacent to the Control Room.
- B. Operation and Maintenance Area: May be a separate building adjacent to the Main Process Area, or a separated area connected to the Main Process Area.
- C. Covered Outdoor Break/Eating Area:
1. Adjacent to Main Process Area and Operation and Maintenance Area.
 2. Located away from HVAC exhaust or intakes, delivery areas, and trash collection area.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 82 13

GEOTECHNICAL AND FOUNDATION PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO)
- 1) AASHTO HB Standard Specifications for Highway Bridges, Seventeenth Edition
- B. American Society of Civil Engineers (ASCE)
1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- C. International Code Council (ICC)
1. IBC International Building Code
- D. American Society of Testing Materials International (ASTM)
1. ASTM Applicable Soil and Rock Testing Standards
- E. Bureau of Reclamation (Reclamation)
1. Guidelines for Performing Foundation Investigations for Miscellaneous Structures, available from:
<https://www.usbr.gov/tsc/techreferences/mands/manuals.html>

1.03 EXISTING CONDITIONS

- A. Refer to Section 53 10 00 - Geologic Investigations and Section 53 20 00 - Records of Geologic and Subsurface Investigations.

1.04 PERFORMANCE REQUIREMENTS

- A. Design substructures and foundations in accordance with Section 01 81 05 - General Performance Requirements and Section 01 83 00 - Building Performance Requirements.
- B. Design vaults in accordance with Section 01 81 05 - General Performance Requirements and AASHTO HB as required. Coordinate design with connecting elements.
- C. Refer to Section 01 81 10 - General Pipe Performance Requirements for pipeline earthwork requirements.

- D. Geotechnical Information provided in Division 53 is for information only. Contractor shall be responsible for determining subsurface conditions.
- E. At a minimum, perform additional geotechnical investigations in accordance with Guidelines for Performing Foundation Investigations for Miscellaneous Structures as needed to:
 - 1. Complete design of substructures, foundations, and vaults.
 - 2. Determine swell potential of soils.
- F. Design foundations so facility performs as designed during the design life without maintenance or repairs due to settlement, differential settlement, or heave. Including mitigation of expansive soil and bedrock beneath foundations.
- G. Design foundations and slabs-on-grade to reduce vapor transmission through concrete foundation elements. Consider impacts of vapor transmission on interior finishes and coatings.

1.05 SUBSTRUCTURES AND FOUNDATIONS

- A. Provide load bearing members as required by code and designed to distribute dead loads, live loads, and environmental loads to not exceed bearing capacity.
- B. Dead Loads: Accommodate loads from weights of building materials, construction and fixed service equipment.
- C. Live Loads: Accommodate loads from use and occupancy of the building, either uniformly distributed loads as prescribed by code or concentrated loads, whichever are more restrictive.
- D. Environmental Loads: Accommodate loads from environmental forces in accordance with code.
 - 1. Include lateral soil loads and seismic loads.
 - 2. Condensation: None on interior surfaces under normal interior temperature and relative humidity conditions, during 98 percent of the days in the coldest 3 months of the year.
 - 3. Prevent ground water penetration into the interior of the substructure.

1.06 VAULTS

- A. Comply with requirements and recommended design procedures of ASCE 7.
- B. Accommodate personnel access when enclosure is buried or depth of enclosure is greater than 24 inches.

PART 2 PRODUCTS

2.01 METHODS OF CONSTRUCTION

- A. Excavation, backfill, and compaction by machine or hand.
- B. Pile driving.
- C. Caisson or pier drilling.
- D. Micropiles.

2.02 FOUNDATIONS

- A. Reinforced concrete footings.
- B. Bored and Driven Piles.
- C. Caissons and Drilled Piers.
- D. Micropiles.
- E. Raft foundations.
- F. Precast, pre-stressed concrete.
- G. Post-tensioned concrete slabs-on-grade.

2.03 VAULTS

- A. Reinforced cast-in-place concrete.
- B. Precast concrete.

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 83 00
BUILDING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Society of Civil Engineers (ASCE)
1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- B. International Code Council, Inc. (ICC)
1. IBC International Building Code
 2. IECC International Energy Conservation Code
 3. IFC International Fire Code
 4. IPC International Plumbing Code
- C. National Fire Protection Association (NFPA)
1. NFPA 101 Life Safety Code
- D. United States Access Board
1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PERFORMANCE REQUIREMENTS

- A. Design buildings in accordance with applicable portions of the IBC, IFC, IECC, NFPA 101, ASCE-7, and Section 51 30 10 - Space Utilization Requirements.
- B. Meet ADA/ABA guidelines for building ingress and egress, office areas, public use areas including the accessible public walkway and tour areas, and as otherwise required.

C. Building Signage:

1. Plaque for each building:
 - a. 1/4-inch thick cast or cut bronze plate with cast bronze text.
 - b. Lettering and trim: Raised 1/8-inch minimum.
 - c. Finish – Border Face and Edge, and Lettering Face: Fine satin hand finish.
 - d. Finish – Background: Dark statuary bronze, finely pebbled surface.
 - e. Lettering and Border Outlines: Hand-tool, clean, and sharp.
 - f. Lettering Style: Condensed block.
 - g. Manufacturer's name on backside is acceptable.
2. Coordinate requirements with fire department AHJ, refer to Section 01 86 13 - Fire Suppression Performance Requirements.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

3.01 INSPECTION

- A. In accordance with IBC and other applicable codes.

END OF SECTION

SECTION 01 83 13 SUPERSTRUCTURE PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Society of Civil Engineers (ASCE)
1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- B. ASTM International (ASTM)
1. ASTM E1155 Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers
 2. ASTM E1592 Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
- C. International Code Council, Inc. (ICC)
1. IBC International Building Code
- D. Metal Building Manufacturers Association (MBMA)
1. MBMA Manual Metal Building Systems Manual
- E. Bureau of Reclamation (Reclamation)
1. RSHS2014 Reclamation Safety and Health Standards including revisions posted at [Safety | Bureau of Reclamation \(usbr.gov\)](https://www.usbr.gov/safety/)

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 SYSTEM DESCRIPTION

- A. Superstructure: Roofs, elevated floors, and supports.

- B. Roofs: Roof construction, canopies, and support, insulation, fireproofing, firestopping elements.
- C. Elevated Floors:
 - 1. Above grade and within basements.
 - 2. Balcony, mezzanine, and ramp floors, floors elevated for access, stair construction if part of the structure, and roof decks intended for occupant live load; and the elements required for their support, insulation, fireproofing, and firestopping, as well as finishing, if an integral part of the floor construction.

1.05 BASIC FUNCTION

- A. Structural elements, capable of supporting:
 - 1. Anticipated loads without failure or excessive damage, beyond what is permitted by IBC or MBMA.
 - 2. Monorail hoist system detailed in Section 01 85 00 - Material Handling Performance Requirements.
- B. In addition to the requirements of this section, comply with applicable requirements of Section 01 81 05 - General Performance Requirements and Section 01 83 00 - Building Performance Requirements.

1.06 PERFORMANCE REQUIREMENTS

- A. Wind Loading: Withstand wind loads with deflections no greater than 1/180 of the span, tested in accordance with ASTM E1592.
- B. Fire: Provide members with combustibility, flame spread, and smoke generation characteristics not greater than allowed by IBC or MBMA.
- C. Fire Resistance: Design and select materials to provide fire resistance in accordance with the IBC or MBMA based upon building type.
- D. Fall protection for elevated areas in accordance with RSHS.

1.07 STRUCTURAL CRITERIA

- A. Structural Design: In addition to the requirements of the IBC or MBMA, comply with ASCE 7.
- B. Capacity: Design and provide load-bearing structural members of capacities required by the IBC or MBMA.

1.08 DURABILITY CRITERIA

- A. Applied Fireproofing Materials: Appropriate level of fireproofing in accordance with IBC.

PART 2 PRODUCTS

2.01 GENERAL

- A. Do not use wood structural members.

2.02 SUPERSTRUCTURE

- A. Pre-engineered metal building.
- B. Structural steel frame, concrete-filled steel deck for floors, and unfilled steel deck for roofs.
- C. Cast-in-place reinforced concrete frame and slabs.
- D. Precast concrete frame and floor and roof units.
- E. Load-bearing masonry walls, open-web steel joists, steel deck, and minor structural steel.
- F. Insulated concrete form walls.

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 83 19
ROOFING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American National Standards Institute
1. ANSI A14.3 Ladders - Fixed - Safety Requirements
- B. ASTM International (ASTM)
1. ASTM E1646 Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
 2. ASTM E1680 Rate of Air Leakage through Exterior Metal Roof Panel Systems
- C. Code of Federal Regulations (CFR)
1. 29 CFR 1926.500, Subpart M Fall Protection
- D. International Code Council, Inc. (ICC)
1. IECC International Energy Conservation Code
- E. National Association of Architectural Metal Manufacturers (NAAMM)
1. HMMA 862 Guide Specifications for Commercial Security Hollow Metal Doors and Frames
- F. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards including revisions posted at <https://www.usbr.gov/ssle/safety/RSHS/rshs.html>, Section 13.8 Requirements for Roofing Protection
- G. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
1. SMACNA ASMM Architectural Sheet Metal Manual
- H. Underwriters Laboratories, Inc. (UL)
1. UL 580 Uplift Resistance of Roof Assemblies

I. United States Access Board

1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

J. U.S. Green Building Council (USGBC)

1. LEED LEED Reference Guide for Green Building Design and Construction

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Design for applicable codes listed in Section 01 83 00 - Building Performance Requirements or Requirements of this Section, whichever is most restrictive.
- B. Run-Off: Direct water run-off away from buildings, structures and other site features adverse to wet conditions.
- C. Drain roof to not pond water.
- D. Fall Protection System:
 1. Permanent allowing inspection, maintenance, and repair work to entire roof.
 2. Accessed by fixed exterior ladder(s).
 3. Comply with 29 CFR 1926.500, subpart M.
 4. Provide as required for maintenance or repair of roof-top equipment in accordance with RSHS 13.8.
 5. Function as fall restraint and fall arrest system, allowing continuous hands-free roof access for personnel wearing body harness.
 6. Comply with ANSI A14.3.
 7. Security features to prevent unauthorized entry.
- E. Access Hatches:
 1. Openable and lockable from outside, provided user unlocked from inside before exiting. Insulated if required by the IECC.
 2. Provide a fixed ladder, stair, ship's ladder, or alternating tread stair leading to each hatch used for access to roof equipment or required by code.

3. Provide premanufactured safety extension post for roof access for each access hatch where applicable.
- F. Equipment Hatches: Provide roof hatches or similar for equipment removal.
- G. Appearance:
1. Conceal building HVAC equipment on rooftop, if applicable, using substantial construction other than screens.
 2. Cool Roof: LEED NC SSc7.2 Heat Island Effect.
- H. Water Penetration:
1. None, under conditions of rain driven at 50 mph.
 2. Minimum Slope:
 - a. Field of Roof: 1/4 inch per foot (1:48).
 - b. Water Conductors: 1/8 inch per foot (1:100).
 3. Water Conductor Capacity: As required by code or SMACNA ASMM whichever is greater, based on 10 year 5 minute intensity.
- I. UL-90 rated roofing system that has been tested in accordance with UL 580 test procedure.
- J. Prevent ice formation and buildup on roofing and in water conductors.

PART 2 PRODUCTS

2.01 ROOF COVERINGS

- A. Metal roof.
- B. Prefinished, preinsulated metal roofing panels.
- C. Water Collectors and Conductors: Factory finished metal piping and sheet metal.
- D. Flashing, Trim, and Accessories: Factory finished sheet metal. Use materials which are non-corrosive, non-deteriorating, and compatible with the roof panel faces.
- E. Materials compatible with exterior walls.

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 84 13
INTERIOR PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM E90 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 2. ASTM E413 Classification for Rating Sound Insulation
- B. United States Access Board
1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTION

- A. Finished interiors for spaces indicated in Section 01 81 20 - Programming Performance Requirements.
- B. Interior Doors: Secured when not in use.
- C. Required windows: Refer to Section 01 81 20 - Programming Performance Requirements.
- D. Other Interior Openings:
1. Access Openings: Interior openings where required for maintenance access to mechanical services and other concealed systems, designed to be as unobtrusive as possible.

- E. Stairs: Not less than one stair to unoccupied roofs, mechanical spaces, and equipment mezzanines.
- F. Information Fixtures:
 - 1. For direction and identification of functions and spaces.
 - 2. Signage:
 - a. Room label signs for primary spaces.
 - b. Directional signs: At building entrances and throughout buildings as needed.
 - c. Building directories with replaceable information strips or electronic information.
 - d. Text and content of identifying devices: COR will provide some content. Contractor to provide remaining.
 - e. Required for emergency response services including requirements of the fire authority having jurisdiction, an emergency evacuation plan, and signage locating fire extinguishers and automated external defibrillators.
 - 3. Visual Display Surfaces: Erasable surfaces.
- G. Storage Fixtures:
 - 1. Postal Fixtures:
 - a. One outgoing mail collection box in the Main Process Area.
 - b. One incoming box for each employee in the Main Process Area.
 - 2. Other Storage Fixtures: Adequate for anticipated needs in spaces.
- H. Furniture, Fixtures, and Equipment:
 - 1. Systems furniture: Modular cubicle walls, desks, shelving, cabinetry, chairs, and accessories for personnel in the Office Area.
 - 2. Other furniture, fixtures, and equipment as required for functionality, including but not limited to:
 - a. Office Area: Copier / printer.
 - b. Control Room: Desks, chairs, and accessories.
 - 3. Modular to accommodate future employees and configurations.
 - 4. Automated external defibrillators in accordance with Federal, Tribal, State, and local requirements. Minimum of one with each fire extinguisher.
 - 5. Minimum of one networked workstation for each Startup phase employee. Includes:
 - a. One 24-inch monitor with each workstation: flat panel, LED backlit or LCD, 1920 x 1080 minimum resolution, response rate not more than 5 ms.

- b. Copy of operating system and installed software on CD/DVD with licensing.
 - c. Network cabling to a central office network switch and server.
- I. Continuous accessible public walkway and tour assembly areas for tour groups.
- J. ADA/ABA compliant building interior for building ingress and egress, office areas, and public use areas including the accessible public walkway and tour areas.
- K. Where features function as features defined within another group, meet requirements of both groups.

1.05 PERFORMANCE REQUIREMENTS

- A. Design for applicable codes listed in Section 01 83 00 - Building Performance Requirements or Requirements of this Section, whichever is most restrictive.
- B. Access around equipment in accordance with equipment manufacturer's installation, operation, and maintenance requirements with additional consideration for adjacent simultaneous access requirements.
- C. Do not access primary interior spaces exclusively through another primary interior space other than main process or activity areas.
- D. Accessible public walkway through Lobby, Process Equipment Area, and other applicable areas. Demarcate walkway on floor of Process Equipment Area.
- E. Interior Doors:
 - 1. Compatible with Door Access Control systems as specified in Section 01 86 33 - Electronic Safety and Security Performance Requirements.
 - 2. STC Value: Minimum 50 in accordance with ASTM E90 and ASTM E413.
 - 3. Lock cylinders and keying on doors:
 - a. Furnish locks with seven-pin, interchangeable-core, lock cylinders.
 - 1) Temporary construction core system which can be voided after contract completion.
 - 2) Key locks alike.
 - b. Furnish permanent core system after contract completion. Two keys per lock.
 - c. Stamp construction keys with "U.S. Property - Do Not Duplicate" and appropriate key numbers.
 - d. Furnish six construction keys to COR for Government's use during construction.

- e. Deliver construction keys to COR at jobsite after completion of work when acceptable to the COR.
 - 4. Door Surfaces:
 - a. Scuff-resistant in foot impact areas.
 - b. Highly scratch-resistant in hand contact areas.
 - c. Applied protective surfaces for vulnerable areas are acceptable.
 - 5. Flexible Seal Materials: Minimize deterioration due to operation of doors, and aging.
- F. Information Fixtures:
- 1. Graphic and Braille signs for the following functions.
 - 2. Room Label Signs and Directories: Allow for information change without involvement of sign company or other agency.
- G. Storage Fixtures:
- 1. Shelter for users of outdoor fixtures.
 - 2. Closed Material and equipment storage:
 - a. Floor-mounted cabinets equipped with full-extension drawers, extension shelves, rotating corner storage shelves, and doors that open a full 180 degrees.
 - b. Wall-mounted cabinets equipped with adjustable shelving and doors that open a full 180 degrees.
 - 3. Lockers:
 - a. Dial combination locksets.
 - b. Door louvers, gaps at head and sill, perforations, or expanded metal panels.
 - 4. At locations intended for the storage of flammable or highly combustible materials, provide storage fixtures made of noncombustible materials.
- H. Furniture, Fixtures, and Equipment: Commercial grade.
- I. Window Treatments:
- 1. Enhances interior thermal comfort.
 - 2. Adequate control of light, glare, privacy, and views for spaces with interior and exterior windows.
- J. Safety Displays for general public and personnel: Communicate safety requirements and recommended practices for Water Treatment Plant (WTP) areas.
- K. Storage for tools and equipment.

PART 2 PRODUCTS

2.01 PARTITIONS

- A. Fixed Partitions: Cast-in-place concrete, brick, concrete masonry, gypsum board and/or preinsulated metal panels on metal framing.
- B. Restroom Partitions: Manufactured metal toilet compartments and screens.
- C. Interior Railings: Pipe and tube railings of steel or aluminum.

2.02 INTERIOR DOORS

- A. Dimensions: Sized for people, vehicles, and goods likely to move between adjacent spaces.
- B. Interior Pedestrian Doors:
 - 1. Hollow steel doors and frames.
 - 2. Aluminum doors and frames as part of a storefront window and door system.
- C. Gates:
 - 1. Swinging steel gates
 - 2. Swinging aluminum gates.

2.03 OTHER INTERIOR DOOR OPENING ELEMENTS

- A. Hardware for Swinging Doors:
 - 1. Use fire rated hardware on fire rated doors.
 - 2. Door Locks: Lab, Control Room, offices, storage rooms, and restrooms for use by one person at a time.
 - 3. Doors Stops: Interior swinging doors.
 - 4. Kick Plates: Both sides of interior swinging doors.
 - 5. Door Hold-Opens: Wall-mounted type, or door/frame mounted type.
 - 6. Do not use:
 - a. Different metals subject to galvanic action in direct contact with each other.
 - b. Aluminum in direct contact with concrete or cementitious materials unless protected.

2.04 INTERIOR WINDOWS

- A. Steel or Aluminum.

- B. Glazing:
 - 1. Double pane sound insulating units.
 - 2. Use one of the following:
 - a. Fully tempered glass.
 - b. Laminated glass.
 - 3. Wired glass at lites in fire-rated openings.

2.05 OTHER INTERIOR OPENINGS

- A. Louvers and Vents: Metal louvers matching other metal fabrications.
- B. Access Panels and Floor Hatches: Metal.

2.06 STAIRS AND RAMPS

- A. Metal or concrete.

2.07 RESTROOM ACCESSORIES

- A. Use one of the following:
 - 1. Stainless steel accessories.
 - 2. Chrome-plated cast zinc accessories.
 - 3. Enameled steel accessories.
 - 4. Aluminum accessories.
- B. Shower Closures. Use one of the following:
 - 1. Plastic shower curtains.
 - 2. Glazed shower doors.

2.08 INFORMATION FIXTURES

- A. Identifying Devices:
 - 1. Wall-mounted room, functional, and directional signs at rooms and functional areas within the Main Process Area and Operation and Maintenance Area.
 - 2. Wall-mounted “No Smoking” signs at interior primary building spaces and at building entries.
- B. Interior Wall-Mounted Signs: Manufactured and pre-finished sign systems for surface mounting.
- C. Room, function, directional, primary building space, and “No Smoking” signs: Use Metal or plastic panel signs with pre-applied characters and graphics.

D. Marker Boards and Magnetic Boards:

1. Use at Lab, Control Room, offices, and break rooms.
2. Erasable, magnetic, wall-mounted marker boards.

2.09 STORAGE FIXTURES

A. Built-in manufactured cabinetry or casework:

1. Custom-made or manufactured finished wood cabinets at Kitchens and Break Rooms.
2. Metal cabinets at the Maintenance Area / Vehicle Bays and Maintenance Shop.
3. Solid plastic countertops at Kitchens and Break Rooms.
4. Steel or wood countertops at the Maintenance Area / Vehicle Bays and Maintenance Shop.

B. Built-in lockers in locker rooms. Use one of the following:

1. Metal frame and panel lockers with baked enamel finish.
2. Expanded metal lockers with baked enamel finish.

2.10 FURNITURE, FIXTURES, AND EQUIPMENT

A. Systems and office furniture:

1. Cubicle wall height to allow natural light to permeate the space.
2. Desks: solid plastic or laminate.
3. Shelving and cabinetry: Metal, solid plastic, or laminate.
4. Chairs: For personnel and guests. Personnel chairs with cushioned seat. Fabric or mesh seat and back.
5. Accessories:
 - a. Trash cans.
 - b. Other accessories as needed.

B. Copier / printer:

1. Scanning capability.
2. Color print, copy, and scan capability.
3. Double-sided print, copy, and scan capability.
4. Accommodates paper sizes of 8-1/2-inch by 11-inch and 11-inch by 17-inch, minimum.

C. Break Room and Kitchen furniture:

1. Tables: Wood, solid plastic, or laminate.

2. Chairs: Fabric, mesh, or plastic seat and back.
3. Storage: Wood, solid plastic, or laminate.

2.11 WINDOW TREATMENTS

- A. Water-resistant and made of non-corrosive materials not damaged by contact with condensation on window surface.

2.12 EQUIPMENT

- A. Pressure Washer: 200-gallon hot water pressure washer, gas powered, trailer mounted, tank filled.
- B. Instrument Calibration Bench: 8 feet to 12 feet length.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 84 16
EXTERIOR PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. Exterior Color:
1. Color of non-horizontal surfaces including but not limited to building walls, roofs, tank walls, and concrete walls.
 2. Does not include curb, gutter, or building foundations with less than 12 inches viewable above grade.

1.03 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 2. ASTM E331 Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 3. ASTM E413 Classification for Rating Sound Insulation
 4. ASTM E547 Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
- B. Builders Hardware Manufacturers Association (BHMA)
1. BHMA A156.13 Mortise Locks and Latches
- C. International Code Council, Inc. (ICC)
1. IBC International Building Code
 2. IECC International Energy Conservation Code
- D. National Association of Architectural Metal Manufacturers (NAAMM)
1. HMMA 862 Guide Specifications for Commercial Security Hollow Metal Doors and Frames

- E. Underwriters Laboratories, Inc. (UL)
 - 1. UL 752 Bullet-Resisting Equipment
- F. United States Access Board
 - 1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.05 BASIC FUNCTION

- A. Provide an essentially vertical separation between exterior and interior conditioned space:
 - 1. Keeps out weather, uninvited people, and animals and insects, without unusual action by occupants.
 - 2. Facilitates convenient movement of occupants between inside and outside, desirable natural light, and views from inside to outside.
- B. Fill, cover, close, or otherwise protect openings in the exterior walls components that change with the season.
- C. Balcony Walls: Same requirements as exterior walls, except thermal performance not required.
- D. Parapets: Same requirements as associated walls, except thermal performance is not required.
- E. Where features function as features defined within another group, meet requirements of both groups.
- F. Meet ADA/ABA guidelines for building ingress and egress and where otherwise required.

1.06 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. Coordinate with architectural aesthetic approach with site specific conditions, including environmental, cultural, and technical considerations.
 - 2. Design for codes listed in Section 01 83 00 - Building Performance Requirements or requirements of this Section, whichever is most restrictive.

- B. Thermal Performance:
 - 1. Continuous insulated enclosure to comply with the IECC.
 - 2. Expansion and Contraction:
 - a. Within and between elements.
 - b. Temperature Range: Per design engineer.
 - c. Do not damage components and anchorage.
 - 3. Exterior Soffits and Ceilings: Same requirements as exterior walls.
 - a. Exception: If the space between soffit and floor/roof above is not conditioned space, thermal performance requirements may not apply.
- C. Water Penetration Resistance:
 - 1. Mock-Up Test:
 - a. 2.86 psf and 5.0 gal/sf/hr static pressure in accordance with ASTM E331.
 - b. 2.86 psf and 5.0 gal/sf/hr cyclic static pressure in accordance with ASTM E547.
 - c. Interior skin not integral part of exterior enclosure, test without interior skin.
- D. Air Infiltration Resistance:
 - 1. Provide continuous separate membrane exterior enclosure that allows moisture vapor transmission while preventing air infiltration.
 - 2. Air leakage rates and vapor permeance in accordance with the IECC.
 - 3. Operable openings normally closed: Maximum of 0.3 cfm/sf in accordance with ASTM E283 at differential pressure of 1.57 psf.
 - 4. Mechanical Ventilation Openings:
 - a. Automatically closed when ventilation not required.
 - b. Unless ducted, maximum of 0.3 cfm/sf of crack when closed, measured in accordance with ASTM E283 at differential pressure of 1.57 psf.
- E. Construction materials and methods to minimize sound transmission from building interiors to exteriors.
- F. Elements Adjacent to Traffic: Impact resistant at 5 mph.
- G. Fire Resistance: Non-combustible materials.
- H. Anchorage:
 - 1. Precast concrete, reinforced masonry, and metal siding.
 - 2. Do not damage supporting structure and exterior skin.

- I. Provide shelter for users of outdoor fixtures.
- J. Exterior Windows:
 - 1. Daylighting in areas listed in Section 01 84 13 - Interior Performance Requirements.
 - 2. Use high windows, such as clerestory, transom, or high bay windows to provide natural light in primary building spaces, including the Process Equipment Area and Maintenance Area / Vehicle Bays.
 - 3. Exterior glare control where required.
- K. Exterior Doors:
 - 1. Door Handles and Knobs: As required by code; where code and other requirements allow an option, exit devices are preferred.
 - 2. Operation at Swinging Doors: Self-closing unless otherwise indicated.
 - 3. Doors and door hardware compatible with Door Access Control systems as specified in Section 01 86 33 - Electronic Safety and Security Performance Requirements.
 - 4. Power-Assisted and Operated Door Control:
 - a. Local actuators each side unless otherwise indicated.
 - b. Least obtrusive method of control/actuation possible.
 - c. Access Control System: As specified in Section 01 86 33 - Electronic Safety and Security Performance Requirements.
 - d. Main Entrances: Local actuators only.
 - 5. Minimum Dimensions:
 - a. Entry Vestibule and Lobby: Not less than 6-foot width.
 - b. Swinging Doors Width: Not less than 36 inches.
 - c. Swinging Door Height: Not less than 84 inches.
 - d. Garage Doors: To accommodate a lowboy trailer in both width and height.
 - 6. Fully glazed pedestrian doors at Entry Vestibule and Lobby.
 - 7. Provide hidden hinges on hatches and where applicable.
 - 8. Doors capable of resisting forced entry.
 - 9. Scuff-resistant surfaces in areas with foot impact. Highly scratch-resistant in areas with hand contact.
 - 10. Door Handles and Knobs:
 - a. Highly scratch-resistant.

- b. Finish that minimizes appearance changes due to wear; no plated or coated finishes.
- 11. Flexible Seal Materials: Minimize deterioration due to operation of doors and aging.
- 12. Easy to use, repair and replace.
- L. Minimize rainwater penetration. Protect interior from water damage.
- M. Openings and Components of Openings:
 - 1. Positively drain water to exterior of the building.
 - 2. Top of Openings: If wall construction does not provide drainage, use flashing to prevent water from entering openings or building interior.
 - 3. Bottom of Openings: Integral or separate sill or flashing to prevent water running over or draining out of opening components from entering the wall construction below or the interior of the building.
- N. Exterior Colors:
 - 1. Blend with the existing natural environment as approved by COR.
 - 2. COR may review and approve alternate colors.
 - 3. Match Pumping Plant 4 colors.
 - 4. Concrete: Pigmented color, not stained, where visible from N36.

PART 2 PRODUCTS

2.01 EXTERIOR WALL ELEMENTS

- A. Exterior Skin of Exterior Walls:
 - 1. Concrete masonry units.
 - 2. Cast in place concrete.
 - 3. Precast concrete.
 - 4. Brick.
 - 5. Prefinished, preinsulated metal panels.
 - 6. Transpired solar collector wall on south-facing walls.
- B. Insulation:
 - 1. Board insulation.
 - 2. Batt insulation.
 - 3. Metal building sheet insulation.

- 4. Foamed-in-place insulation:
 - a. Secondary insulation.
 - b. For filling small gaps and openings.
- C. Use the following as needed:
 - 1. Joint sealers on exterior building skin.
 - 2. Air barriers.
 - 3. Vapor retarders.
- D. Supporting Structure of Exterior Walls: Refer to Section 01 83 13 - Superstructure Performance Requirements.
- E. Exterior Ceilings and Soffits:
 - 1. Construction similar to exterior walls.
 - 2. Metal soffit panels.
- F. Exterior Railings:
 - 1. Construction similar to exterior walls.
 - 2. Steel railings.
- G. Coordinate component colors with Section 01 81 05 - General Performance Requirements, including exterior exposed framing and trim for doors and windows.

2.02 EXTERIOR WINDOWS

- A. Windows:
 - 1. Fixed non-operable windows.
 - 2. Protect windows within twelve feet of ground level from intrusion.
 - 3. Steel or aluminum windows.
 - 4. Aluminum windows at Entry Vestibule and Lobby as part of a storefront window and door system.
 - 5. Provide exterior glare control.
- B. Glazing:
 - 1. Glass.
 - 2. Double pane insulated units.
 - a. Exterior pane: 1/4-inch tempered glass with low-E coating on Number 2 surface.

- b. Interior pane:
 - 1) 1/4-inch annealed laminated safety glass.
 - 2) 0.060-inch laminate minimum.
- 3. Use fire rated glazing where required.
- 4. Protection Devices for Windows:
 - a. Grille Protection Devices for Windows and Doors:
 - 1) Solid steel bars 1/2-inch diameter or square, welded at each horizontal and vertical bar intersection.
 - 2) Maximum opening: 8-inch.
 - 3) Anchored into masonry or structural steel at maximum 16 inches on center with minimum 3/8-inch by 3-inch anchor bolts or similar.

2.03 OTHER EXTERIOR OPENINGS

- A. Ventilation Openings:
 - 1. Cover natural and mechanical ventilation openings.
 - 2. Material: Aluminum, steel, or stainless steel.
 - 3. Protection devices for exterior openings less than 8-inch width.
 - a. Stationary blade vents or louvers.
 - b. Operable vents or louvers.
 - c. Grilles.
 - 4. Protection Devices for Other Openings:
 - a. Solid steel bars 1/2-inch diameter or square, welded at each horizontal and vertical bar intersection.
 - b. Maximum opening: 8-inch.
 - c. Anchored into masonry or structural steel at maximum 16 inches on center with minimum 3/8-inch by 3-inch anchor bolts or similar.

2.04 EXTERIOR DOORS

- A. Main Entrance Doors at Entry Vestibule and Lobby:
 - 1. Steel or aluminum doors and frames as part of a storefront window and door system.
 - 2. Provide weatherstripping and thresholds.

- B. Other Pedestrian and Swinging Service Doors:
 - 1. Insulated hollow steel doors:
 - a. HMMA 862: Grade Number 4 doors and frames.
 - b. Door skin and plates: 12 gauge steel.
 - c. Doors to be reverse bevel. Swing in direction of egress.
 - 2. Provide weatherstripping and thresholds.
- C. Garage Doors:
 - 1. Insulated metal rollup, overhead coiling doors. Mechanically operated, interior deadbolt with hole to receive padlock.
 - 2. Provide weatherstripping.
 - 3. Exterior finish color to match the building exterior color.
- D. Hardware for Swinging Doors:
 - 1. Use fire rated hardware on fire rated doors.
 - 2. Provide locks on exterior doors.
 - 3. Lock cylinders and keying on doors.
 - a. Furnish locks with seven-pin, interchangeable-core, lock cylinders.
 - 1) Temporary construction core system which can be voided after contract completion.
 - 2) Key locks alike.
 - b. Furnish permanent core system after contract completion. Provide two keys per lock.
 - c. Stamp construction keys with "U.S. Property - Do Not Duplicate" and appropriate key numbers.
 - d. Furnish six construction keys to COR for Government's use during construction.
 - e. Deliver construction keys to COR at jobsite after completion of work when acceptable to the COR.
 - 4. Locking and latching hardware to be operational grade 1, BHMA A156.13, security grade 1.
 - 5. Door hinges to have non-removable pins or hospital tips, security studs (safety studs), and shear resistant studs or prison safety feature.
 - 6. Door Closers on Exterior Swinging Doors:
 - a. Smooth closing motion.
 - b. Slower latching speed than closing speed, no slamming.
 - 7. Doors stops on exterior swinging doors.

8. Kick plates on both sides of exterior swinging doors.
9. Glazing in Doors:
 - a. Glass.
 - b. Type: Match exterior windows where practical.
 - c. Fire rated glazing in fire doors.
- E. Louvers:
 1. In Metal Doors: Same material as doors.
 2. Use fire rated louvers on fire rated doors.

2.05 LADDERS

- A. Refer to Section 01 83 19 - Roofing Performance Requirements.
- B. Do not place ladders within ten feet of any exterior wall openings.

2.06 SIGNS

- A. Weather-resistant metal or plastic panel signs with pre-applied characters and graphics within ten feet of all building entries reading “No Smoking within 25 Feet of Building.”

PART 3 EXECUTION

3.01 GENERAL

- A. Incorporate bullet resistant products’ manufacturer installation requirements into the design as well as the construction sequencing.
- B. Protect bullet resistant products from damage during construction. Perform a final cleaning of ballistic resistant products in accordance with the manufacturer’s written instructions.
- C. Install permanent door hardware after finish work is complete.

END OF SECTION

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SECTION 01 84 19
INTERIOR FINISHES PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Association of Textile, Apparel and Materials (AATCC)
1. AATCC Test Method 134 Electrostatic Propensity of Carpets
 2. AATCC Test Method 174 Antimicrobial Activity Assessment of Carpets
- B. ASTM International (ASTM)
1. ASTM C1028 Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
 2. ASTM D2047 Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
 3. ASTM E96/E96M Water Vapor Transmission of Materials
 4. ASTM F793 Wall Covering by Use Characteristics
- C. National Fire Protection Association (NFPA)
1. NFPA 99 Health Care Facilities Code
- D. United States Access Board
1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTIONS

- A. Provide appropriately finished interiors for spaces required in Section 01 81 20 - Programming Performance Requirements. Where interior finishes are integral with elements defined within another element group, meet requirements of both element groups.
- B. Wall finishes, including interior face of exterior walls and vertical faces of superstructure elements.
- C. Floor finishes, except for access flooring.
- D. Suspended ceilings and soffits.
- E. Applied ceiling finishes.
- F. Stair finishes, except for integral stair surfaces.
- G. Finishes applied to other interior surfaces.

1.05 DESIGN CRITERIA

- A. General: Design for applicable codes listed in Section 01 83 00 - Building Performance Requirements or Requirements of this Section, whichever is most restrictive.
- B. Interior moisture vapor permeance in accordance with ASTM E96.
 - 1. Wall Finishes at Exterior Walls: 1 perm maximum.
 - 2. Interior Ceiling Finishes at Roof Level: 1 perm maximum.
- C. Interior spaces acoustical absorption in accordance with Section 01 84 13 - Interior Performance Requirements.
- D. Slip Resistance:
 - 1. For spaces subject to floor wetting, including entry lobbies, provide floor finishes with inherent slip resistance under wet conditions.
 - 2. Building entries: Means for reducing or minimizing moisture and debris on shoe soles.
 - 3. Entries, Lab, Kitchen, restrooms, locker rooms, janitor closets and other wet areas: Floor surfaces with minimum static coefficient of friction of 0.60 when wet in accordance with ASTM C1028 or ASTM D2047.
 - 4. Stairs and corridors: Floor finishes with minimum static coefficient of friction of 0.60, in accordance with ASTM D2047.
 - 5. Ramps, showers, and sloped floor surfaces: Floor finishes with minimum static coefficient of friction of 0.80, in accordance with ASTM D2047.

6. Polymer chemical storage and pumping areas: Textured floor finish for slip protection, refer to Section 01 89 09 - Coating Performance Requirements.
- E. Tactile Warning Surfaces: Provide floor surfaces that comply with ADA for accessible design detectable warning requirements at potentially hazardous locations. Include top and bottom of stairs, top and bottom of escalators, top and bottom of ramps, and edge of loading dock.
- F. Lab Static Resistance: Floor finishes with conductivity between 25 kilohms and 1.0 megaohms, in compliance with NFPA 99.
- G. Static Generation for computer installations and laboratories with electronic equipment:
 1. Floor finishes: Generate less than 2.0 kV at 20 percent relative humidity, tested in accordance with AATCC 134 using step and scuff tests with Neolite and leather soles.
- H. Cleanliness:
 1. Kitchen wall, ceiling, and floor surfaces: USDA approved.
 2. Lab, Restrooms, Locker Rooms, and Janitor Closets wall, ceiling, and floor surfaces: Inherently resistant to moisture and cleaned by caustic agents without damage.
- I. Laboratory: Wall surfaces shall not support mold, mildew, or bacterial growth.
- J. Carpeted Areas:
 1. Not less than 2 mm halo of inhibition for staphylococcus aureus, tested in accordance with AATCC 174.
 2. Not less than 1 mm halo of inhibition for klebsiella pneumoniae, when tested in accordance with AATCC 174.
 3. No fungal growth, when tested in accordance with AATCC 174.
- K. Wall Finishes:
 1. Integral or applied wall surfaces appropriate for anticipated usage and traffic.
 2. Durability not less than detailed in ASTM F793.
 3. Interior Wall Finishes at Exterior Walls: No damage by incidental condensation from windows.
- L. Corridors, Process Equipment Area, storage rooms, Vehicle Bays, and Maintenance Area wall protection: Impact resistant wall bumpers and corner guards or wall surfaces resistant to impact damage due to rolling carts, hand trucks, and vehicular traffic.
- M. Pedestrian or Vehicular Traffic Partition Opening Protection: Door frames (cased openings) or corner guards.

- N. Refer to Section 01 89 09 - Coatings Performance Requirements for details on coatings and finishes.

PART 2 PRODUCTS

2.01 CEILINGS AND CEILING FINISHES

- A. Process Equipment Area, storage rooms, mechanical rooms, electrical rooms, Vehicle Bays, Maintenance Area, Maintenance Shop, and Ancillary Facilities.
1. Open ceiling with exposed structural steel, metal decking, or metal face of preinsulated, prefinished roofing panels. Coat exposed ceiling components in accordance with Section 01 89 09 - Coating Performance Requirements.
 2. Finished surface using prefinished, preinsulated metal panels, or similar.
- B. Other:
1. Textured gypsum board ceilings.
 2. Painted gypsum board ceilings.
 3. Acoustical tile ceilings.
- C. Do not use:
1. Wood ceilings.
 2. Plaster ceilings.
 3. Exposed insulation as a ceiling finish.

2.02 WALL FINISHES

- A. Ceramic tile from floor up to a minimum height of 5 feet in restrooms, locker rooms, and janitor closets.
- B. Ceramic tile backsplash at Kitchen countertop.
- C. Painted gypsum board at Entry Vestibule, Lobby, Lab, Control Room, Offices, Conference Rooms, Break Rooms, Kitchens, Restrooms, Locker Rooms, and Janitor Closets.
- D. Concrete masonry units.
- E. Brick.
- F. Cast-in-place concrete.
- G. Preinsulated, prefinished metal panels.

2.03 FLOOR FINISHES

- A. Ceramic tile at Kitchen, Restrooms, Locker Rooms, and Janitor Closets.
- B. Carpet tile, broadloom carpet, linoleum, or other appropriate materials at Offices, Conference Rooms, and Break Rooms with rubber base on adjacent walls.
- C. Lab Floor: Textured to reduce slipping hazard but facilitate ease of cleaning with rubber base on adjacent walls.
- D. Static dissipative vinyl composition tile in Control Room, server rooms, and communication rooms with rubber base on adjacent walls.
- E. Use concrete or other appropriate materials in other areas.

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 85 00
MATERIAL HANDLING EQUIPMENT PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
1. ANSI B56 Safety Standards for Industrial Trucks
- B. American Institute of Steel Construction (AISC)
1. AISC 325 Steel Construction Manual
- C. American Society of Mechanical Engineers (ASME)
1. ASME B30 Safety Standards for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
- D. Code of Federal Regulations (CFR)
1. 29 CFR Part 1910 Occupational Safety and Health Standards
- E. Crane Manufacturer's Association of America (CMAA)
1. CMAA 70 Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes
 2. CMAA 74 Top Running and Under Running Single Girder Electric Overhead Cranes, Utilizing Under Running Trolley Hoist
- F. National Fire Protection Association (NFPA)
1. NFPA 70 National Electrical Code

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide material handling equipment, to transport and position equipment and materials in the water treatment process areas, clearwell pumping plant, and operation and maintenance building for purposes of maintenance, repair, and replacement.
- B. Government may require access depending on the area configuration and equipment type.
- C. Sized for safe and satisfactory operation.
- D. Characteristics:
 - 1. Structural elements: Steel, aluminum, or other suitable metallic components designed in accordance with AISC 325.
 - 2. Structural elements attached to the building: Rated and suitable for use with the hoist and trolley and designed in accordance with Section 01 83 13 - Superstructure Performance Requirements.
 - 3. Heavy-duty.
 - 4. Industrial grade.
 - 5. Suitable for outdoor use in wet and dusty conditions, at design elevation and temperatures provided in Section 01 81 05 - General Performance Requirements.
 - 6. Load rating: Ample allowance for heaviest item required to be lifted, including loads from below-the-hook lifting beams or devices.
- E. Cranes or hoists including a hoist for a monorail crane system, if used.
 - 1. In accordance with applicable sections of:
 - a. CMAA 70 or CMAA 74.
 - b. NFPA 70.
 - c. 29 CFR 1910.
 - d. ASME B30.
- F. Forklift:
 - 1. In accordance with applicable sections of ANSI B56 and 29 CFR 1910.
 - 2. Quantity: One.

PART 2 PRODUCTS

2.01 FORKLIFT

- A. Power: Propane-fueled, type appropriate to location of use.

- B. Suitable for loading or unloading trucks and trailers outside of the building and for moving equipment and supplies within the building.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and provide equipment in accordance with manufacturer's recommendations.
- B. Field Quality Test:
 - 1. Test equipment to demonstrate rated load can be raised, lowered, and held for one minute without lowering.
 - 2. Ensure limit devices and operational controls are fully functional.
 - 3. Test equipment to demonstrate range of motion to fully perform required positioning of loads.

END OF SECTION

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SECTION 01 86 13
FIRE SUPPRESSION PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. International Code Council (ICC)
1. IFC International Fire Code
- B. National Fire Protection Association (NFPA)
1. NFPA 13 Installation of Sprinkler Systems
 2. NFPA 14 Installation of Standpipe and Hose Systems
 3. NFPA 20 Installation of Stationary Pumps for Fire
 4. NFPA 2001 Clean Agent Fire Extinguishing Systems

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. Construction Progress Submittals:
1. Functional performance testing.
 2. Tests of each system.

1.04 PERMITTING

- A. Permitting of fire suppression system as required by Navajo Nation Department of Fire & Rescue Services.
- B. “Code” in this section indicates codes outside the listed NFPA standards may need to be met because no applicable NFPA code exists or the Authority Having Jurisdiction (AHJ) has more stringent code requirements.

1.05 BASIC FUNCTION

- A. Install portable fire extinguishers as required by IFC.

- B. Refer to Section 01 81 10 – General Pipe Performance Requirements.
- C. Design, furnish and install fire suppression systems where required by IFC and in rooms specifically required below.
- D. Basic Water Based Fire Suppression Systems:
 - 1. Design system to be compatible with water supply during all times of the year.
 - 2. Fire Sprinklers: Design and construction in accordance NFPA 13.
 - 3. Standpipes:
 - a. Design and construction in accordance NFPA 14.
 - b. Design system based on environment of installation.
 - 4. Water Source: Provide water supply as required by codes and AHJ.
 - a. Determine minimum water supply requirements for each sprinkler and standpipe system using the hydraulic calculation method defined by NFPA 13.
 - b. Provide a permanent water supply for standpipes as required by code.
 - c. Provide fire pump(s) designed in accordance with NFPA 20.
 - d. Provide water from on-site source.
- E. Novec 1230 Clean Agent Fire Extinguishing Systems:
 - 1. Control Room and SCADA Room within Administration Building. Include subfloor protection.
 - 2. Design and construction in accordance with code and NFPA 2001.
- F. Provide a fire suppression water supply loop around the entire WTP site. Locate the piping to allow fire hydrant positioning meeting code and AHJ requirements.

PART 2 PRODUCTS

2.01 FIRE SUPPRESSION SYSTEM

- A. Use corrosion resistant materials.
- B. Do not use ferrous metal unless hot dipped galvanized, chrome plated, or coated with rust inhibitive paint. Design for humid environment due to plant processes.
- C. Material Components: FM approved or UL listed for specific application selected.

PART 3 EXECUTION

3.01 GENERAL

- A. Commission each system in accordance with applicable NFPA standard.
- B. Unions:
 - 1. Adjacent to each valve in pipes 2 inches and smaller.
 - 2. Not required on flanged devices or in piping installations using grooved couplings.
- C. Sprinkler piping with drains for complete system drainage.
- D. Pressure Gages:
 - 1. On riser or feed main and at each sprinkler test connection.
 - 2. Connection not less than 1/4 inch and with isolation valve arranged for draining pipe between gage and valve.
 - 3. Locate for removal and to eliminate freezing.
- E. Clean dirt and debris from sprinklers.
- F. Replace sprinklers having paint other than factory finish with new sprinklers.
- G. Do not clean and reuse painted sprinklers.

3.02 IDENTIFICATION

- A. Paint exposed fire piping, including exterior piping red.
- B. Label pipe in accordance with ANSI A13.1 using plastic tape pipe markers.

END OF SECTION

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SECTION 01 86 16
PLUMBING AND VALVES PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Society of Civil Engineers (ASCE)
1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- B. American Society of Mechanical Engineers (ASME)
1. ASME A13.1 Scheme for the Identification of Piping Systems
 2. ASME B31.3 Process Piping
 3. ASME B31.9 Building Services Piping
- C. American Water Works Association (AWWA)
1. AWWA D100 Welded Carbon Steel Tanks for Water Storage
 2. AWWA C512 Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
 3. AWWA C517 Resilient-Seated Cast-Iron Eccentric Plug Valves
- D. Clinical & Laboratory Standards Institute
1. CLSI GP40 Preparation and Testing of Reagent Water in the Clinical Laboratory
- E. International Safety Equipment Association (ISEA)
1. ANSI/ISEA Z358.1 Emergency Eyewash and Shower Equipment
- F. International Code Council (ICC)
1. IBC International Building Code
 2. IFC International Fire Code

- 3. IFGC International Fuel Gas Code
- 4. IMC International Mechanical Code
- 5. IPC International Plumbing Code
- 6. IPSDC International Private Sewage Disposal Code
- G. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
 - 1. MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation
 - 2. MSS SP-99 Instrumentation Valves
- H. National Fire Protection Association (NFPA)
 - 1. NFPA 30 Flammable and Combustible Liquids Code
 - 2. NFPA 54 National Fuel Gas Code
 - 3. NFPA 70 National Electric Code
- I. New Mexico Environment Department (NMED) Construction Programs Bureau
 - 1. NMED Water Facilities Standards 2006 Recommended Standards for Water Facilities
- J. Navajo Nation Environmental Protection Agency (NNEPA)
 - 1. Surface and Ground Water Protection Department Domestic Wastewater Regulations
- K. Occupational Safety and Health Administration (OSHA)
 - 1. OSHA 1910.147 Control of Hazardous Energy
- L. Underwriters Laboratory
 - 1. UL 499 UL Standards for Safety Electric Heating Appliances

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. Construction Progress Submittals:
 - 1. Shop Performance Test Reports: Pump performance test.
 - 2. Field Performance Test Reports:

- a. Pipe system pressure test.
- b. Fuel system leak test.
- c. Evaluation of service air

1.04 SYSTEM DESCRIPTION

- A. Refer to Section 01 81 10 – General Pipe Performance requirements for system description
- B. Meet industry standards for similar facilities.
- C. Fuel Gas: Fuel supply and distribution within buildings for generators, fire pumps or HVAC systems.
- D. Potable and non-potable water supply and distribution required by IPC for building occupancy and use.
- E. Service Water: Water used for process and maintenance and operations of water treatment facility.
- F. Sanitary Sewer: Per IPC, IPSDC San Juan County and Navajo Nation EPA.
- G. Compressed and Instrument Air:
 - 1. As required for the operation of the process and plant features.
 - 2. Process Air Piping: In accordance with Section 01 89 19 – Process Piping Performance Requirements.
 - 3. Service Air per ASME B31.9.
 - 4. Air Distribution: Piping within the building, serving fixtures, specialties, and equipment.
 - 5. Compressed Air Equipment: Compressors, dryers, tanks, filters, and treatment equipment.
- H. Drain, Waste, and Vent:
 - 1. Drainage for disposal of liquid waste and clear wastes: As required by IPC and IPSDC.
 - 2. Maximum Discharge Temperature into Sewer: 120 degrees Fahrenheit.
 - 3. Resistance to Corrosive Wastes:
 - a. Where corrosive wastes are neutralized, removal is not required; otherwise, provide appropriate interceptors to remove corrosive wastes, including solids.
 - b. Grease and Oil Interceptors: Located to prevent oil contamination of system.

- c. Sediment Interceptors: Located at each floor drain where significant amount of sand is likely.
- 4. Chemical Drain, Waste, and Vent: Drainage or venting from equipment, tanks, or lines to approved place of disposal.
- I. Deionized Water: From storage tanks to end use.
- J. Plumbing fixtures necessary for occupancy, use, emergency response, and sanitation as required by IPC.
- K. Building Water Meters:
 - 1. Instantaneous and totalized flow output to SCADA system.
 - 2. Define quantity of meters in the Sustainable Design Plan. Refer to Section 01 81 13 - Sustainable Design Performance Requirements.

1.05 AMENITY AND COMFORT CRITERIA

- A. Odors:
 - 1. Locate odor producing elements in areas separate from human occupancy in dedicated equipment rooms.
 - 2. Provide an automatic means of priming traps which may evaporate enough water to break the trap seal allowing sewer gases to enter the building.
- B. Fuel Leakage: Run fuel lines through low use areas.

1.06 HEALTH AND SAFETY CRITERIA

- A. Plumbing systems: Designed in accordance with IFC, IFGC, IPC, and IMC.
- B. Potable Water: In addition to IPC provide backflow prevention devices in accordance with NNEPA requirements and listed in the most current ASSE Seal Authorization Booklet.
- C. Pressure Control: Control pressures to protect the building, fixtures, equipment, and occupants from harm.
- D. Labeling: Refer to Section 01 81 10 - General Pipe Performance Requirements.
- E. Diesel Fuel: Comply with applicable rules and regulations of IFGC, NFPA 30, NFPA 54 and shall meet all prevailing Federal, Tribal, State, and local codes governing this type of installation.

1.07 STRUCTURAL CRITERIA

- A. Piping design per ASME B31.9 for fuel gas, service water, service air, and service water.

- B. Provide seismic restraints per ASCE 7.
- C. Support pipe systems in accordance with IPC, MSS-SP-58, and applicable ASME code.
- D. Pipe Stress and Strain Control: Provide pipe loops, bends, expansion joints, and flexible pipe connectors to reduce stress and strain due to expansion and contraction.

1.08 OPERATION AND MAINTENANCE CRITERIA

- A. Water Consumption: WaterSense, or equivalent, as applicable.
- B. Capacity of Water Service:
 - 1. Provide adequate water flow and pressure to supply peak demand requirements.
 - 2. Size the water supply to exceed IPC fixture unit count by 10 percent.
- C. Maintenance of Sanitary Drainage: Where sewer discharge is higher than item to be drained, provide a means of lifting the waste for drainage.
- D. Energy Efficiency: Piping and equipment insulation to comply with ASHRAE 90.1.

PART 2 PRODUCTS

2.01 GENERAL

- A. Piping components conform with Standard piping components list per ASME B31.9 Table 926.1, ASME B31.3 Table 326.1 and IPC.
- B. Provide dielectric unions and fittings between dissimilar metals.
- C. Provide isolation valves as necessary to allow maintenance and repairs while not interrupting operations. Do not route wetted pipe above electrical equipment or electrical cabinets.

2.02 FUEL GAS

- A. Fuel Gas Pipe:
 - 1. Stainless steel pipe (ASTM A312 304/304L/316/316L), with welded joints or flanged and fittings.
 - 2. Carbon steel pipe (ASTM A53) with welded or flanged joints and fittings.

2.03 DOMESTIC POTABLE AND SERVICE WATER

- A. Water Piping In accordance with IPC.
- B. Water Heating:

1. Provide heaters complete with control system, gauges and ASME rated combination pressure and temperature relief valve.
2. Hot Water Storage Tanks: AWWA D100, glass- or cement-lined vertical steel tanks, minimum of 125 psig (862 kPa) (gage) working pressure.
3. Tankless hot water heaters with thermostatically controlled adjustable output temperature are acceptable.
4. For emergency shower and eyewashes, provide tepid water per ANSI Z358.1.
5. Energy star rated.

C. Pumps:

1. Potable water service, base mounted, end suction pumps with mechanical seals and drip-proof electric motors.
2. In-line circulator for service water distribution system. Factory assembled and tested pumps constructed of materials suitable for hot domestic water service.

2.04 SANITARY SYSTEM

- A. Includes sanitary sewer, septic tank and leach field if applicable.
- B. In accordance with San Juan County and Navajo Nation EPA requirements, whichever is more restrictive

2.05 DRAIN, WASTE, AND VENT PIPING AND EQUIPMENT

- A. Chemical Resistant Drain Waste and Vent Piping.
- B. Cleanout Plugs: Brass, plastic, or stainless steel.
- C. Cleanout Caps: Brass, plastic, reinforced neoprene or cast iron.
- D. Roof Drains, Area Drains or Floor Drains:
 1. Heel proof.
 2. Material: Bronze, cast iron, copper or stainless steel.
- E. Sump Pumps:
 1. Factory assembled and tested submersible type pumps for operation under water.
 2. Automatic pump controls.
 3. Minimum one standby pump per sump.

2.06 DEIONIZED WATER

- A. Test Pressure: 100 psig hydrostatic.
- B. Industry standard.

2.07 PLUMBING FIXTURES

- A. Emergency Equipment:
 - 1. Per ANSI/ISEA Z358.1.
 - a. Plumbed eyewash station.
 - b. Self-contained eyewash station.
 - c. Plumbed drench shower.
 - d. Plumbed combination drench shower/eyewash station.
- B. Backflow Preventor: Provide backflow preventor at each potential health hazard location to prevent backflow due to back siphonage and/or backpressure.
- C. Design plumbing system to protect pumps from debris.

2.08 VALVES

- A. General: Comply with standard piping components list per ASME B31.9 Table 926.1. and IPC.

2.09 RELIEF DEVICES

- A. Vacuum Relief:
 - 1. AWWA C512 for applicable air and vacuum valves.
- B. Air Relief:
 - 1. AWWA C512 for applicable air and vacuum valves.

PART 3 EXECUTION

3.01 GENERAL

- A. Coat pipe (as required) in accordance with Section 01 89 09 - Coating Performance Requirements.
- B. Provide drain valves and drain lines from each piping low point, between two block valves, between block valves and backflow preventer discharge check valves, and from each item of equipment requiring drains.
- C. Provide unions at each equipment connection, at each relief or control valve, at specialty items, and at locations to accommodate maintenance and to ensure safety. Locate unions between shut-off valves and equipment so as to permit removal of the equipment with minimal disturbance to the piping.

1. Unions are not required at flanged valves, flanged equipment connections, or victaulic type mechanical joints provided that maintenance and safety requirements are met.
- D. Following systems start-up, remove strainer screens, clean screen and body, and reinstall screen. Provide documentation that this was done.

3.02 STRUCTURAL CRITERIA

- A. Support piping and components in accordance with ASME B31.9
- B. Structural Design and Flexibility Analysis of Components and Supports: In accordance with B31.9 and IBC.
- C. Pipe supports in accordance with MSS SP-58.

3.03 TESTING

- A. Prior to installation of plumbing fixtures and prior to concealment of piping, air and water tests of piping systems at 110 percent of operating pressure, maintaining pressure for 2 hours to demonstrate system is watertight.
- B. Leak test fuel system.
- C. Functional tests of fixtures and equipment.
- D. Observation of function during full occupancy, simulating extreme conditions.

END OF SECTION

SECTION 01 86 19
HVAC PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Associated Air Balance Council (AABC)
1. AABC National Standards for Total System Balance
- B. Air Movement and Control Association International, Inc. (AMCA)
1. AMCA 210 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
- C. American Society of Civil Engineers (ASCE)
1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- D. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
1. ASHRAE 15 Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants
 2. ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
 3. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality
 4. ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings
 5. ASHRAE 110 Method of Testing Performance of Laboratory Fume Hoods
 6. ASHRAE 111 Testing, Adjusting, and Balancing of Building HVAC Systems
 7. ASHRAE Handbook Fundamentals
 8. ASHRAE Handbook HVAC Applications

- E. International Code Council (ICC)
 - 1. IBC International Building Code
 - 2. IFC International Fire Code
 - 3. IMC International Mechanical Code
 - 4. IPC International Plumbing Code
- F. Natural Environmental Balancing Bureau (NEBB)
 - 1. NEBB Testing, Adjusting, and Balancing of Environmental Systems, Seventh Edition
- G. National Fire Protection Association (NFPA)
 - 1. NFPA 70 National Electrical Code
 - 2. NFPA 90A Installation of Air Conditioning and Ventilating Systems
 - 3. NFPA 101 Life Safety Code
- H. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 1. SMACNA 1966 HVAC Duct Construction Standard-Metal and Flexible

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTION

- A. HVAC Systems: IMC, IBC, IFC, and IPC.
- B. Duct Systems: SMACNA 1966.
- C. Equipment: Energy star rated.
- D. HVAC System Design:
 - 1. Based on computer-generated heating and cooling analysis with one of the following software programs:
 - a. Trane TRACE 700 or Trane TRACE 3D.
 - b. Carrier HAP.
 - c. Energy Plus.

2. Based on design weather data conditions found in the ASHRAE Fundamentals Handbook for the geographically closest weather station.
 - a. Use 99.6 percent heating dry bulb and the 0.4 percent cooling dry bulb for the basis of the analysis.
 - b. Use 0.4 percent evaporation wet bulb for the basis of any evaporative cooling design.
3. Elements to control the building's indoor environment:
 - a. Capabilities required by ASHRAE 90.1 and the IMC.
 - b. Including the possible inclusion of economizers and energy recovery.
 - c. Cooling: Use refrigerated units. Do not use evaporative cooling.
 - d. Programmable thermostat for each zone to maintain required space conditions and local, packaged control for each major piece of HVAC equipment.
 - e. Building control system: Not required.

1.05 AMENITY AND COMFORT CRITERIA

A. Recommended Space Temperature Setpoints:

1. Main Process Area:
 - a. Mechanical Room, Electrical Room, Non-Chemical Storage Rooms, Janitor's Closet, Vehicle Bay, and Process Equipment Areas:
 - 1) 85 degrees Fahrenheit summer.
 - 2) 45 degrees Fahrenheit winter.
 - 3) Tolerance: Plus or minus 3 degrees Fahrenheit.
 - b. Chemical Storage Rooms:
 - 1) 85 degrees Fahrenheit summer, unless otherwise recommended by the Material Safety and Data Sheet (MSDS) for the stored chemicals.
 - 2) 45 degrees Fahrenheit winter, unless otherwise recommended by the MSDS for the stored chemicals.
 - 3) Tolerance: Plus or minus 3 degrees Fahrenheit, unless otherwise recommended by the MSDS for the stored chemicals.
 - c. Control Room, Server Room and Communications Room:
 - 1) 75 degrees Fahrenheit year round.
 - a) Tolerance: Plus or minus 1 degrees Fahrenheit.
 - 2) 50% Relative humidity.
 - a) Tolerance: Plus or minus 10%.

- 3) Do not use evaporative units.
 - 4) Provide audible temperature and humidity alarms integrated with WTP control system.
 - d. Lobby, Restroom/Lockers, Conference Rooms, Break Room/Kitchenette, Office, Laboratory:
 - 1) 75 degrees Fahrenheit summer.
 - 2) 68 degrees Fahrenheit winter.
 - 3) Tolerance: Plus or minus 1 degree Fahrenheit.
2. Treated/Finished Water Pump Station:
 - a. 85 degrees Fahrenheit summer.
 - b. 45 degrees Fahrenheit winter.
 - c. Tolerance: Plus or minus 3 degrees Fahrenheit.
3. Chemical Facility:
 - a. 85 degrees Fahrenheit summer, unless otherwise recommended by the Material Safety and Data Sheet (MSDS) for the stored chemicals.
 - b. 45 degrees Fahrenheit winter, unless otherwise recommended by the MSDS for the stored chemicals.
 - c. Tolerance: Plus or minus 3 degrees Fahrenheit, unless otherwise recommended by the MSDS for the stored chemicals.
4. Air Chamber Building:
 - a. 85 degrees Fahrenheit summer.
 - b. 45 degrees Fahrenheit winter.
 - c. Tolerance: Plus or minus 3 degrees Fahrenheit.
5. Operation and Maintenance Area:
 - a. Electrical Room:
 - 1) 75 degrees Fahrenheit year round.
 - 2) Tolerance: Plus or minus 1 degree Fahrenheit.
 - b. Other spaces:
 - 1) 85 degrees Fahrenheit summer.
 - 2) 62 degrees Fahrenheit winter.
 - 3) Tolerance: Plus or minus 3 degrees Fahrenheit.
6. Maintain spaces containing a computer server, SCADA equipment, or other temperature-sensitive electronic devices at 75 degrees Fahrenheit year round.
7. Electrical Rooms:
 - a. Relative humidity: 50% +/- 10%.

- b. Do not use evaporative units.
 - c. Provide audible temperature and humidity alarms integrated with WTP control system.
 - d. Do not install piping including water, condensate, fire suppression or sanitary above electrical equipment.
- 8. Deviations from recommended setpoints shall be approve by COR.
- B. Humidity Space Temperature Setpoints: Humidity control when required by material storage and process equipment.
- C. Air Distribution Noise: Systems which comply with the RC Levels as defined in ASHRAE HVAC Applications Handbook
- D. Ventilation and Indoor Air Quality:
 - 1. Indoor quality: In accordance with, Ventilation Rate Procedure of ASHRAE 62.1 and IMC requirements.
 - 2. Meet IFC requirements. Includes, but not limited to, the possibility of scrubbers.
- E. Convenience: Locate HVAC equipment, control systems, damper operators, diffuser adjusters in a way that they can be accessed without the usage of a ladder, lift, or other means of elevation above the ground.
- F. Filtration of the air distributed to the occupied spaces in accordance with ASHRAE 52.2 and IMC requirements.

1.06 HEALTH AND SAFETY CRITERIA

- A. Life Safety: Meet the requirements of IBC, IMC, IFC, and NFPA 90A and 101. Interconnection and coordination of HVAC controls with other life safety systems.
- B. Electrical Shock Prevention: Per NFPA 70.
- C. Refrigerants:
 - 1. Comply with the requirements of ASHRAE 15 and the IMC.
 - 2. Prevent release of refrigerant to atmosphere.
 - 3. Prevent exposure of occupants to hazardous refrigerants.

1.07 STRUCTURAL CRITERIA

- A. Seismic Protection: In accordance with ASCE 7.

1.08 DURABILITY CRITERIA

- A. Temperature Endurance: Indoor equipment designed for temperatures ranging from 45 degrees Fahrenheit to 104 degrees Fahrenheit.

1.09 OPERATION AND MAINTENANCE CRITERIA

- A. Testing, Adjusting, and Balancing: Services to be performed according to AABC, ASHRAE 111, or the NEBB standard by an independent contractor.

PART 2 PRODUCTS

2.01 HVAC SYSTEM TYPES

- A. Thermal and Humidity Conditioning: Electric systems capable of meeting the temperature and humidity requirements of Part 1 above.
- B. Additional systems as necessary to meet ventilation requirements:
 - 1. Laboratory: Hood as detailed in Section 01 81 20 - Programming Performance Requirements. Design and install to comply with ASHRAE 110.
 - 2. Ventilate Maintenance Area vehicle bays.
- C. HVAC equipment to meet the minimum product efficiency requirements of ASHRAE 90.1 and IMC requirements.
- D. Minimize use of refrigerants.

2.02 AIR DISTRIBUTION

- A. Ductwork: In accordance with SMACNA 1966.
- B. Fans: Match fan pressure characteristics to the air distribution system pressure characteristics including the system effect factors; pressure characteristics based on AMCA Standard 210 fan ratings and system characteristics based on engineering calculations.

2.03 HVAC CONTROLS

- A. Control System: At a minimum, provide following control functions or features:
 - 1. Seven-day scheduling with holidays.
 - 2. Night setback.
 - 3. Outside air economizer when required by AHRAE 90.1 or IMC.
- B. Control System: Electronic only; pneumatic systems not allowed.
- C. Provide high temperature alarms for each building, control and server room. Connect to WTP Control System.
- D. Comply with requirements of 01 86 30 – Information Systems.

PART 3 EXECUTION

3.01 GENERAL

- A. Install hinged access panels on ductwork and housing to provide access to automatic dampers, fire damper, smoke damper, duct turning vanes, before and after coils, and other locations where items or equipment require inspection or maintenance.

3.02 AIR QUALITY

- A. Protect Air Quality During Construction:
 - 1. Follow SMACNA IAQ Guidelines.
 - 2. After construction and prior to occupancy perform pre-occupancy flush out.
 - 3. Perform post-occupancy flush out.
- B. Provide two sets of filters for each air handling unit: One set for testing, balancing, and start up, and one set for the Government.

END OF SECTION

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SECTION 01 86 25

SYSTEM CONTROL AND MONITORING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. FEMP: Federal Energy Management Program
- B. BIOS: Basic Input/Output System
- C. I/O: Input/Output.
- D. IRIG-B: Inter Range Instrumentation Group mod B
- E. NDAA: National Defense Authorization Act
- F. OIT: Operator Interface Terminal.
- G. PAC: Programmable Automation Controller.
- H. PID: Proportional-Integral-Derivative
- I. PLC: Programmable Logic Controller.
- J. RAID: Redundant Array of Independent Disks.
- K. UHD: Ultra High Definition
- L. UPS: Uninterruptible Power Supply.
- M. VLAN: Virtual Local Area Network
- N. Water Treatment Plant (WTP): All work performed for this contract.

1.03 REFERENCE STANDARDS

- A. Electrical Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment
2. IEEE 1815 Electric Power Systems Communications – Distributed Network Protocol (DNP3)

- | | | |
|--|---------------|--|
| 3. | IEEE C37.90.1 | Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus |
| 4. | IEEE C62.41.1 | Guide on the Surge Environment in Low-Voltage (1000 V and Less AC Power Circuits |
| 5. | IEEE C62.42.0 | Guide for the application of Surge-Protective Components in Surge-Protective Devices and Equipment Ports - Overview |
| 6. | IEEE C62.43.0 | Surge Protectors and Protective Circuits Used in Information and Communications Technology Circuits, Including Smart Grid Data Networks - Overview |
| 7. | IEEE C62.43.1 | Surge Protectors and Surge Protective Circuits Used in Information and Communication Technology Circuits (ICT), Including Smart Grid – Part 1 Applications |
| 8. | IEEE C62.72 | Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or Less) AC Power Circuits |
|
B. International Code Council (ICC) | | |
| 1. | IBC | International Building Code |
|
C. Electrotechnical Commission (IEC) | | |
| 1. | IEC 61131-3 | Programmable Controllers – Part 3: Programming Languages |
|
D. International Society of Automation (ISA) | | |
| 1. | ISA 5.1 | Instrument Symbols and Identification |
| 2. | ISA 18.2 | Management of Alarm Systems for the Process Industries |
| 3. | ISA 18.2.1 | Alarm Philosophy |
| 4. | ISA 18.2.2 | Alarm Identification and Rationalization |
| 5. | ISA 18.2.3 | Basic Alarm System Design |
| 6. | ISA 18.2.6 | Alarm Systems for Batch and Discrete Processes |
| 7. | ISA-TR 18.2.7 | Alarm Management when Utilizing Packaged Systems |
| 8. | ISA 101.01 | Human Machine Interfaces for Process Automation Systems |

- 9. ISA 62381 Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)
- E. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- F. National Fire Protection Association, Inc. (NFPA)
 - 1. NFPA 70 National Electrical Code (NEC)
- G. Underwriters Laboratories, Inc. (UL)
 - 1. UL 508 Industrial Control Equipment, Seventeenth Edition

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 - Electrical and Control Drawings and Data, Section 01 33 28 - Process Flow Diagrams and Piping and Instrumentation Diagrams, and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. RSN 01 86 25-1 Approval Data:
 - 1. Component Data:
 - a. Bill of Material, including component description, manufacturer, model, and ratings, and quantity provided.
 - b. Extra materials list.
 - 2. System architecture drawing, including network and communications links. Show major components, including network switches, converters, and communication protocol used between links.
 - 3. System Description Documentation
 - a. Functional System Description: Of WTP Control System, features and limitations, compliance with requirements, operation, software algorithms, display screens, and software configuration.
 - b. System Overview:
 - 1) Provide general understanding of hardware, software, control functions, interfaces, and general data flow associated with system.
 - 2) Include a software block diagram of system.
 - 4. Graphic display drawings.

5. Logic diagrams: Functional and binary logic drawings for the entire control system.
 6. Layout drawings showing equipment in each cabinet or enclosure.
 - a. Dimensioned drawings showing relative positions of components. Including component identification and layout information.
 - b. Enclosure or Rack Layout Drawings
 - 1) Exterior and interior arrangements.
 - 2) Layout drawings for rack mounted equipment and components
 7. Wiring diagrams.
 - a. Complete wiring point-to-point diagrams for internal and external connections.
 - b. Connections for communications circuits.
 - c. Show information on wire termination location for each circuit or connection point at each device.
 8. Final I/O List, including at a minimum the following information:
 - a. Point designation.
 - b. Card location.
 - c. Type and rating information.
 - d. Termination data.
 9. Master Alarm List, including the minimum following information for each alarm:
 - a. Alarm identifier.
 - b. Alarm priority.
 - c. Alarm group.
 - d. Alarm setpoints.
 10. Historian database of all points, system generated points as well as I/O points, to be recorded by the Control System historical archiving, including at a minimum:
 - a. Datapoint identifier name.
 - b. Description.
 - c. Point range.
 - d. Deviation limit.
 11. Final Communication Interface:
 - a. Includes information on the setup of the communication links between devices and list of datapoints communicated between devices.
- D. RSN 01 86 25-2, Factory Acceptance Test Plan:

1. Document planned checkout and testing activities.
 2. Include procedure for testing and checkout activities.
- E. RSN 01 86 25-3, Factory Test Notification:
1. Expected dates of factory testing.
 2. Include factory or manufacturer's representative contact person(s) name, phone number, and email address.
- F. RSN 01 86 25-4, Factory Test Report:
1. Certification of test compliance.
 2. Contains detailed breakdown of outcomes of individual test, and verification activities.
- G. RSN 01 86 25-5, Final Software:
1. Documentation of supplied software and firmware with identified versions, revisions, and patch levels.
 2. Include software required under 'Extra Materials', as well as other backup software or programming required in Specifications.
 3. Provide a list of passwords and usernames currently in use, for software or components. Identify what they are associated with and what levels of permission provided.
- H. Include San Juan SCADA System in Operation and Maintenance Manual submittals required in Section 01 78 30 – Project Record Documents.

1.05 SYSTEM DESCRIPTION

- A. San Juan SCADA System includes the WTP Facility Control System and San Juan Lateral SCADA System.
1. WTP Facility Control System: Control system for facilities identified in Section 01 81 05 - General Performance Requirements. Primary control system for WTP.
 2. San Juan Lateral Control: Remote control and monitoring for facilities identified Table 01 86 25A – Data Transfer. System shall interface with local facility control systems or monitoring systems located at identified facilities.
- B. San Juan SCADA System:
1. Configuration and programming activities required for a complete and functional system.
 2. Provide operator interface, engineering interface, control processing and I/O processing.
 3. Interface with secondary control systems and control components through either hardwired I/O signals or datalinks.

4. Fully integrated automation controller and microprocessor based system, and have the following minimum features:
 - a. Automation controllers, processing units, servers, I/O cards, network and communication cards, backplanes, power supplies and other miscellaneous control components.
 - b. Provide similar level of automation shown on screen shots in Section 51 00 40 – Automation Graphic Displays.
5. Graphic displays:
 - a. Viewable from Operator Workstations, OITs and required displays.
 - b. Developed to cover equipment connected to San Juan Lateral SCADA System and WTP Facility Control System including sub-displays in accordance with this Section.
6. Provide the latest hardware offered by the respective manufacturers at time of award.
7. Control, data, and monitoring requirements:
 - a. Control, data, and monitoring to render a complete, and functional, system which meets, at a minimum, the functional intent and requirements stated here-in and provides safe and reliable operation of the facility components under all conditions.
 - b. Fully integrated startup, shutdown, and on-line control system.
 - c. Render complete, and functional, system which meets, at minimum the functional intent and requirements stated herein.
 - d. Provide safe and reliable operation of facility components under all conditions.
- C. Software, including graphics and control logic implementations shall be configurable by the Government to allow for future modifications to the San Juan SCADA System.
 1. Graphic display configuration software shall include libraries of standard displays, nameplates, and components utilized by the Government for future San Juan SCADA System modifications.
 2. Modules used in the control logic implementation shall be viewable and configurable by the Government, including the internal implementation of those modules.
- D. Utilize off the shelf system components and software packages.
- E. Common datapoint identifiers from a common datapoint identifier database for the facility.
 1. Utilize function based datapoint identifiers and not hardware based datapoint identifiers.

2. Datapoint identifiers shall be distributed. Modifications to datapoint identifiers shall require the user to update the master database and shall not require the user to individually modify the datapoint identifiers in each automation controller.
- F. Component and Equipment Naming and Designations:
1. Display names and designations for each piece of equipment supplied by the Contractor, on the graphics.
 2. Develop datapoint and component identification in the San Juan SCADA System in accordance with the requirements in Section 01 81 05 - General Performance Requirements.
- G. Automation controllers, I/O cards, communication cards, backplanes, and other components, utilized in the San Juan SCADA System shall be of the same manufacturer. Minimize the number of different types and models utilized.
- H. Electronics shall be immune from false operation or failure from high voltage, high frequency transients which may occur in control circuitry and power supplies, and radio frequency interference:
1. Take special precautions to limit exposure of sensitive electronic circuits connected to remote equipment.
 2. Design system to meet the requirements, guidelines and recommendations of IEEE 1100, IEEE C37.90.1, IEEE C62.41.1, IEEE C62.42, IEEE C62.43, and IEEE C62.72.
- I. Electronics shall be insensitive to radiated high frequency interference such as that coupled from portable radio transmitters (typically 5 W output in the 150-800 MHz band) operating within 2 meters of the equipment with cabinets or protective covers closed or in place.
- J. Provide energy efficient devices and equipment compliant with FEMP product recommendations where available.
- K. Provide in accordance with the requirements in Section 01 86 30 – Information System Security Performance Requirements.
- L. Provide system software and components not mentioned specifically but essential for the system to meet the functional requirements of these Specifications.

1.06 DESIGN REQUIREMENTS

- A. Develop system architecture, arrangement and layout of system components.
- B. Develop I/O points lists and databases.
- C. Develop alarm points lists and databases.
- D. Develop archival and historical databases.

- E. Perform analysis of each treatment train and process system startup, stop and shutdown sequencing to develop automated sequences for these activities in the San Juan SCADA System. Include electrical protection system and instrumentation-initiated events and responses to limit unnecessary component wear or damage.
- F. Support online and offline modification, and component replacement with a minimum impact to the system. View and modify control logic and system programming for control system from the Operator Workstations or Engineering Workstations without interrupting system operation.
- G. Provide San Juan SCADA System control logic and macros: Includes development of logic diagrams, schematics, and facility component interface modifications.
- H. Provide interface design: Include development of schematics, datalinks, and other applicable items, required for interface between internal San Juan SCADA System components and external components. External components include but are not limited to connections to NTUA and City of Gallup SCADA systems.
- I. San Juan SCADA System Start-Up:
 - 1. Cold Start-Up: Automation Controllers shall perform boot-up and restart functions and be available within 3 minutes of turn-on from power off condition.
 - 2. Warm Start-Up: Automation Controllers shall perform boot-up and restart functions and be available within 120 seconds of performing a re-start or reset on an already running system.
- J. Include safety and operational interlocks.
- K. Design components of the San Juan SCADA System referenced in this Section.
- L. Provide configuration and programming of San Juan SCADA System components.

1.07 EXTRA MATERIALS

- A. Furnish a set of special tools and accessories required for installation, normal operation, and maintenance for each facility. Include:
 - 1. Contractor and manufacturer recommended tools and accessories.
 - 2. Tools and accessories:
 - a. Recommended for field maintenance.
 - b. Designed to aid in the diagnosis, maintenance, repair, and replacement of supplied equipment.
- B. Furnish spare parts. Furnish a set of the following components for each facility:
 - 1. I/O Cards: Minimum of 5 percent spare of each type used at the facility, no less than one (1) of each size and type used at each facility.

2. Network and Communication Cards: Minimum of one (1) spare of each type of control system component.
 3. Automation Controllers: Fully redundant spare set of automation controllers. Sufficient quantity of each type to allow swap out of each unit's automation controllers located at the facility. The redundant set of automation controllers shall be preprogrammed to allow quick replacement of installed facility controllers in the event of a failure.
 4. Back planes: Minimum of one (1) spare of each type of control system component.
 5. Communications Converters: Minimum of one (1) spare of each type of communications converter used.
 6. Miscellaneous Components: Minimum of one (1) spare of each type of control system component.
 7. OIT: One spare of each type.
 8. Contractor or manufacturer recommended spare parts.
 9. Replace spare parts used during the installation, testing, and commissioning process to provide a complete set of spare parts at each facility.
- C. Furnish two copies of system software. Include:
1. Software required to re-install software required for the system to function properly, for each facility.
 2. Copies supplied shall contain the final version of all furnished software.
 3. Operating system software.
 4. Database and application software, including SCADA, autodialer, programmable automation controllers, communications, operator interface terminal programming.
 5. Data archiving/backup and retrieval software.
 6. Trending and reporting software.
 7. Security software.
 8. Licensing in the Government's name for all software.
 9. Provide a complete restorable external backup of software components. Archive point shall be latest software versions prior to Contractor demobilization and include punch list changes made after Commissioning.

PART 2 PRODUCTS

2.01 OPERATOR INTERFACE TERMINAL (OIT)

- A. At each facility provide OITs where required for facility operation.

1. Include a minimum of one OIT able to access WTP Facility Control System graphic displays and system operating information in each building with process equipment, including pumps, chemical injection components, or other treatment components.
 2. Include OITs in close proximity, less than 50 feet, to equipment or skids that require operating commands or setpoint adjustments to be entered in the WTP Facility Control System for normal operation, startup, shutdown, or maintenance activities.
- B. Operators shall have access to the controls for entire facility from each OIT.
- C. UL listed.
- D. Color Touchscreen: 14-inch display, minimum.
- E. Communications:
1. Supports Ethernet/IP communication.
 2. One USB port and one ethernet port, minimum.
- F. Minimum Functions:
1. OITs shall include all requirements for ‘Graphic Displays’.
 2. Access Controlled Function:
 - a. Operate facility.
 - b. Modify all setpoints and other operator adjustable values accessible from facility graphic displays.
 - c. Control functions associated with the alarms, including accepting alarms.
 3. Non-Access Controlled Functions:
 - a. View only system data includes, at a minimum:
 - 1) System and component status, configuration, and setpoints, as well as overall system operation.
 - 2) Alarm information.

2.02 OPERATOR WORKSTATION

- A. Provide at a minimum:
1. WTP Facility Control System: Two operator workstations for WTP Facility Control System located in Control Room.
 2. San Juan Lateral SCADA System: Two operator workstations for the San Juan Lateral SCADA System located in Control Room
- B. Allows user to perform following minimum functions:

1. Operate the facility.
 2. Operate remote sites/off-site equipment and systems, where required.
 3. Access display formats, data entry, initiation of control actions.
 4. Display and modify San Juan SCADA System programming, including control logic and graphic display programming.
 5. On-line trouble shooting of San Juan SCADA System logic and operation.
 6. Printing and exporting configuration information such as programming, datapoint identifiers database, control and graphics configurations, historical databases, and similar.
 7. View historical data and use trending.
 8. Backup system software while the equipment is online, without disrupting any functions.
- C. Includes a mouse and full function QWERTY keyboard.
- D. Minimum of two 24-inch monitors:
1. Touchscreen.
 2. Flat panel.
 3. LED .
 4. Resolution: 3840 x 2160 pixels, 4K UHD, minimum.
 5. Usable in all lighting conditions.
 6. Response rate: Not more than 5ms.
- E. DVD-RW drive.
- F. Minimum ports:
1. 4 USB Type-A ports.
 2. 2 USB Type-C ports.
 3. Serial port
 4. 2 network ports
 5. Additional ports as required for interconnecting workstation accessories.
- G. Provide hot plug redundant power supply.
- H. Display the Government's System Use Notification banner.
- I. Operating System: Microsoft Operating System.
- J. Other Software: As required.

2.03 ENGINEERING WORKSTATION

- A. At a minimum provide:
 - 1. Access controlled location at the San Juan WTP.
 - 2. One engineering workstation for the San Juan SCADA System.
- B. At a minimum allows the user to:
 - 1. Display and modify San Juan SCADA System programming, including control logic and graphic display programming.
 - 2. On-line trouble shooting of San Juan SCADA System logic and operation.
 - 3. Printing and exporting configuration information such as programming, datapoint identifiers database, control and graphics configurations, historical databases, and similar.
 - 4. View historical data and use trending.
 - 5. Backup system software while the equipment is online, without disrupting any functions.
- C. Includes a mouse and full function QWERTY keyboard.
- D. Minimum of two 24-inch monitors:
 - 1. Touchscreen.
 - 2. Flat panel.
 - 3. LED.
 - 4. Resolution: 3840 x 2160 pixels, 4K UHD, minimum.
 - 5. Usable in all lighting conditions.
 - 6. Response rate: Not more than 5ms.
- E. DVD-RW drive.
- F. Minimum ports:
 - 1. 4 USB Type-A ports.
 - 2. 2 USB Type-C ports.
 - 3. Serial port
 - 4. 2 network ports
 - 5. Additional ports as required for interconnecting workstation accessories.
- G. Provide hot plug redundant power supply.
- H. Display the Government's System Use Notification banner.

I. Operating System: Microsoft Operating System.

J. Other Software: As required.

2.04 SYSTEM STATUS DISPLAYS

A. Large industrial displays to provide information on status of plant operation and active alarms for operators and facility personnel.

B. Display screens at:

1. One wall mounted display located in the Lab.
2. Two wall or ceiling mounted displays located in the Control Room

C. Size displays appropriately for installation location and mounting method.

1. Provide large displays to accommodate distance viewing.
2. Size: 27-inches or larger.

2.05 PRINTERS

A. Provide a minimum of one color printer mounted in the control room.

1. Print alarms, logs, historical data, graphic displays, and similar.
2. Capable of printing 11-inch by 17-inch prints.

2.06 I/O

A. Provide I/O as required to meet specified functionality.

B. Provide 10 percent spare installed I/O modules of each size and type at each I/O location.

C. Non-redundant I/O cards are allowed, however, loss of a single I/O card shall not result in any treatment process-related systems being taken offline.

D. Input/output modules shall be manufactured by the same manufacturer as the PLC, and shall be intended to work with supplied PLC system and PLC controller.

E. Provide capability to install 20 percent additional future I/O cards at each I/O location. Includes connection capability, space on backplanes and sufficient margin in power and operating capacity for a true ‘plug and play’ installation of additional I/O cards.

2.07 AUTOMATION CONTROLLERS

A. Provide automation controllers as required to provide specified functionality.

B. Provide controllers from the Modicon M580 product line, manufactured by Schneider Electric, <http://www.schneider-electric.com>.

- C. Onboard RAM provided, as required to support device functionality. No less than 3 MB RAM shall be provided on any automation controller. No less than 6 MB total memory storage on the automation controller.
- D. Includes nonvolatile memory for user programming and datapoint identifier storage.
- E. Provide the automation controllers with a minimum of 40 percent spare capacity, including memory utilization, processing capacity, and other functions.
- F. PLC accessory components, including PLC chassis, backplanes, power supplies, I/O modules, Remote I/O modules, communication modules, etc., shall be supplied from the same manufacturer as PLC and shall be intended for use with the supplied PLC and PLC Controller.

2.08 SERVERS

- A. Provide servers as required to meet specified system functionality.
- B. Type: Rack mount for industrial server rack.
- C. CPU: Intel Xeon or equal.
- D. RAM: 32 GB, minimum.
- E. Provide rack mounted LED display and keyboard located in the industrial server rack with the servers to provide user interface to the servers. Provide switch or other user interface to switch display and keyboard between the servers where necessary.
- F. Provide hot plug redundant power supply.
- G. Provide a minimum backup redundancy and capability equivalent to that of the RAID 5 configuration for storage drives.
- H. For each server provide: Spare capacity of 50 percent of its base memory, server utilization, addressable points, and other factors that affect server utilization.
- I. Operating System: Microsoft Operating System.
- J. Other Software: As required.

2.09 SCADA SOFTWARE

- A. Utilize the EcoStruxure Hybrid DCS package developed by Schneider Electric, <http://www.schneider-electric.com> or equal with the following essential characteristics:
 - 1. Compatible with required SCADA system.
 - 2. Includes all required related packages, libraries, and software components.

3. System should be based on local data storage and software implementation and should not be cloud based or require internet connectivity.

2.10 AUTO DIALER

- A. Provide an auto dialer to provide remote alarm notification to facility personnel for critical alarms from the San Juan SCADA System.
- B. Built in Battery Backup Time: 20 hours.
- C. Minimum of 16 digital alarm inputs.
- D. Dialer Features:
 1. 16 telephone numbers minimum, each up to 60 digits in length.
 2. Phone numbers and Standard pulse dialing or touch Tone DTMF dialing are user programmable via system's keyboard or remotely via Touch Tone telephone.
 3. Group Alarm Calls – On alarm, system shall selectively call the correct phone number according to the specific alarm(s).
 4. Detect Telephone Line Fault and indicated condition with Front Panel LED.
 5. Automatically select Tone versus Pulse Dialing.
 6. Monitor Call Progress – Detect Busy and Ringing Signals, Abandon Call if busy, wait until phone is answered to Annunciate Voice Reports.
- E. Voice Message Recording and Playback Features:
 1. Two categories of speech message capability:
 - a. User Field Recorded Messages – User shall be able to record and re-record their own voice messages for each input channel and for the Station ID.
 - b. Permanent built-in messages.
- F. Alarm Criteria:
 1. Alarm on Closed Circuit.
 2. Alarm on Open Circuit.
 3. Run Time Meter.
 4. Status Only.
 5. Totalizer.
- G. Local and Remote Programming Capabilities, via keyboard entry or remotely from any Touch Tone telephone:
 1. Alarm Response Delay: Includes different delays being assignable to different alarms.
 2. Delay between Alarm Call-outs.

3. Alarm Reset Time.
4. Incoming Ring Response (Answer) Delay.
5. Number of Message Repetitions.
6. Autocall Test.
7. Remote Arming and Disarming of System.

2.11 ALARM MANAGEMENT SYSTEM

- A. Provide an alarm management system for the San Juan SCADA System in accordance with the requirements and recommendations in ISA 18.2 ISA 18.2.1, ISA 18.2.2, ISA 18.2.3, ISA 18.2.6 and ISA 18.2.7.
- B. Maintain a consistent approach to alarming, and establishment of alarm priorities across the entire system.
- C. Identify the alarms and develop alarm prioritization and alarm grouping schemes.
 1. Identify a hierarchy of alarm priorities and the criteria used to designate each level of the hierarchy.
 2. Group alarms based on area, or system, which the alarm impacts.
 3. Displays of alarm points shall include information on alarm prioritization and alarm grouping.
- D. Document the following for each alarm, in accordance with ISA 18.2:
 1. Alarm type.
 2. Alarm priority.
 3. Alarm group.
 4. Alarm setpoint.
- E. Provide integrated master alarm database with a single location to access all alarm points in the San Juan SCADA System.
- F. Provide alarm suppression capability, to help prevent alarm avalanches or repeated nuisance alarms. Include operator initiated and automatic logic based alarm suppression techniques.
- G. Time stamped logs for alarm history, event history, diagnostic and audit history for the alarm management system.

2.12 GRAPHIC DISPLAYS

- A. Provide graphic displays for the San Juan SCADA System with a minimum level of functionality in accordance with the requirements and recommendations in ISA 101.01 and the requirements in this Specification.

- B. San Juan SCADA System graphic displays are subject to approval by the COR.
- C. Spare capacity for an increase of up to 20 percent in the number of graphic pages.
- D. Designed to support user situational awareness, intuitive navigation, and intuitive system status and condition information.
- E. Support types of tasks and activities required of the operator.
- F. Separate graphic display screens shall be designed and provided for screens with different functions and locations.
- G. Use consistent design philosophy across graphic displays, however the specific functions desired for the individual screens may require unique arrangements of graphics and information.
- H. The San Juan SCADA System graphic displays shall incorporate a hierarchy of displays that provide a progressive exposure to detail. The following list provides a general guideline for the hierarchy of displays.
 - 1. The highest level display shall show the entire system within the operator's control. This display is intended to act as an overall indicator as to how the facility is running, by tracking key performance indicators.
 - 2. Displays for each process train, and the common systems.
 - 3. Displays shall consist of smaller, sectional system operations.
 - 4. Displays shall consist of detail information on the system operations.
- I. User interaction techniques shall be developed in accordance with the following guidelines:
 - 1. Clear, with graphics that are consistent in the method that they present similar information.
 - 2. Graphic functions: Standardized, intuitive, straight forward with minimal user manipulation.
 - 3. Error tolerance in user interaction for critical devices shall be included, with simple notification of error and effective methods for recovery.
- J. Develop a color scheme for the graphic displays for approval by the COR.
 - 1. Grey backgrounds for the graphics, with a minimal use of color in the graphics.
 - 2. Utilize color very specifically and consistently.
 - 3. Color alone shall not be the sole differentiator of an important condition or status.
- K. Include analog representation of important measurements, indicating their value relative to normal, abnormal and alarm conditions. Include embedded and formatted trends of important parameters.

- L. Include visual indication if an operator input field, or other operator initiated control function, has been disabled.
- M. Response time requirements for the graphic displays:
 - 1. Graphic displays shall take no longer than 3 seconds to appear when called up.
 - 2. Update live information on the display every 2 seconds unless the critical nature of the process information displayed requires more frequent updating.
- N. Provide feedback on the completion of an action or of the failure to complete an action.
- O. Component Depiction:
 - 1. Utilize standard shapes for components. Shapes should be simple and avoid unnecessary detail.
 - 2. Show status of components clearly and consistently.
 - 3. Include operating hours on operating and standby rotating equipment.
 - 4. Provide faceplates to display detailed component information and user input fields.
 - 5. Vessels and Tanks: Size shown shall be relative to the process importance of the component and also relate to its physical size.
 - 6. Process Lines: Limited number of line types and line thickness.
 - 7. Process Controllers:
 - a. Depicted as a physical entity on the graphics, with key values like set point, output, and control mode displayed.
 - b. Provide faceplate type displays for process controllers with detailed information and user input fields, where required, for the process controller.
- P. Text and Values:
 - 1. Do not display leading zeros when depicting values unless the value is less than 1.
 - 2. Differentiate live values from static text, for example by depicting live values with a color. Units of measure should not be depicted as a live value.
 - a. Units of measure should not be depicted as a live value.
 - b. Do not use scientific notation for live values: For example, 2.3×10^6 , or 1.2E5.
 - 3. Provide faceplates for live values with additional details, including point name.
- Q. Provide visual display of lockout/tagout application and when equipment is in 'Local' operation and not controlled from San Juan SCADA System.
- R. Provide faceplates for sequences, including automatic startup and shutdown.

- S. Provide dynamic permissive and interlock (first-out) lists accessible directly from control faceplates to allow the operator to quickly determine why the device does not have an operational permissive. Annunciate active trip conditions on the graphic, not just the condition that caused the trip (first-out condition).
- T. Alarms:
1. Alarms and indications of abnormal situations shall be clear, prominent, and consistently distinguishable.
 2. Design alarm display and interface in accordance with ANSI/ISA 18.2.
 3. Provide the following minimum alarm displays:
 - a. Alarm summary, including:
 - 1) Sorting by priority.
 - 2) Sorting by group.
 - 3) Sorting by time stamp.
 - b. Alarm status.
 - c. Alarm log.
 - d. Alarm identifier detail.
 - e. First-out.
 - f. Out-of-service alarm.
 - g. Suppressed alarm.
 - h. Alarm indication on process.
 - i. Alarm banner showing recent alarms.
 4. Displays shall provide the operator the ability to:
 - a. Silence audible alarm indicators (without acknowledging the alarm).
 - b. Acknowledge alarms.
 - c. Place alarms out of service (access controlled operation).
 - d. Modify alarm attributes (access controlled operation).
 5. Alarm indication in the process system graphic displays shall be performed using an alarm flag where color, indication, and the shape of the alarm flag are consistent with the priority of the alarm. A single color and shape shall be used universally for each priority level for the alarms.
 6. Alarm indication in the San Juan SCADA System shall have audible alarms associated with them.
 - a. Each alarm priority shall have its own unique alarm sound.
 - b. Sound level of the alarm shall be enough for easy detection, with a value of 15 dBA above background noise.

- c. Lower priority alarms can be muted during a higher priority alarm.
 - d. Include a time out function to automatically reinstate audible alarms after a significant duration of time has passed.
- 7. A process graphic shall visually and consistently identify alarm identifier in alarm, whether the alarm is acknowledged and the priority of the alarm.
- U. No animation except for specific alarm related graphics.

2.13 HISTORICAL ARCHIVING

- A. Provide historical archiving package with data storage via hard disk drives, or solid state drives with non-volatile memory.
- B. Perform data interface function for historian on a separate server from server performing long-term data storage function for historian.
 - 1. Data interface server: Provide data buffering between the WTP Control System components and server providing long-term data storage.
 - 2. Long term data storage server: Automatically update from data interface server on loss of connectivity of long-term data storage server.
- C. Store inputs, outputs, set-points, and logic developed points, at all times, even if not in alarm, in as compact a form as possible. Store operator actions, alarms, and returns to normal service.
- D. Point records include at minimum:
 - 1. Point description.
 - 2. Source time stamps.
- E. Record alarms in the system for later evaluation.
- F. Size system to handle required number of process points, and minimum and maximum, totals, runtimes, and similar. In addition, size system with a minimum of 40 percent spare capacity for future growth in process and logic points.
- G. Monitor critical analog control and monitoring points, as well as system diagnostic points at a frequency of no less than once per second.
- H. Data shall be stored at a high sample rate, providing a minimum 2 second sample rate.
- I. The system shall inform the operator when a storage disk is at a preset percentage full and needs to be changed, or if an invalid storage disk has been mounted.
- J. Historical retrieval functions shall be available on any Operator Workstation or Engineering Workstation connected to the San Juan SCADA System.

- K. Size data storage for the historical data collection for a minimum of 1 year without intervention.
- L. Provide data export to Microsoft Office compatible formats.
- M. Include real-time and historical trending software.

2.14 TRENDING

- A. Provide a trending package.
- B. Capable of allowing operator to create a trend or select from pre-established trend points/groups from the Operator Workstations or Engineering Workstations.
- C. Capable of displaying real time and historical data simultaneously.
- D. Allows generation of trends with multiple X or Y axes.
- E. Trend layout: Highly configurable including colors, legends, and title.
- F. Time span that can be presented on trend curves: Selectable.
- G. Provide data export to Microsoft Office compatible formats.
- H. Able to print to a networked printer.
- I. Trending built into the Control System graphics shall reference the historian data points where possible.

2.15 REPORTING

- A. Capable of generating user configurable reports from the San Juan SCADA System.
- B. Includes at a minimum:
 - 1. Equipment Status Reports
 - 2. Periodic Reports.
 - 3. Water Reports.
 - 4. Alarm and Event Reports.
 - 5. Operator configurable reports
- C. Provide data export to Microsoft Office compatible formations. Capable of printing to networked printer.
- D. Water Inflow Report:
 - 1. Water supplied to WTP.

2. Maximum and minimum values during time period including recording time.
Mean value during the time period.
 3. Adjustable operator-input duration.
- E. Water Effluent Report:
1. For each weekday in gallons or million gallons. Total effluent quantity for the week in gallons or million gallons.
 2. Maximum and minimum values during time period including recording time.
Mean value during the time period.
 3. Adjustable operator-input duration.
- F. Water Chemistry Report:
1. Maximum and minimum daily water chemistry measurements during time period and times values were recorded, the mean value during the time period, and the number of data points recorded.
 2. Maximum and minimum values during time period and times values were recorded as well as the mean value during the time period.
 3. Water chemistry data at the intake, clearwell and at key process locations in the water treatment plant.
- G. Chemical Usage Report:
1. For each weekday in pounds per day and pounds per million gallons water treated.
 2. Total chemical usage for the week in average pounds per day and average pounds per gallon water treated.
 3. Maximum and minimum daily chemical usage values during time period and times values were recorded as well as the mean value during the time period.
- H. Discharge Monitoring Report Information. Includes:
1. For the duration of the operator-input period, include following parameters with associated units:
 - a. Clearwell Effluent:
 - 1) Flow, 30-day average, in million gallons per day.
 - 2) Flow, daily maximum, in million gallons per day.
 - 3) pH, daily maximum, in standard units.
 - 4) Temperature, maximum weekly average, in degrees Celsius.
 - 5) Temperature, daily maximum, in degrees Celsius.
- I. San Juan Lateral Discharge Monitoring Report Information. Includes:
1. For the duration of the operator-input period, include the following parameters with associated units:

- a. For Each Facility or turnout with flow monitoring:
 - 1) Flow, 30-day average, in million gallons per day.
 - 2) Flow, daily maximum, in million gallons per day.
 - b. Total Flow out of the San Juan Lateral
 - 1) Flow, 30-day average, in million gallons per day.
 - 2) Flow, daily maximum, in million gallons per day.
- J. Automatic Daily Reports: Communications Error Report.
- K. Automatic Weekly Reports:
 - 1. Water Inflow Report.
 - 2. Water Effluent Report.
 - 3. Chemical Usage Report.
 - 4. Water Chemistry Report.
- L. Automatic Monthly Reports:
 - 1. Water Inflow Report.
 - 2. Water Effluent Report.
- M. Automatic Quarterly Report:
 - 1. Quarterly means for a 3-month, operator-input period.
 - 2. Discharge Monitoring Report Information.
- N. On-Demand Reports:
 - 1. All automatic reports:
 - 2. Inhibited Alarm Report. Provides list of all alarms which are inhibited at time report is requested.
 - 3. Deactivated Points Report. Provides list of all datapoints deactivated at time report is requested.
 - 4. Tag Reports. Identify current tag placements.
 - 5. Equipment Run Time Report.
 - 6. Equipment Status.
 - 7. Communications Status.

2.16 DIAGNOSTICS

- A. San Juan SCADA System components shall contain self-diagnostic programs to identify component degradation, malfunction, failure and faults.

- B. Provide documentation and feedback on potential causes of alarms related to operation of internal control system components, to be used to support trouble shooting of system components.

2.17 CONTROL

- A. Designed to aid the operator over the complete operating range of the facility while the controlled equipment is in service.
- B. Available and configurable parameters usable to control the equipment within manufacturer's limitations and enhance equipment life shall be incorporated into the system design.
- C. Provide modifiable setpoints and control variables, including operator adjustable setpoint deadbands, delays, alarm setpoints, and control setpoints modifiable in graphic displays:
 - 1. Include sufficient setpoints to allow operator adjustment of system through desired facility operating range.
 - 2. Values referred to as 'setpoints' in these Specifications: Modifiable from the graphic displays.
- D. Include a system of interlocks to:
 - 1. Prevent improper and hazardous actions of the control system.
 - 2. Provide maximum flexibility of system operation, maintenance, testing and calibration while providing safe operating conditions.
- E. Select control loops shall utilize double, or triple redundant measurement systems, based on the criticality of the control loops, the likelihood of failure of the field devices, and the existence of multiple measuring devices which are available at the facility.
- F. Provide logic to minimize the requirement for operator intervention.
 - 1. Designed to incorporate permissives, which ensure that prerequisite conditions for safe operation are met prior to allowing the equipment to start, open, or close, as appropriate.
 - 2. Incorporate interlocks to prevent equipment from operating in unsafe or potentially damaging conditions.
- G. Grouped Control Logic:
 - 1. Provided where multiple components are required to operate in a prescribed combination or sequence.
 - 2. Start or stop motors and open or close valves in a predetermined sequence without requiring operator action during the process.
 - 3. Provide a manual mode to allow step-by-step operator control in event of process interruption.

- H. Provide control logic to mitigate bad quality or out of range signals. Logic shall drive devices to a safe state, substitute a value, or hold last value as appropriate for the application.
- I. Fault checking shall be included and cause appropriate response, change over, and/or alarm.
- J. Upon initial system power up, or system power restoration, all systems shall be in manual with outputs in “off” or fail-safe mode.
- K. Provides rapid shut down and emergency shutdown of equipment.
- L. Utilize operator adjustable deadbands and other control strategies to limit equipment “hunting” and equipment or device unnecessary operation. Control setpoints shall include an operator adjustable deadband.
- M. Monitoring and Alarming:
 - 1. Display information received from end devices on graphic displays. Display information in units of process measurement where applicable.
 - a. Display at a minimum:
 - 1) Status alarms for control system equipment.
 - 2) Status alarms for electrical distribution system equipment.
 - 3) DC and UPS power system equipment.
 - 4) Security and fire protection systems.
 - 2. Alarming:
 - a. Provide for levels that indicate pre-trip and trip conditions in the process system.
 - b. For example, include Low, Low-Low, High, and High-High alarm conditions as applicable.
- N. Startup and Shutdown Sequences:
 - 1. Startup and shutdown sequences for the WTP.
 - 2. Startup and shutdown sequences for individual systems and process trains.
- O. Provide batching operation as an option for treating water through the plant.
- P. Motor Control:
 - 1. Provide resettable run time monitoring for each motor.
 - 2. Display motor status and run time on graphic displays. Where motors have an associated VFD display VFD status and operating speed.
 - 3. Automatic setpoint control for automated operation.

4. Manual operation with ability for operator to manually operate each motor. Where motors are operated via speed control, position-based control, or similar signal allows operator to enter motor operating parameters.

Q. Pump Control:

1. Automated pump operation.
2. Utilize lead-lag pump operation where applicable:
 - a. Allow operator to set which pumps shall operate as lead and lag.
 - b. Where more than two pumps: Designate multiple sequenced lag pumps with Operator adjustable operating setpoint for each pump.
 - c. Transition pumps between lead and lag pump assignment at operator settable time period, to allow equal wear on pumps.
 - d. Where lead pump is locked out, or otherwise set out of service in San Juan SCADA System the system shall automatically transition to alternate pump.

R. Valve Control:

1. Automated valve operation.
2. Display valve full-open and full-closed status on graphic displays and valve percent open when valves are modulated and are not operated in just a full-open or full-closed configuration.
3. Provide ability for operator to manually operate each valve to full-open and full-closed. Where valves are operated via modulating or position-based control allow operator to enter desired valve position as well as full-open and full-closed operation.

S. Instrumentation

1. Where redundant instrumentation, or feedback on same process variable exists, implement automatic fail over to operate the control system based on feedback from alternate instrument in event of instrument or feedback failure.
2. Alarm when redundant feedback from instrumentation on the same process variable varies from each other more than an operator settable range.

2.18 CONTROL MODES

A. Automatic / Manual Control:

1. These control modes shall be available for each component and process system, in the San Juan SCADA System.
2. Automatic:
 - a. Designed to eliminate the necessity for operator actions except for set point changes, biasing, and similar actions during normal operation.

- b. If a component, or system, is incapable of full automatic operation, due to lack of electronic control interfaces with physical components, or operating concerns for a specific piece of equipment, the control shall be automated to the extent possible.
 - c. Includes automatic start/stop capability to automatically start and stop equipment, including proper sequencing of component operation to prevent damage or premature aging.
- 3. Manual:
 - a. Allows the operator to step through operating sequences.
 - b. Allows manual operation of each component controlled from the San Juan SCADA System.
- 4. Designed to provide bumpless transfer between automatic and manual operation without the need for operator action.

2.19 TAGOUT

- A. Tagout functionality shall provide the operator with the following minimum control features:
 - 1. Ability to tagout all individual components.
 - 2. Ability to tagout process systems.
- B. Upon application of a tagout command the system shall automatically stop, or remove from service, the affected component or system.
 - 1. Perform operation regardless of the control mode that the system is in.
 - 2. The San Juan SCADA System shall include logic to automatically react to the application of tagout on a component, or system, by making appropriate adjustments or shutting down impacted systems.

2.20 SCADA INTERFACE

- A. San Juan Lateral SCADA System Remote Facility Interface:
 - 1. Design and provide an interface between the San Juan Lateral SCADA system for the Reclamation Remote Facilities listed in Section 01 86 29 – Communications Performance Requirements.
 - a. Display monitoring data from facilities on San Juan Lateral graphic displays.
 - a. Remotely control facility equipment via remotely adjusting setpoints and allowing operators at San Juan WTP Control room to manually operate equipment at the remote sites. Primarily includes ability to manually dispatch pump stations/pumping plants and adjust setpoints for automatic operation of those pump stations/pumping plants.

- b. Interface with local facility control systems at remote sites to pull monitoring data and send control signals.
- 2. Data Transfer:
 - a. Includes all monitoring signals from the San Juan Lateral SCADA System required to allow operation of the WTP facilities.
 - b. Coordinate specific data to be transferred between systems with Reclamation and facility installer. See Table 01 86 25A – Data Transfer- for preliminary list of datapoints.

Table 01 86 25A – Data Transfer

Location	WTP Monitor and Control Operations
River Intake and River Pumping Plant	<p>Remotely operate River Intake Gates, including the radial gates and the Lopac gates.</p> <p>Receive monitoring feedback from the intake gates and instrumentation.</p> <p>Monitor the travelling water screens.</p> <p>Adjust operating setpoints for River Pumping Plant Pump operation and manually dispatch pumps from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Receive site alarms.</p>
Reservoir	<p>Monitor reservoir levels.</p> <p>Receive site alarms.</p>
Morgan Lake Tank	Monitor Water Level
Pumping Plant 1	<p>Adjust operating setpoints for pumping plant pump operation and VFD operation, as well as manually dispatching the pumps and VFDs from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Receive site alarms.</p> <p>Add control algorithms at t San Juan SCADA System necessary for dispatching and adjusting pump operating points to interface with the water treatment plant and operation of the water treatment plant intake and process systems.</p>
Pumping Plant 2	Adjust operating setpoints for the pumping plant pump operation, as well as manually dispatching the pumps from the SCADA system.

Table 01 86 25A – Data Transfer

Location	WTP Monitor and Control Operations
	<p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Monitor chlorine residual values.</p> <p>Receive site alarms.</p>
Pumping Plant 3	<p>Adjust operating setpoints for the pumping plant pump operation, as well as manually dispatching the pumps from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Receive site alarms.</p>
Pumping Plant 4	<p>Adjust operating setpoints for the pumping plant pump operation, as well as manually dispatching the pumps from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Monitor chlorine residual values.</p> <p>Receive site alarms.</p>
Pumping Plant 7	<p>Adjust operating setpoints for the pumping plant pump operation, as well as manually dispatching the pumps from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Receive site alarms.</p>
Tohlokai Pumping Plant	<p>Adjust operating setpoints for the pumping plant pump operation, as well as manually dispatching the pumps from the SCADA system.</p> <p>Monitor pump status, other equipment status, and pumping plant instrumentation.</p> <p>Monitor chlorine residual values.</p> <p>Receive site alarms.</p>
Black Hat Tank	<p>Monitor tank levels.</p> <p>Receive site alarms.</p>

Table 01 86 25A – Data Transfer

Location	WTP Monitor and Control Operations
McKinley Surge Tank	Monitor tank levels. Receive site alarms.
Turnouts	Monitor flow feedback data and control closure of the flow control valves.
Shiprock Turnout	Monitor flow feedback data and control closure of the flow control valves Monitor chlorine residual values.

B. NTUA Monitoring:

- San Juan Lateral SCADA System shall transfer monitoring data points for NTUA owned facilities along the San Juan lateral through the interface with NTUA referenced in Section 01 86 29 – Communications Performance Requirements.
- Display facility monitoring points transferred from NTUA on the San Juan Lateral SCADA System graphic displays and store them in the system historian.
- Include the following minimum number of datapoints to be received from NTUA. Government will provide specific information on these datapoints will be provided later.
-

Table 01 86 25B – NTUA Data Transfer

Location	Quantity of Datapoints	Description
SJL WTP	250	Monitoring Datapoints from NTUA for NTUA facilities.

C. City of Gallup Monitoring

- San Juan Lateral SCADA System shall transfer monitoring data points from and send monitoring datapoints to the City of Gallup SCADA system for City of Gallup facilities connected to the San Juan Lateral through the interface with City of Gallup referenced in Section 01 86 29 – Communications Performance Requirements.
- Display the facility monitoring points transferred from City of Gallup on the San Juan Lateral SCADA System graphic displays and store them in the system historian.
- Include the following minimum number of datapoints to be received from City of Gallup, specific information on these datapoints will be provided later.

Table 01 86 25AC – NTUA Data Transfer

Location	Quantity of Datapoints	Description
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Tohlakai Pumping Plant	20	Monitoring Datapoints from City of Gallup for City of Gallup facilities.
Tohlakai Pumping Plant	20	Monitoring Datapoints to City of Gallup for City of Gallup facilities.

D. NTUA Enclosures

1. Provide space for future floor mounted equipment enclosures. Locate Space with front access to enclosures.
2. Server Rooms: Provide a minimum of two 24 inch long x 35 inch deep x 80 inch high spaces for locating future equipment enclosures.

2.21 TOHLAKAI PUMPING PLANT CONTROL MODIFICATIONS

- A. Modify existing Tohlakai control system to remove existing PLC, desk mounted computer and server. Replace with a PLC and OIT installation similar to local control system provided at Pumping Plant 3.
- B. Remove server, rack mount display, and desk mounted control station.
- C. Provide a new OIT located in Tohlakai Control Room, in the front panel of the control enclosure with the BOR owned PLC.
- D. Existing PLCs may be reused.
- E. Connect the OIT to the existing PLC and develop new graphic displays for the OIT.
- F. New control shall at a minimum contain the same functionality as the existing control installation
- G. Remove any logic and monitoring associated with the (future) 12B pumps that were to be located at the Tohlakai Pumping Plant, as well as for the chlorination storage system for the City of Gallup chlorine storage tank.
- H. Modify the chlorine controller and chlorine analyzer installation for the Reach 12B pipeline, so that the chlorine injection is permanently disconnected and it only measures the chlorine residuals.
- I. Connect the optical fiber cable installed for Reach 12.1/12.2 to the facility network. The optical fiber cable is currently terminated on a patch panel in the Tohalaki Control Room.

2.22 SECURITY

- A. Provide information security in accordance with the requirements in Section 01 86 30 – Information System Security Performance Requirements.

- B. Provide a protection mechanism to prevent unwanted changes to system BIOS across Contractor-supplied equipment. Utilize UEFI firmware where applicable.

2.23 NETWORK

- A. Coordinate with the requirements in Section 01 86 29 - Communications Performance Requirements and 01 86 30 – Information System Security Performance Requirements.
- B. Provide high speed data network between automation controllers, processors, servers, workstations, and similar.
 - 1. Network shall be designed to be scalable and facilitate future expansion of the system.
 - 2. Network design shall allow removal of any given component, including controllers, backplanes, communication cards, or I/O modules, associated with a given system partition without impacting communication to the other partitions.
 - a. Specifically, taking out of service controllers, backplanes, communications cards, or I/O cards associated with a specific piece of equipment cannot impact the San Juan SCADA System communication to components associated with a different piece of equipment.
 - 3. The network shall be designed to facilitate speed of communication between networked components and shall not introduce significant datalag.
 - 4. The network shall be designed to have 50 percent spare base system capacity without exceeding the performance limits.
 - 5. Provide fiber optic cable for connections between network switches and other locations where required.
- C. Provide capability for continual capture of netflow data between components for network performance and protocol analysis.
- D. Provide hardware, software, and design to provide fully functional bi-directional data links to other systems, components, PLCs, PACs, and networks as required.
 - 1. The system shall provide support for the following minimum communication protocols:
 - a. DNP 3.0 per IEEE 1815.
 - b. Modbus Serial (RTU and ASCII).
 - c. Modbus Network (TCP).
 - d. HART (as required).
 - e. Additional communication protocols as required to provide communication links to Contractor supplied equipment.
- E. Provide capability for continual capture of netflow data between components for network and protocol analysis.

F. Network Switches:

1. NDAA Compliant.
2. All network switches shall be managed industrial switches which provide the following minimum features:
 - a. Supports linear, star, and ring topology.
 - b. Loop prevention.
 - c. Resiliency.
 - d. Segmentation.
 - e. Prioritization.
 - f. Time synchronization.
 - g. Security and diagnostics.
 - h. Provide ports and connections, as required. Include a minimum of 20 percent spare ports of each type used at the switch.

2.24 PARTITIONING

- A. Provide partitioning to group control system components for each piece of equipment and common systems. Partitioning shall be performed in accordance with the following guidelines.
1. I/O shall be functionally partitioned to minimize disruption of facility operation upon failure of an I/O card or loss of communications between controllers.
 2. I/O, automation controllers, and similar shall be grouped by equipment and common facility systems, to facilitate staggered replacement and upgrade activities of control system components to the extent possible.
 3. Process variables that are redundant shall not be terminated on a common card.
 4. I/O of the same type associated with a specific component shall be grouped.

2.25 POWER

- A. Provide a power distribution system to all San Juan SCADA System components, including protection, to support full operation of the system. This distribution system shall include analog loop power supplies, and contact interrogation voltages for dry contact inputs.
- B. Provide redundant power feeds for all automation controllers, I/O modules, network and communication cards, servers, workstations, network switches and related components.
- C. The power feeds shall utilize the following voltages:
1. Primary: 120 VAC UPS battery backed up source.
 2. Backup: 120 VAC source, supplied from onsite generator.

- D. The power sources shall be hot swappable with seamless transition between the sources in the event of a power failure.
- E. Failure of an individual power supply, or transfer switch, shall not affect system operation. Failure of any power supply, or power feed, shall be alarmed in the San Juan SCADA System.
- F. Provide all fuses, circuit breakers, power supplies, transformers, and similar required to supply and transform power feeds at the desired voltage.
- G. UPS:
 - 1. Provide a UPS for the WTP. Where the distance between buildings requires additional circuit derating for distribution circuits from the UPS separate UPS's may be supplied.
 - 2. At a minimum supply the following loads from the UPS:
 - a. San Juan SCADA System.
 - b. Process equipment controllers.
 - c. Electrical distribution equipment controllers.
 - d. Controllers and components required for safe shutdown of the WTP.
 - e. Networking equipment.
 - f. Fiber equipment.
 - g. Access control and video surveillance system components not supplied with their own battery backup.
 - h. Telephone System.
 - 3. Sizing: Sized to provide at least 150 percent of full load current for the supplied equipment.
 - 4. Minimum outputs:
 - a. On line.
 - b. On battery.
 - c. Overload.
 - d. Trouble.
 - 5. Overload Capacity: 110 percent overload for 10 minutes.
 - 6. Supports hardwired power connection via terminals to the UPS.
 - 7. Batteries:
 - a. Leak-proof.
 - b. Hot-swappable, user replaceable.
 - c. Maintenance-free sealed Lead-Acid battery with suspended electrolyte.

- d. Sized to provide at least the maximum rated load current of the UPS system for at least 60 minutes.
- H. Circuit isolation and protection components:
 - 1. To provide a reliable power distribution system.
 - 2. Implements the guidelines included in the Partitioning article above.
 - 3. Minimum guidelines for circuit isolation and protection components.
 - a. Isolate power circuits into a control panel or control enclosure.
 - b. Distribution within the cabinet or control enclosure shall be fused, with power supplies individually fused.
 - c. Individual I/O shall be electrically isolated from each other and I/O for each card shall, at a minimum, be separately fused when supplied from the San Juan SCADA System power sources.
 - d. Separate power sources from the distribution panels shall be supplied for control components associated with different equipment or components associated with the common facility systems.
- I. The control system shall not be designed to use a wetting voltage below 24 VDC or 24 VAC. Higher voltages shall be used where required to support voltage and signal strength without resorting to measures like increased conductor sizing.

2.26 TIME SYNCHRONIZATION

- A. Provide time clock synchronization at all automation controllers, servers, network switches, and similar, such that time data stored or available in the San Juan SCADA System is synchronized to the same master clock.
- B. Minimum Component Requirements: Precision time satellite clock module manufactured by Rockwell Automation, Model 1756-TIME, or equal, with the following salient characteristics:
 - 1. Same manufacturer as PLC and plugs into PLC chassis.
 - 2. Receives GPS time signal.
 - 3. In accordance with IRIG-B time code.
 - 4. Precision Time Protocol (PTP) on ethernet port and chassis interface.
 - 5. Network Time Protocol (NTP) on ethernet port.
 - 6. Provide GPS latitude, longitude, and altitude information.
- C. Provide required peripherals and accessories, including antenna, grounding components, including antenna grounding and lightning arresting components, and required connectors and mounting apparatus.

2.27 PROGRAMMING CONTROL LOGIC

- A. Provide capability of programming control logic in the San Juan SCADA System using the following programming languages, in accordance with IEC 61131-3:
 - 1. Ladder Diagram.
 - 2. Function Block Diagram.
 - 3. Structured Text.
- B. Implement the majority of the control logic in the San Juan SCADA System using Ladder Diagram or Function Block Diagram, with only select areas implemented using the other methods if necessary.
- C. Emphasize readability and maintainability in the control logic implementation.
- D. Fully document all control logic developed for each facility.

2.28 COMPONENT LIFE CYCLE / SUPPORT

- A. Select components for San Juan SCADA System to maximize installation life-cycle and extend the time to replacement to the extent possible. Components shall be chosen with the following characteristics to help provide maximum life-cycle of the installation.
 - 1. Components from established product lines and manufacturers.
 - 2. Components from the most recent generation of equipment available from their manufacturer. Components where a later generation of equipment with a similar functionality is available shall not be acceptable.
- B. For the following components provide manufacturer guarantee for continued manufacture of the component for a minimum of three years beyond the completion date of the Work, and continued availability of the component, and support for the component for a minimum of ten years beyond the completion date of the Work.
 - 1. Automation Controllers.
 - 2. I/O cards.
 - 3. Network & Communication Cards.
 - 4. Backplanes and all components mounted on backplanes.
- C. Software packages used in the installation and for development of system graphics, control logic, and similar shall be up-to date and compatible with the most recent version of major operating systems, including Microsoft Windows.
- D. Provide software and firmware updates and patches throughout work until project acceptance or as approved by the COR.

2.29 ENCLOSURES

A. Enclosures:

1. Provide minimum NEMA 250 Type 1 or 12 enclosures for indoor installations and NEMA 250 Type 3R, 4 or 4X enclosures for outdoor installations. Identify and select equipment materials and enclosure types for the location where installed and the probability of exposure to water and hazardous or corrosive environments.
2. Provide 120 VAC LED or fluorescent light fixtures sufficient to illuminate the panel interior for each enclosure containing, automation controllers, I/O, or communication components.
3. Provide thermostatically controlled cabinet space heaters to control condensation in all cabinets not in a temperature controlled environment, or subject to condensation.
4. Lighting, enclosure heating, and convenience power outlets shall be supplied from a circuit and power source separate from all other enclosure components.
5. Enclosures design shall allow free and easy access to internal components.
6. Enclosures shall have louvers, or ventilation, as required to maintain the temperature of the equipment within manufacturer recommended range. The interior temperature shall be maintained at a minimum of at least 10 degrees Fahrenheit below the maximum operating temperature of the internal devices at the maximum ambient temperature.
 - a. Fans or other forced ventilation devices shall be provided as redundant pairs and shall be provided with temperature alarms.
 - b. Louvers and openings shall be equipped with screens and changeable filter material to prevent the entrance of dust, insects and rodents.
7. Doors shall be lockable.
8. Components, including meters, pushbuttons, control switches, displays, and similar required for normal operation and maintenance access shall be accessible from the front of the enclosure and shall not require access of internal components. This excludes the following components:
 - a. Communication links and interface ports.
 - b. Interface touchscreens located outside of the Control Room when in non-access controlled locations or exposed to environments that may damage the touchscreen.
9. All new enclosures shall include a minimum of 25 percent spare space.
10. Finishes: Manufacturer's standard finishes.

B. Provide copper ground bus in each section of an enclosure.

2.30 NETWORK RACKS

- A. Include:
 - 1. 19-inch Electronic Industries Association (EIA) rails.
 - 2. Depth, at a minimum, to accommodate deepest equipment to be mounted in rack with additional space to accommodate connections to rear of equipment.
 - 3. 25 percent spare space.
 - 4. Perforated lockable doors, front and rear.
 - 5. Power outlets.
 - 6. Cable management system.
 - 7. Leveling feet and bolt down brackets.
- B. Design shall allow free and easy access to internal components.
- C. Design racks to maintain components mounted in the rack within manufacturer's specified operating temperature range.
- D. Manufacturer's standard anti-corrosion coating.'

2.31 ARRANGEMENT

- A. All San Juan SCADA System components located outside of the Control Room shall be located in an enclosure.
- B. All San Juan SCADA System components located in the control room excluding OITs, workstations, printers, or displays shall be located in an enclosure or rack mounted.

2.32 OPERATOR'S CONSOLE AND FURNITURE

- A. Provide console installation for installing desk mounted equipment. Consoles shall provide sufficient space for mounting workstations and other computers located in Control Room and for facility operators to work.
- B. The following minimum equipment shall be located on the consoles.
 - 1. Security System Workstation, refer to Section 01 86 33 - Electronic Safety and Security Performance Requirements.
 - 2. San Juan Lateral Control System Workstations.
 - 3. WTP Control System Workstations.
 - 4. Two additional desktop computers (by others).
- C. Include barrier panel along back edge of console desk integrated into console design. Extending a minimum 6 inches above desktop.

- D. Integrated adjustable monitor holders to adjust location and height of monitors.
- E. Cabinets for under desk mounting of computers. Workstation computers shall not be located on top of the desk.
- F. Adjustable and removable over console light.
- G. Under desk cable management system for mounting power supplies and routing cables allowing a neat installation of cables. Cables running across floor or open-air drops from console shall not be allowed.
- H. Integrated power outlets located both above the desk and under the desk in locations accessible from equipment mounted in cabinets.
- I. Adjustable ergonomic desk chairs for a minimum of two people working at the consoles.
- J. Provide employees with an ergonomic workspace that includes sufficient desktop space to perform daily tasks at the location and maintain a neat appearance with equipment installed.

2.33 SOURCE QUALITY CONTROL

- A. Government reserves the right to inspect equipment at supplier's manufacturing plant prior to final testing.

2.34 SOURCE QUALITY TESTING

- A. Tests shall verify the ability of all equipment and components to perform their intended functions, such that when the equipment is shipped and correctly connected to external devices the complete system is operable as intended.
- B. Perform testing in accordance with the requirements Section 01 86 30 – Information System Security Performance Requirements.
- C. Factory Acceptance Testing:
 - 1. Perform Factory Acceptance Testing in accordance with the requirements ISA 62381.
 - 2. Support personnel provided during testing shall be familiar with the project and be capable of fixing problems identified during testing.
 - 3. Perform 100 percent I/O checkout, closed loop simulation of binary/modulating logic, and validations of all logic, displays, and reports.
 - 4. Test power systems.
 - 5. Test datalinks by setting up, or emulating the datalink device and, or datatable. Actual addresses and protocols shall be used in the testing. Includes testing of datalinks to external devices.

6. Verify validated software and hardware updates and patches are installed prior to start of functional testing.
7. Perform vulnerability scan and correct any deficiencies found: Use tool such as Nipper Studio, Nmap, Nessus, or equal.
8. All inputs and outputs shall be connected to a soft simulation and tested for functionality. The simulation software shall include:
 - a. Simulation of 100 percent of the I/O.
 - b. Simulation of all controlled analog process variables, such that a change in a controlled device shall result in a change in the correct direction for the process variable.
 - c. Simulation of all controlled “digital” variables such that a change in an output shall result in a change in a corresponding input.
 - d. The capability of simulating failures of equipment by forcing inputs on/off as needed.
 - e. All temporary logic changes shall be logged and tracked.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NFPA 70, IBC, and manufacturer’s requirements.
- B. Grounding: Provide grounding in accordance with Section 01 86 26 - Electrical Performance Requirements IEEE 1100.
- C. Cable and Wiring: Provide cable and wiring in accordance with Section 01 86 26 - Electrical Performance Requirements.
- D. Installation shall look complete and professionally done, all damage to enclosures or installation area shall be repaired and left in a finished condition.
- E. Remove and disable accounts not needed for normal or maintenance operation prior to delivery to the Government.

3.02 FIELD ADJUSTMENTS

- A. Provide in accordance with Section 01 91 16 - Facility Commissioning.

3.03 CONTRACTOR FIELD QUALITY TESTING

- A. Perform in accordance with Section 01 91 16 - Facility Commissioning.

END OF SECTION

SECTION 01 86 26
ELECTRICAL PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
1. MC96.1 Temperature Measurement Thermocouples
- B. Association of Edison Illuminating Companies (AEIC)
1. AEIC CS8 Extruded Dielectric Shielded Power Cables
Rated 5 Through 46 kV
- C. Building Industry Consulting Service International (BICSI)
1. BICSI-TDMM Telecommunications Distribution Methods
Manual (TDMM)
- D. Bureau of Reclamation (Reclamation)
1. RSHS Reclamation Safety and Health Standards
including revisions posted at [Safety | Bureau
of Reclamation \(usbr.gov\)](https://www.usbr.gov/safety/bureauofreclamation/)
 2. FIST 1-1 Hazardous Energy Control Program
available at:
https://www.usbr.gov/power/data/fist_publications/
[ml](https://www.usbr.gov/power/data/fist_publications/)
 3. FIST 5-14 Electrical Safety Program
- E. Illuminating Engineering Society (IES)
1. IES LH Lighting Handbook
- F. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C2 National Electrical Safety Code (NESC)
 2. IEEE 81 Guide for Measuring Earth Resistivity,
Ground Impedance, and Earth Surface
Potentials of a Grounding System

- | | | |
|---|-----------------|--|
| 3. | IEEE 142 | IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems |
| 4. | IEEE 1100 | IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment |
| G. Insulated Cable Engineers Association | | |
| 1. | ICEA S-87-640 | Optical Fiber Outside Plant Communications Cable |
| 2. | ICEA S-104-696 | Standard for Indoor-Outdoor Optical Fiber Cable |
| H. International Standards Association | | |
| 1. | ISO 11801 | Information Technology – Generic Cabling for Customer Premises |
| I. National Electrical Manufacturers Association (NEMA) | | |
| 1. | NEMA MG 1 | Motor and Generators |
| 2. | NEMA WC 57 | Standard for Control, Thermocouple Extension, and Instrumentation Cables |
| 3. | NEMA WC 70 | Power Cables Rated 2000V or Less for the Distribution of Electrical Energy |
| 4. | NEMA WC 74 | 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy |
| 5. | NEMA 250 | Enclosures for Electrical Equipment (1000 Volts Maximum) |
| J. National Fire Protection Association (NFPA) | | |
| 1. | NFPA 70 | National Electrical Code (NEC) |
| 2. | NFPA 70E | Standard for Electrical Safety in the Workplace) |
| 3. | NFPA 780 | Standard for the Installation of Lightning Protection Systems |
| K. Telecommunications Industry Association (TIA) | | |
| 1. | TIA 568.0-Rev.D | Generic Telecommunications Cabling for Customer Premises. |
| 2. | TIA 568.2-Rev.C | Balanced Twisted-Pair Telecommunications Cabling and Components Standards |

L. Underwriters Laboratories, Inc. (UL)

1. UL 1666-2007 Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. RSN 01 86 26-1, Construction Approval Drawings:
 1. Wiring diagrams including cable and conductor interface to components.
- D. RSN 01 86 26-2, Electrical System Calculations:
 1. Protective Device Coordination Study and development of settings for electrical protective devices, meters, and similar.
 2. Arc Flash Analysis

1.04 PROJECT CONDITIONS

- A. Determine total electrical power demands and general system voltage for the facility in accordance with NFPA 70.
- B. Coordinate sizing of utility service equipment with Government and local utility.
- C. Government will provide power from Navajo Tribal Utility Authority (NTUA) to the site on or before May 1, 2026.
- D. Contractor shall:
 1. Provide required loads for construction, Phase 1 and Phase 2 by June 1, 2024. Projected load lists and recommended service size for construction, Phase 1, and Phase 2 facility operation.
 2. Recommended location for service drops based on proposed site layout.
 3. Design and install means of providing power for construction, commissioning, and operation from the Utility point of service.

1.05 BASIC FUNCTION

- A. Provide electrical power with the appropriate characteristics.
 1. Capacity: Calculated in accordance with NFPA 70. Provide additional capacity to allow for final-capacity buildout.

2. Transformers: In accordance with NEC.
 3. Switchgear: In accordance with NEC
 4. Switchboards: In accordance with NEC.
 5. Panelboards: In accordance with NEC.
 6. Utility Revenue Meters: Provided by local utility.
- B. Emergency Power: As required by NFPA and other applicable codes.
- C. Standby Power:
1. As required by NEC.
 2. Standby Generator:
 - a. Sized for:
 - 1) Lighting.
 - 2) Controls
 - 3) HVAC: Sufficient to prevent equipment damage caused by temperature extremes.
 - 4) Safe shutdown of process equipment.
 - b. Generator Fuel Supply: Diesel.
 - c. Generator Sizing: Capacity to carry 110 percent of the loads identified within 1.05.C.2.a.2).
 - d. Run Time: 72 hours at 100 percent load.
 - e. Automatic Transfer Equipment: As required to provide power for required equipment.
 - f. Resistive Load Bank: Rating 50 percent of generator size, 1.0 power factor, minimum.
- D. Distribution: Power for equipment circuits, lighting circuits, receptacle circuits, and electrical utilization devices.
- E. Grounding and Lightning Protection:
1. Protect from lightning strikes in accordance with NFPA 780.
 2. Comply with requirements of NFPA.
 3. Comply with applicable recommendations of IEEE 142 and IEEE 1100.

1.06 PERFORMANCE REQUIREMENTS

- A. Design and construct in accordance with IEEE C2.
- B. Equipment designed and rated appropriately for site location and conditions.

- C. Ensure delivery of power at least 99 percent of the time. This requirement is independent of the local utility reliability.
- D. Allow for maintenance of power facilities as indicated in Section 01 81 05 – General Performance Requirements.
- E. Interior and exterior floor or slab mounted equipment to be provided with appropriately sized housekeeping pads to prevent inundation with water.
- F. Allowance for Change and Expansion:
 - 1. System Capacity:
 - a. Provide infrastructure to support full treatment plant buildout required to meet Phase 2 flow.
 - b. Extrapolate electric utility service requirements using equipment selected for this contract with no allowance for future efficiency improvements in the electrical demands of water treatment systems.
 - 2. Spare Capacity:
 - a. Load: 5 percent, minimum.
 - b. Rated Capacity: 5 percent, minimum.
 - c. Branch Circuits: Wiring with sufficient capacity to accommodate future growth and renovation without major rewiring.
 - d. Number of Additional Circuits: 10 percent, minimum.
 - e. Spare Conduits: 15 percent, minimum.

1.07 SERVICE AND DISTRIBUTION

- A. Main Electrical Service:
 - 1. Utility will provide a service and metering equipment on east side of WTP property. Actual location may be negotiated during the design process to optimize electrical distribution system design.
 - 2. The utility equipment area will be located outside the site fence.
 - 3. NTUA will provide a transformer rated for site utilization voltage.
 - a. Maximum: 4,160 volts.
 - 4. Contractor shall coordinate the transformer size, location, and dedicated area with the Government and NTUA based on the Contractor's facility design.
 - 5. Contractor shall extend feeder from utility service equipment to supply the facility.
- B. Design and construct system to convey power from the point of service.
- C. Facility Utilization Voltage: Determine based on overall facility power demands.

- D. Distribution Circuit Configuration: Radial circuit arrangement.
- E. Primary Unit Substation:
 - 1. Determine necessity of a primary unit substation based on system requirements.
 - 2. Locate in dedicated electrical equipment enclosure easily accessible by emergency response personnel.
 - 3. Ensure applicable altitude de-rating factors are applied.
- F. WTP Switchgear and Motor Control Center: Locate in dedicated electrical equipment room.
- G. Motor Control:
 - 1. Provide centers for process equipment where practical. Stand-alone motor controllers are acceptable based on equipment requirements and construction.
 - 2. Provide motors with appropriate protective, control, and indicating devices.
- H. Lighting and appliance panelboards separate from panelboards serving equipment.
- I. Locate in closets and electrical rooms.
- J. Provide industrial grade enclosures.

1.08 BRANCH CIRCUITS

- A. Conductors and cables from panelboards to fixtures, wiring devices, and mechanical equipment.
- B. Wiring devices, including: Receptacles, junction boxes, wall switches, and wall plates.
- C. Comply with code and UL listed or labeled.
- D. Design wiring and protective devices so local overloads do not affect unrelated areas or systems.

1.09 LIGHTING

- A. Exterior Lighting:
 - 1. Follow Internal International Dark-Sky Association recommendations, guidelines and policies.
 - 2. Lighting for exterior of building, walkways, parking areas, and flag pole.
 - a. Light fence perimeter only at entrance gates for a minimum of full road width as well as access gates.

- b. Provide manually-controlled lighting for the exterior delivery areas to view sides of the largest delivery vehicle, fill connections, and emergency containment systems components.

B. Lighting levels per IES LH.

1.10 METERING AND MONITORING

- A. Local and remote monitoring, in a single location.
- B. Provide an interface between electrical monitoring and building automation system.

1.11 ENERGY GENERATION EQUIPMENT

- A. Generators and Fuel Supplies: Located out-of-doors. Locate engine-generators away from building HVAC air intakes.

1.12 GROUNDING

- A. Design and provide grounding system for facility in accordance with IEEE 81, 142 and 1100.
- B. Fence:
 - 1. Ground electrically continuous fences.
 - 2. Do not provide additional grounding for fences grounded in accordance with requirements for lightning protection.

1.13 ELECTRICAL HAZARDS

- A. Design in accordance with NFPA standards that apply to the occupancy, application, and design.
- B. Control access to spaces housing electrical components and allow access only by qualified personnel.
- C. Provide electrical distribution equipment with locking cabinets, doors, and panels when located in public areas.
- D. Comply with NFPA 70 requirements for hazardous locations applications.
- E. Hazardous Locations: Comply with NFPA.
- F. Perform an arc flash hazard analysis and provide arc flash hazard warning labels as required by NFPA 70E, RSHS, FIST 1-1 and 5-14.

1.14 TRANSFORMER

- A. Service Transformers: Insulation Class 220 degrees Celsius.

- B. General-Purpose Transformers: Insulation Class 220 degrees Celsius.

1.15 ENCLOSURES

- A. Appropriate for use.
- B. Enclosures for equipment < 1000V, in accordance with NEMA 250.
- C. Electrical and instrumentation cabinet enclosure filtration:
 - 1. Removable filters.
 - 2. Install filters to allow for filter replacement without the use of tools and without the need to remove other equipment that interferes with filter removal.
 - 3. Install filters away from unprotected high voltage wiring.
 - 4. Ensure a tight seal between the cabinet and the filter.

1.16 WIRE CONNECTIONS

- A. Make connections at device terminals or terminal blocks. Maximum number of wires not to exceed UL listing for the terminal.
- B. Install incoming 120-volt branch circuits on adjacent terminal block terminals.
- C. Install ring tongue connectors for terminations at terminal blocks and electrical devices. Use pin-type terminal connectors where use of ring tongues is not practical such as terminations at selector switches, pushbuttons, indicating lamps, and auxiliary relays.
- D. High density terminal blocks are not permitted for connection of circuits 120-volt and higher.
- E. Terminal connectors are not required for PLC and low voltage applications where high density terminal blocks are installed.
- F. Wiring device connections to solid conductor “premise wire” do not require terminal connectors.
- G. Wire splices are not acceptable.
- H. Enclosure Wiring:
 - 1. Install wiring in a neat and workman like manner with wireways provided inside enclosures and cable ties used to secure all conductors installed outside wireways.
 - 2. Support incoming and outgoing cables in enclosures.
 - 3. Keep exposed wiring to a minimum.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE ENTRANCE

- A. Underground service entrance.

2.02 ELECTRICAL ENERGY GENERATION

- A. Generator Sets:
 - 1. Engine Type: Four-cycle.
 - 2. Starting and Control Batteries:
 - a. Lead-acid (flooded cell).
 - b. Nickel cadmium.
 - 3. Engine Cooling: Liquid-cooled engine mounted radiator.

2.03 SERVICE AND DISTRIBUTION

- A. Distribution Transformers for Ordinary Loads: Use general purpose transformers.
- B. Primary Service:
 - 1. Types of Equipment: Medium-voltage switchgear.
 - 2. Main Devices: Vacuum circuit breakers.
 - 3. Protection Devices: Multi-function relay.
 - 4. Busbars: Copper. Plating determined at the discretion of the designer.
- C. Transformers:
 - 1. Dry type.
 - 2. Secondary-unit substation.
 - 3. Pad-mounted.
 - 4. Indoor distribution.
- D. Service and Distribution Feeders:
 - 1. Conductors: Copper.
 - 2. Provide wire markers.
- E. Main Service Equipment:
 - 1. Types of Equipment:
 - a. Low voltage switchgear.
 - b. Switchboards.
 - c. Distribution panels.

- d. Motor control centers.
 - 2. Main Devices:
 - a. Electrically operated power circuit breakers.
 - b. Molded case circuit breakers.
 - 3. Branch Devices: Circuit breakers.
 - 4. Busbars: Copper. Plating determined at the discretion of the designer.
- F. Branch Circuit Panelboards:
- 1. Circuit Breakers: Molded case circuit breakers.
 - 2. Busbars: Copper. Plating determined at the discretion of the designer.
- G. Medium Voltage Motor Control Centers:
- 1. Main Devices:
 - a. Vacuum contactors.
 - b. Reduced voltage soft starter or variable frequency drive.
 - c. Power factor correction equipment.
 - 2. Protection Devices: Multi-function relay/motor protection relay.
 - 3. Busbars: Copper. Plating determined at the discretion of the designer.
- H. Low Voltage Motor Control Centers:
- 1. Overcurrent Protectors:
 - a. Circuit breakers.
 - b. Motor circuit protector (MCP).
 - 2. Busbars: Copper. Plating determined at the discretion of the designer.

2.04 RACEWAYS

- A. Below Grade: PCRS conduit or PVC Schedule 80 conduit.
- B. Exterior, Exposed: GRS conduit.
- C. Interior, Exposed: Cable Tray, Wireway, or GRS conduit.
- D. Interior, Concealed: GRS conduit.
- E. Electrical metallic tubing (EMT) may be used in areas of commercial type settings, such as office-type buildings/spaces. Above grade only.
- F. Aluminum rigid conduit may be used in exposed areas of buildings, except where chemical compatibility would degrade material. Above grade only.

G. Provide raceway markers.

2.05 CABLES

A. General:

1. Install per manufacturer's instructions and do not exceed manufacturers' cable pull tensions.
2. Block cable opening in conduits and sleeves with silicone-foam, fire-retardant material in accordance with NFPA 70.
3. Rated for Installed configuration in installation locations, including plenums or NFPA 70 Class 1, Class 2 and Class 3 hazardous areas, where applicable.
4. UL listed and labeled.
5. Cable and Conductor Markers:
 - a. Text to be machine or computer generated. Hand written text is not acceptable.
 - b. Print cable or conductor designations as shown on approved drawings.
 - c. Tag cables at each end.
 - d. Cable Markers:
 - 1) Provide cable with cable marker. Print cable designation.
 - 2) Attach tags to cable with self-locking tie wraps or cable ties.
 - e. Conductors Markers:
 - 1) Provide individual conductors of multi-conductor control cable and instrumentation cable with conductor marker. At a minimum, print conductor designation.
 - 2) Self-laminating-vinyl type or heat-shrink type.

B. Medium Voltage Power Cable:

1. Utilized for cable operating at voltages above 600 volts.
2. Voltage rating of the insulation above maximum operating voltage of the cable.
3. Conform to NEMA WC-74 and AEIC CS8, where applicable.

C. 600V and Below Power Cable:

1. Single-conductor power cable in accordance with NEMA WC 70. Multi-conductor cable in accordance with NEMA WC 57.
2. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC, including derating of the cable ampacity for conditions where the cable shall be installed.
3. Type:

- a. Single-conductor or multi-conductor, non-shielded type.
 - b. Suitable for wet or dry location, indoors or outdoors.
 - c. Suitable for installation in above grade or underground raceway.
4. Insulation Type: THHN/THWN or XHHW.
5. Flame Test Rating: IEEE 1202 or UL 1685
- D. Control Cable:
 1. Utilized for cable operating voltages below 600 volts.
 2. Single-conductor cable in accordance with NEMA WC 70. Multi-conductor cable in accordance with NEMA WC 57.
 - a. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC, including derating of the cable ampacity for conditions where the cable shall be installed.
 3. Type:
 - a. Single-conductor or multi-conductor, non-shielded type.
 - b. Suitable for wet or dry location, indoors or outdoors.
 - c. Suitable for installation in above grade or underground raceway.
 4. Insulation Type: THHN/THWN or XHHW.
 5. Flame Test Rating: IEEE 1202 or UL 1685.
- E. Instrumentation Cable:
 1. Minimum 300-volt rated insulation.
 2. Cable in accordance with NEMA WC 57.
- F. Building Premises Wire:
 1. Purpose: For connection of lighting system and power receptacle components below 277 volts.
 2. Minimum 600-volt rated insulation.
 3. Single, solid conductor in accordance with NEMA WC 70.
- G. Thermocouple Extension Cable:
 1. Purpose: For use with thermocouples.
 2. Minimum 300-volt rated insulation.
 3. Cable in accordance with NEMA WC 57.
- H. Telecommunications Cable:
 1. Purpose: For supervisory computer control, voice communication, data transfer and logic level signals. Fiber, Ethernet, coax, and similar.

2. General:
 - a. Provide cabling rated for the installation purpose it is installed (indoor, outdoor, plenum, riser, and similar) in accordance with NFPA 70.
 - b. Install in accordance with BICSI-TDMM, TIA-568, NFPA 70, and UL standards as applicable.
3. Fiber Optic Cable:
 - a. Provide cable in accordance with ICEA S-87-640, and ICEA S-104-696, as appropriate.
 - b. At a minimum cable shall be rated for wet or dry applications, and for installation in cable trays.
 - c. Loose tube.
 - d. Gel-free.
 - e. Rod Filler: Central dielectric strength member.
 - f. Cable Core: Symmetrically stranded buffer tubes around dielectric central member.
 - g. UL listed, where available.
 - h. Color Coding: Per TIA -598.
 - i. Flame-retardant jacket.
 - j. Attenuation:
 - 1) Maximum attenuation as required to support application.
 - 2) Single Mode Fiber Optic Cable:
 - a) Max attenuation of 1310/1383/1550 nanometer wavelength light: Less than 0.5/0.5/0.4 decibels per kilometer.
 - 3) Multi-Mode Fiber Optic Cable: Max attenuation per ISO 11801 requirements for OM3 fiber.
 - 4) Directly proportional to cable length for an arbitrary cable length section after steady-state conditions are reached.
 - k. Provide a minimum of 50 percent spare fibers in each cable with no fewer than two spare fiber pairs in any cable.
 - l. Fire Retardant: OFNR, in accordance with UL 1666.
 - m. Connect fiber cables and connect to termination/patch/splice panel.
 - n. Do not splice fiber optic cables outside of termination/patch/splice panels.
 - o. Terminate fiber optic cable routed to control panels, or other electrical or control enclosures, on fiber optic patch panels, and not on individual end devices. All fibers in the cable shall be terminated on the patch panel, including spare or unused fibers.

4. Fiber Optic Patch Cable:
 - a. Length: As required.
 - b. Connectors: As required to connect to fiber optic equipment.
 - c. Loss per connector: Less than 0.5 decibels.
5. Category 3 (CAT 3) Cable:
 - a. Provided per TIA-568-C.2.
 - b. Conductors:
 - 1) Copper.
 - 2) Minimum Conductor Size: Minimum size 22 AWG.
6. Category 5e (CAT 5e) and Category 6 (CAT 6) cable with RJ45 connections:
 - a. Provide in accordance with TIA 568.
 - b. Cable jacket: Resistant to abrasion, moisture, weather, and environmental cracking.
 - c. Type:
 - 1) UL listed CMR cable, unless otherwise required for installation conditions.
 - 2) Single twisted pair, or multiple individual twisted pairs. Quantity of pairs as required for application.
 - 3) Suitable for installation in above grade or underground raceways.
 - d. Flame Test Rating: UL 1666 Riser.
7. Coaxial Cable:
 - a. Provide in accordance with TIA 568.
 - b. Cable jacket: Resistant to abrasion, moisture, weather, and environmental cracking.
8. Special Purpose Cable: With the approval of the COR.

2.06 LIGHTING

- A. Interior Lighting:
 1. Occupancy sensors.
 2. Office Areas: LED.
 3. Process Area: Industry standard suitable for environment.
- B. Emergency Lighting: Self-contained battery-powered lighting units.
- C. Exterior Lighting Control: Photocell for continuous operation fixtures.

PART 3 EXECUTION

3.01 GENERAL

- A. Install in accordance with approved drawings and submittals.
- B. Provide safety signs and arc flash hazard risk labels on equipment in accordance with NFPA and OSHA requirements.

END OF SECTION

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SECTION 01 86 27
INSTRUMENTATION PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. ANSI
1. ANSI MC96.1 Temperature Measurement Thermocouples
- B. The American Society of Mechanical Engineers (ASME)
1. ASME B1.20.1 Pipe Threads, General Purpose, Inch
2. ASME B31.3 Process Piping
3. ASME B31.9 Building Services Piping
4. ASME B40.100 Pressure Gauges and Gauge Attachments
5. ASME B40.200 Thermometers, Direct Reading and Remote Reading
6. ASME MFC-1 Glossary of Terms Used in the Measurement of Fluid Flow in Pipes
7. ASME MFC-3M Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi
8. ASME PTC 19.2 Pressure Measurement
9. ASME PTC 19.3 Temperature Measurement
10. ASME PTC 19.3TW Thermowells
11. ASME PTC 19.5 Flow Measurement
- C. ASTM International (ASTM)
1. ASTM A36/A36M Carbon Structural Steel
2. ASTM E230 Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
3. ASTM A26915a Seamless and Welded Austenitic Stainless Steel Tubing and Accessories
4. ASTM E1137 Industrial Platinum Resistance Thermometers

- D. Electrical Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 1050 Guide for Instrumentation and Control Equipment Grounding in Generating Stations
 2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment
 3. IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
 4. IEEE C62.42 Guide for the Application of Component Surge – Protective Devices for Use in Low-Voltage [Equal to or Less than 1000 V (ac) or 1200 V (dc)] Circuits
 5. IEEE C62.43 Guide for the Application of Surge Protectors Used in Low-Voltage (Equal to or Less than 1000 Vrms or 1200 Vdc) Data, Communications, and Signaling Circuits
 6. IEEE C62.72 Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or Less) AC Power Circuits
- E. International Society of Automation
1. ISA 5.1 Instrumentation Symbols and Identification
 2. ISA 7.0.01 Quality Standards for Instrument Air
 3. ISA 20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves
 4. ISA TR20.00.01 Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations – Updated
 5. ISA 50.00.01 Compatibility of Analog Signals for Electronic Industrial Process Instruments
- F. International Standards Organization (ISO)
1. ISO 5167-1 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full – Part 1: General Principles and Requirements

2. ISO 5167-2 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full – Part 2: Orifice Plates
 3. ISO 5167-3 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full – Part 3: Nozzles and Venturi Nozzles
 4. ISO 5167-4 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full – Part 4: Venturi Tubes
 5. ISO 5167-5 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full – Part 5: Cone Meters
- G. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
1. MSS SP-97 Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends
 2. MSS SP-99 Instrumentation Valves
- H. National Electrical Manufacturers Association (NEMA)
1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- I. Navajo Nation Environmental Protection Agency (NNEPA)
1. Primary Drinking Water Regulations
- J. State of New Mexico
1. 20.7.10 NMAC Drinking Water Regulations
 2. New Mexico Environment Department (NMED) Construction Program Bureau “Recommended Standards for Water Facilities”

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 - Electrical and Control Drawings and Data, Section 01 33 28 - Process Flow Diagrams and Piping and Instrumentation Diagrams, and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

- C. RSN 01 86 27-1, Construction Approval Drawings:
 - 1. Panel and Enclosure Wiring Diagrams.
- D. RSN 01 86 27-2, Factory Calibration Sheets.
- E. Include Instrumentation in Operation and Maintenance Manual submittals required in Section 01 81 05 - General Performance Requirements.

1.04 DESIGN REQUIREMENTS

- A. Provide instrumentation in accordance with industry standards for water treatment plants.
- B. Instrumentation System requirements for process system instrumentation. Does not apply to:
 - 1. 01 86 19 – HVAC Performance Requirements.
 - 2. 01 86 13 – Fire Suppression Performance Requirements.
- C. Instrumentation System and related modifications in accordance with the contract documents and the requirements in ASME B31.3, B31.9, ASME MFC 1, ASME PTC 19.2, ASME PTC 19.3, ASME PTC 19.5, IEEE 1050, IEEE 1100 and applicable NNEPA and State of New Mexico regulations.
- D. Includes transmitters, local indicators, gauges, switches, transducers, encoders, sensors, instrument taps, instrument tubing, instrument piping, sensing lines, instrument valves, instrument cabinets, diaphragm seals, annular seals, and other applicable items.
- E. Instrumentation and components based on the system hazardous area rating for the location where they are installed.
- F. Design, identification, arrangement and layout of system components.
- G. Develop instrument required accuracy, set points and configuration based on requirements for water treatment plant (WTP) controls and operation.
- H. Design to support online and offline modification, and component replacement with a minimum impact to the system.
- I. Component Naming and Designations: In accordance with Section 01 81 05 - General Performance Requirements.
- J. Electronics shall be immune from false operation or failure from high voltage, high frequency transients which may be conducted in the control circuitry and power supplies.
 - 1. Provide surge protection for instruments and other components that could be damaged by electrical surges.
 - 2. Take special precautions to limit exposure of sensitive electronic circuits connected to remote equipment.

3. Design system to meet the requirements, guidelines and recommendations of IEEE 1050, IEEE 1100, IEEE C62.41.1, IEEE C62.42, IEEE C62.43, and IEEE C62.72.
- K. Electronics shall be insensitive to radiated high frequency interference such as that coupled from portable radio transmitters (typically 5 W output in the 150-800 MHz band) operating within 2 meters of the equipment with cabinets or protective covers closed or in place.
- L. Limit use of pneumatic controls. Use only where other conventional alternatives are not available.
- M. Instrument electrical housings shall be a minimum of dustproof and moisture-proof, in accordance with NEMA 250 Type 4 or NEMA 250 Type 4X requirements.
- N. Similar types of instrumentation shall be supplied from the same manufacturer. Minimize the different types and models utilized.
- O. Protect digital displays from direct sunlight where possible.
- P. Minimum WTP Facility Instrumentation:
 1. Provide instrumentation for the following functions:
 - a. Detect abnormal operating conditions in the process systems.
 - b. Protect equipment and facility from damage.
 - c. Support maintenance activities.
 - d. Provide sufficient feedback to the WTP Facility SCADA system to ensure that the WTP Facility is operating within desired parameters, operating setpoints, and compliance requirements.
 - e. Provide sufficient feedback for automated operation of the process systems.
 - f. Support facility operation and monitoring through WTP Facility SCADA system with operators located in a centralized control room.
 2. Provide Flowmeters, Water Quality Analyzers, Level Measurements, and Leak Detection Systems where specified and required by process system design, and required to monitor WTP performance
 3. Flowmeters:
 - a. Monitor Raw Water flow rate by an incoming signal from PP1. Refer to and Section 01 86 25 – System Control and Monitoring Performance Requirements.
 - b. Provide a flow meter on the Treated Water piping downstream of the WTP Treated Water pump station. Refer to Section 01 89 44 – Pre-Treated and Treated Water Pump Performance Requirements.

- c. Provide a location for installation of a future flowmeter for the Shiprock Turnout.
 - d. Provide flow meters on critical treatment process systems, including each treatment train and recycle lines.
 - 4. Locate instrumentation, so that WTP operation is not impacted by isolating redundant process trains or redundant equipment.
- Q. Instrumentation with digital or electronic output shall provide feedback to WTP Facility SCADA System on process values measured by instrument and, where available, on status of instrument.

1.05 EXTRA MATERIALS

- A. Manufacturer-recommended spare parts.
- B. Replace spare parts used during the installation, testing, and commissioning process to provide a complete set of spare parts.
- C. Handheld communication device(s) for use with smart transmitters to perform maintenance functions. Supply a minimum of one handheld communication device capable of communicating with each instrument that supports setup, maintenance or calibration activities via handheld communicator.

PART 2 COMPONENTS

2.01 INSTRUMENTATION SIGNALS

- A. Instrumentation control and signal connections shall be supplied in accordance with the requirements in ISA 50.00.01, except where otherwise specified.
- B. No primary sensor full-scale signal level, other than thermocouples, shall be less than 10 mV or greater than 125 V.
- C. Analog signals for electronic instrument systems shall be 4 to 20 mA direct current.
- D. Communication links shall be in accordance with the requirements in Section 01 86 25 - System Control and Monitoring. The use of HART communication is acceptable.
- E. Provide signal converters and repeaters where required.

2.02 TRANSMITTERS AND ANALYZERS

- A. Transmit measured values back to the WTP Facility SCADA system. Values may be supplied to the WTP Facility SCADA system directly from the instrument, or through local control panels or control system for the sub-system.

- B. Transmitters and analyzers shall have an LCD display with a scale appropriate for the full instrument range located near the point being measured at an accessible location.
- C. Include onboard diagnostics.

2.03 WATER QUALITY ANALYZERS

- A. Local Indication: Provide digital indicating type transmitters with local display to supply local indication wherever any analyzers are located.
- B. At a minimum provide a turbidity analyzer, Total Organic Carbon (TOC) Analyzer, UV254 Analyzer, pH Analyzer, Chlorine Analyzers, and Alkalinity Analyzer.

2.04 ELECTRICAL CONNECTIONS

- A. Power distribution system to Instrumentation System components:
 - 1. Protection, to support full operation of the system.
 - 2. Power supplies, transformers, and similar.
 - 3. Analog loop power supplies and contact interrogation voltages for dry contact inputs.

2.05 NAMEPLATES

- A. Refer to Section 01 81 05 - General Performance Requirements.

2.06 SOURCE QUALITY CONTROL

- A. Government may inspect equipment at supplier's manufacturing plant prior to shipment.
- B. Factory calibrated, with certified factory calibration sheets provided for verification
- C. Notify COR 30 days prior to shipping.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with manufacturer's recommendations and industry practice unless otherwise specified.
- B. Group and arrange Instrumentation System components throughout the facility to ensure correct operation and, to the extent possible, ease of access.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. Perform in accordance with Section 01 91 16 - Facility Commissioning.

END OF SECTION

SECTION 01 86 28

INDUCTION MOTOR PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 112 Test Procedure for Polyphase Induction Motors and Generators
 2. IEEE 110 Test Procedure for Single-Phase Induction Motors
- B. National Electrical Manufacturers Association (NEMA)
1. NEMA MG 1 Motors and Generators
 2. NEMA Premium General Specification for Consultants, Industrial and Municipal: NEMA Premium Efficiency Electrical Motors

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PROJECT CONDITIONS

- A. Designed for installation in accordance with applicable service conditions.

1.05 PERFORMANCE REQUIREMENTS

- A. Provide motors of a sufficient size for the duty to be performed while not exceeding the full-load rating when the driven equipment is operating at specified capacity under the most severe loading conditions.
- B. Provide premium efficient motors in accordance with NEMA Premium. Exceptions will be permitted where premium efficient motors are not manufactured for specific applications.

PART 2 PRODUCTS

2.01 RATINGS AND GENERAL REQUIREMENTS

A. General:

1. NEMA Premium efficiency, induction, designed for the duties specified.
2. Enclosure Type: Applicable to service location.
3. Horsepower Rating: Sufficient to carry continuously the maximum possible pump load developed under specified conditions without benefit of the service factor. Horsepower rating to be value listed in NEMA MG 1.
4. Temperature Rise: In accordance with NEMA MG 1.
5. Suitable for WTP elevation.
6. Starting Methods:
 - a. Full-voltage across-the-line.
 - b. Reduced voltage.
 - c. Variable frequency drive. Motors using this starting method shall be rated for inverter duty.
7. Starting Capability: In accordance with NEMA MG 1.
8. Nameplate Marking: As listed in NEMA MG 1 for alternating-current motors.
9. Suitable for installation in the required location with sufficient access and working space to permit ready and safe operation and maintenance.
10. Coordinate motor characteristic requirements with torque requirements of the load so that proper operation shall be obtained during the sequence of starting, accelerating, and normal running over the full operating range.
11. Where subject to possible reverse rotation, provide one of the following:
 - a. Motor designed to withstand indefinitely, without injury, the maximum overspeed to which the motor will be subjected when the pump to which it is connected is acting as a hydraulic turbine under the maximum head with the pump discharge pipe open.
 - b. A self-actuated backstop device or antireversing ratchet, to prevent reverse rotation of the pump due to loss of power or failure of the electric prime mover, shall be installed as an integral part of the motor.
12. Motors greater than 250 HP:
 - a. Stator:
 - 1) Stranded copper conductors.
 - 2) Insulation Class F or H.
 - 3) Coils completely sealed and moisture tight.

- 4) Winding configuration: Manufacturer's standard wye or delta.
- 5) Completed winding subjected to two vacuum pressure impregnations in a solventless epoxy resin.
- b. Rotor:
 - 1) Design: Squirrel-cage winding of suitable impedance for starting under specified conditions. Rotor structure constructed in accordance with current practice.
- c. Bearings:
 - 1) Provide manufacturer's standard anti-friction type.
 - 2) Thrust Bearing: Manufacturer's standard.
 - 3) Guide bearings: Manufacturer's standards.
 - 4) Anti-friction type having a capacity meeting ABMA calculated rating life (L_{10}) of no less than 50,000 hours at pump best efficiency point.
 - 5) Lubrication: Grease or oil. If oil, provide oil reservoir.
 - 6) Self-cooled and sealed against loss of lubricant or entrance of dirt.
 - 7) Provide means for removing the lubricant and re-lubricating the bearings without disturbing bearing housing.
- d. Indicating and Protective Devices:
 - 1) Armature winding resistance temperature detectors (RTDs).
 - 2) Motor bearing RTDs.
 - 3) Provide oil sight glass for oil lubricated bearings.
- e. Conduit Boxes:
 - 1) Main Lead Terminal Box:
 - a) Oversized.
 - b) Attached to motor with at least four screws.
 - c) Diagonally split, rotatable to each of four 90-degree positions.
 - d) Threaded hubs for conduit attachment.
 - e) Provided with ground lug inside terminal box.
 - f) Provide gaskets between box halves and between box and motor frame.
 - 2) Accessory Conduit Box:
 - a) Size: Suitable for terminating leads from indicating and protective devices, and motor accessories.

- b) Provide terminal blocks for terminating indicating and protective devices, and motor accessories.
 - c) Manufacturer's standard cover with gasket.
 - 13. Accessories:
 - a. Space Heaters:
 - 1) Provide space heaters to prevent condensation in the motor armature windings when the motor is shutdown for extended periods.
 - 2) Rating: 1-phase, 120-volt, 60 hertz.
 - 3) Thermostatically controlled when motor is de-energized.
 - b. Grounding Provisions: Provide pad with drilled and tapped bolt holes on motor enclosure. Pad to be machined flat and left unpainted.
 - c. Lifting eyes attached to motor housing that are suitable for attaching slings for lifting with a crane. Lifting hooks or similar devices are not acceptable.
 - d. Wire Markers:
 - 1) Type: Machine-printable, self-laminating label or tubular heat-shrink sleeve label.
 - 2) Color: White.
 - 14. Conform to NEMA MG 1.
- B. Motor Fabrication:
- 1. Leads:
 - a. Terminate all power and ancillary component leads in terminal box.
 - b. Stator Armature Winding and Armature Leads:
 - 1) Seal armature lead insulation to be equal to armature coil insulation with regard to moisture resistance and voltage class.
 - 2) Armature leads brought out of stator frame to motor lead conduit box for external connections. Terminate armature leads with individual bolted-type solderless connectors.
 - 2. Accessory Conduit Box (as applicable):
 - a. Terminate indicating and protective devices, and motor and pump accessories at terminal blocks using ring-tongue connectors.
 - b. Termination of bare conductors at terminal blocks is not acceptable.
 - 3. Nameplates:
 - a. Provide in accordance with Standard Drawing 40-D-6234.

- b. Include in the nameplate captions, the device function number (where applicable) and the nameplate device description.
 - 1) Nameplate captions can be changed by COR at the time the nameplate list drawing is first submitted for approval at no change in contract price or delivery.
 - 2) Device function numbers to be assigned at the time the drawings are first submitted for approval.

PART 3 EXECUTION

3.01 MOTOR TESTS

- A. Perform manufacturer's routine factory tests and following the routine tests required by Part 20 of NEMA MG 1.
 - 1. Measurement of winding resistance.
 - 2. No-load motoring readings of current, power, and nominal speed at rated voltage and frequency.
 - 3. Alternating-current (AC) high-potential test. A direct-current (DC) high-potential test is not acceptable.
 - 4. Perform temperature test (by resistance) on one motor of each horsepower size.
- B. Perform tests in accordance with requirements of NEMA MG 1, IEEE 112, and IEEE 114.

END OF SECTION

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SECTION 01 86 29
COMMUNICATIONS PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. National Fire Protection Association, Inc. (NFPA)
1. NFPA 70 National Electrical Code (NEC)
- B. National Electrical Manufacturer's Association (NEMA)
1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. Building Industry Consulting Service International (BICSI)
1. BICSI-TDMM Telecommunications Distribution Methods Manual (TDMM)
- D. National Electrical Contractors Association (NECA)
1. NECA/BICSI 568 Installing Building Telecommunications Cabling
- E. Telecommunications Industry Association (TIA)
1. TIA 568.0-Rev.D Generic Telecommunications Cabling for Customer Premises
 2. TIA 568.1-Rev.D Commercial Building Telecommunications Infrastructure Standard
 3. TIA 568.2-Rev.C Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. TIA 568.3-Rev.D Optical Fiber Cabling Components Standard
 5. TIA 568.4-Rev.D Broadband Coaxial Cabling and Components Standard
 6. TIA 598 Optical Fiber Cable Color Coding
 7. TIA J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

8. TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 – Electrical, Section 01 86 30 - Information System Security Performance Requirements, and Control Drawings, and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. Include communication systems in Operation and Maintenance Manual submittals required in Section 01 81 05 - General Performance Requirements and 01 78 30 – Project Record Documents.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store communications equipment in accordance with manufacturer's instructions. Include copy of these instructions with equipment at time of shipment.

1.05 PERFORMANCE REQUIREMENTS

- A. Provide information security in accordance with the requirements in Section 01 86 30 - Information System Security Performance Requirements.
- B. Utilize IPSec VPN tunnels for transmission of the SCADA/Control Data with remote facilities.
- C. SCADA and Control Network:
1. Covers WTP locations.
 2. In accordance with the requirements for networks and network components in Section 01 86 25 – System Controls and Monitoring Performance Requirements.
 3. Wire components of the WTP San Juan SCADA system, specified in Section 01 86 25 – System Controls and Monitoring Performance Requirements.
 - a. As well as local digital control components supplied with the process equipment or electrical distribution equipment to a dedicated SCADA and control network.
 - b. Utilize components of network, including patch panels, network switches, data outlets, etc. solely for SCADA and control applications.
 4. Provide SCADA and control network patch panels where necessary. Minimum of one location per building.
 5. Provide optical fiber paths between SCADA and control network patch panels, creating ring networks with redundant paths of communication.
 - a. Fiber optic path shall utilize fibers assigned solely for use by SCADA and control systems. Do not utilize fibers used by other systems or functions.

- b. Terminate optical fibers utilized for optical fiber path at patch panels located at or near security network patch panels.
 - 6. Provide network switches and other components necessary to complete the security network.
- D. San Juan Lateral Network Interface for **Reclamation** Remote Facilities:
 - 1. Network interfaces for remote facilities along the San Juan Lateral shall be provided in accordance with these requirements.
 - 2. Provide a single point connection between networks for the San Juan Lateral facilities and the WTP Facility Control System. Provide an electronic security perimeter, including firewall, between the two networks.
 - 3. Remote facilities along San Juan Lateral include:
 - a. River Intake and River Pumping Plant.
 - b. San Juan Generating Station Reservoir.
 - c. Morgan Lake Tank.
 - d. Pumping Plant 1.
 - e. Pumping Plant 2.
 - f. Pumping Plant 3.
 - g. Pumping Plant 4.
 - h. Pumping Plant 7.
 - i. Tohlakai Pumping Plant.
 - j. McKinley Hill Surge Tank.
 - k. Black Hat Tank.
 - l. SJL Lateral Turnouts
 - 4. Design SCADA/Control data interface in accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements.
 - 5. Primary communication:
 - a. Optical Fiber Transmission System
 - 1) Optical fiber cable connections between the SJLWTP and remote facilities shall be supplied by Others.
 - 2) Remote sites are connected by a linear optical fiber network running between the facilities. Installation and termination of optical fiber cable to network equipment located in control enclosures at remote sites are provided by Others.
 - 3) Contractor is responsible for equipment and components located on the San Juan WTP site.

- 4) Contractor shall make necessary settings and programming changes at PLCs, network switches, and routers to implement communication between the San Juan SCADA System and remote sites.
 - 5) Connection to optical fiber transmission system.
 - a) Connect to existing fiber lines installed with Reach 4A and Reach 3.
 - b) Coordinate final location with NTUA.
 - c) Provide underground vaults with optic fiber splice box for interface location.
 - b. Connection Components to optical fiber transmission line:
 - 1) Fiber bypass unit to prevent power outage at WTP from impacting connectivity along optical fiber transmission line.
 - 2) RUGGEDCOM RX 1510 network switch, or equal, with the following essential characteristics:
 - a) Compatible with existing system installed by others.
 - b) Integrated Router/Firewall/VPN.
 - c) SNMPv3 encrypted authentication and access security.
 - d) Multi-level passwords.
 - e) Supports IPSec Virtual Private Networking.
 - f) Allows enabling/disabling ports.
 - 3) Primary communication system utilized for transmission of SCADA/Control Data.
 - 4) Backup communication system utilized for transmission of SCADA/Control Data (backup communication path).
 - c. Coordinate with Reclamation and remote facility installers for setup of interface signals between facilities. Include interface signals required in Section 01 86 25 - System Control and Monitoring Performance Requirements.
- E. San Juan Lateral Network Interface **for** NTUA facilities:
1. Provide single point connection between networks for San Juan Lateral facilities and NTUA network connection.
 - a. Provide electronic security perimeter, including firewall, between two networks.
 - b. PLC based data concentrator to act as:
 - 1) Interface to other control system components.

- 2) Data aggregation point for gathering monitoring data to pass to or collect from NTUA.
 2. Design SCADA/Control data interface in accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements.
 3. Connect to external optical fiber located at the Northwest corner of the SJL WTP site.
 4. Provide equipment and components located on the San Juan WTP site.
 5. Provide connection to the optical fiber connection point at a location agreed to with NTUA. Provide an underground vault with optic fiber splice box for the interface location.
 6. Components for connection to the optical fiber transmission line:
 - a. Network Gateway Switch:
 - 1) As security firewall between the pumping plant local network and NTUA long-haul communication network.
 - 2) Ciena Z series, model Z22 network switch, or equal with the following essential characteristic: Compatible with NTUA system.
 - b. SCADA Switch:
 - 1) RUGGEDCOM RX 1510 network switch, or equal, with the following essential characteristics:
 - a) Integrated Router/Firewall/VPN.
 - b) SNMPv3 encrypted authentication and access security.
 - c) Multi-level passwords.
 - d) Supports IPSec Virtual Private Networking.
 - e) Allows enabling/disabling ports.
 7. Primary communication system utilized for transmission of SCADA/Control Monitoring Data.
- F. San Juan Lateral Network Interface for City of Gallup:
1. Single point connection between Reclamation PLC and City of Gallup PLC.
 - a. Both located in Tohlokai Pumping Plant Control Room.
 - b. If using an addressable communication protocol, provide an electronic security perimeter, including firewall, between two networks.
 2. Design SCADA/Control data interface design in accordance with Section 01 86 25 - System Control and Monitoring Performance Requirements.
 3. Provide equipment and components required to implement the communication link.

4. Primary communication system utilized for the transmission SCADA/Control Monitoring Data.

G. Security Network:

1. Covers WTP locations.
2. Wire components of security system, specified in Section 01 86 33 – Electronic Safety and Security Performance Requirements, to a dedicated security network. Components of network, including patch panels, network switches, data outlets, etc. shall be utilized solely for the security network.
3. Provide security network patch panels where necessary with a minimum of one location per building.
4. Provide optical fiber paths between security network patch panels, creating ring networks with redundant paths of communication.
 - a. Fiber optic path shall utilize fibers assigned solely for use by security system
 - b. Do not utilize fibers utilized by other systems or functions.
 - c. Optical fibers utilized for required optical fiber path shall be terminated at patch panels located at or near the location of the security network patch panels.
5. Provide network switches and other components necessary to complete the security network.

H. Facility Business Network:

1. Covers WTP locations.
2. Intended to provide external data access for facility staff's computers. Provide access to Business network servers and local storage devices to facilitate staff's performance of daily tasks and other ongoing activities.
3. Wire data outlets to a patch panel utilized solely for facility business network.
 - a. One facility business network patch panel location per building.
 - b. Unless cable lengths connecting to data outlets exceed 100m at which point locate patch panels where required to not exceed 100m cable lengths.
4. Wire data outlets to patch panel utilizing Category 6 cable.
5. Locate patch panel in building with the Point of Demarcation, in same room as Point of Demarcation.
6. Provide optical fiber paths from the locations of business network patch panels back to the patch panel at the Point of Demarcation.
 - a. Fiber optic path shall utilize fibers assigned solely for use by the facility business network and shall not utilize fibers utilized by other systems or functions.

- b. Optical fibers utilized for the required optical fiber path shall be terminated at patch panels located at or near the location of the business network patch panels.
- 7. Provide connection to telecommunications utility's data service connection point to the Point of Demarcation and terminate it on a patch panel there.
- 8. Not necessary to provide network switches required to complete the network.
- 9. Point of Demarcation:
 - a. Overall facility point of demarcation:
 - 1) In Communications Room.
 - 2) Provide space for locating rack mounted business network servers, provided by Others.
 - b. Provide backboards, raceway, pull boxes, vaults and peripherals and accessory components necessary to facilitate the installation of the external telecommunications utility service at this location.
 - c. Installation arrangement: Meet requirements of the external telecommunications utility.
- I. Telephone System:
 - 1. Design Private Automatic Branch Exchange (PABX) to provide VOIP telephone service for the site. Design interconnection between system and telecommunications utility service.
 - 2. Provide a VOIP phone system to provide telephone service for the WTP.
 - 3. VOIP Phone System:
 - a. Compatible with Cisco VOIP telephones.
 - b. Separate extensions for each connected telephone, except as approved by COR.
 - c. Voicemail.
 - d. Call forwarding.
 - e. Sharing lines.
 - f. Interfaced with NTUA's existing VOIP phone system, NTUA is service provider for system.
 - 4. Provide telephones for WTP locations.
 - a. Install telephones on wall mounted or located on Contractor supplied furniture or components.
 - b. Provide loose telephones for furniture supplied by Others.
 - 5. Future expansion of additional phones. Quantity capable of meeting the Phase 2 staffing and room requirements plus 10 percent spare capacity.

6. System shall be able to support required phone connections.
 7. Make system fully operational.
 8. Provide components required for a complete a working system.
 - a. Telephone system shall provide voice quality communication.
 - b. Amplification or attenuation required to the signal shall be applied where necessary to maintain consistency in volume and clarity between calls.
 - c. For instance, if white noise is introduced, it shall not interfere with voice quality.
 9. Wire telephone outlets to a patch panel utilized solely for the telephone system network.
 - a. One telephone system network patch panel location per building.
 - b. Unless cable lengths connecting to outlets exceed 100m at which point locate patch panels where required to not exceed 100m cable lengths.
 - c. Use Category 6 cable. Locate telephone system network switches at patch panel locations.
 10. Locate telephone system patch panel in same room as Point of Demarcation.
 11. Provide optical fiber paths from telephone system network switch back to fiber optic patch panel at Point of Demarcation.
 - a. Fiber optic path shall utilize fibers assigned solely for use by telephone system and shall not utilize fibers utilized by other systems or functions.
 - b. Terminate optical fibers for optical fiber path at patch panels located at or near telephone system patch panels.
 12. Point of Demarcation:
 - a. Locate telephone system Point of Demarcation the same room as business network Point of Demarcation.
 - b. Locate overall facility Point of Demarcation in t Communications Room, with space for rack mounted telephone system servers.
 13. Provide backboards, raceway, pull boxes, vaults and peripherals and accessory components to facilitate installation of external telecommunications utility service. Installation arrangement shall meet requirements of external telecommunications utility.
- J. Provide separate outlets for telephone system connections and data:
1. Office Areas:
 - a. In each room.
 - b. Rooms with multiple occupants shall have sufficient outlets to accommodate number of occupants.
 - c. Desktop Telephones.

2. Conference Rooms:
 - a. Locate, at least one telephone system and two data outlets at front of room.
 - b. Small Conference Rooms:
 - 1) Locate at least one data outlet near wall mounted flat panel monitor.
 - 2) Provide conference Telephone.
 - c. Large Conference Rooms:
 - 1) Locate at least one data outlet near wall mounted flat panel monitors.
 - 2) Locate at least one data outlet on the ceiling near projector. Use data outlet to connect display device to projector.
 - 3) Provide conference Telephone.
 - d. Provide additional outlets to support conference room audio-visual equipment.
3. Break Rooms:
 - a. Provide at least one telephone system and data outlet for each break room.
 - b. Wall Mount Telephones.
4. Lab:
 - a. Provide at least two telephone system and data outlets for the lab.
 - b. Locate additional outlets to accommodate equipment placement and normal work areas.
 - c. Desktop Telephones.
5. Lobby:
 - a. Provide at least one telephone system outlet for the lobby.
 - b. Receptionist Desk: Desktop Telephone.
6. Control Room:
 - a. Provide at least three telephone system and data outlets for the Control Room.
 - b. Locate additional outlets where required to accommodate equipment placement and normal work areas.
 - c. Desktop Telephones.
7. Server Room:
 - a. Provide at least one telephone system outlet and at least two data outlets in server rooms.

- b. Wall Mount Telephones.
 - 8. Storage Areas:
 - a. Provide at least one telephone system and data outlet for each storage room with a dimension larger than 50 feet.
 - b. Wall Mount Telephones.
 - 9. Process Areas:
 - a. Provide a minimum of one telephone system and data outlet for each building with process areas.
 - b. For buildings with over 3000 sq. feet of process areas provide a minimum of one phone and data outlet per 3000 sq. feet of process area, distributed through the process areas.
 - c. Wall Mount Telephones.
 - 10. Electrical Room:
 - a. Provide at least one telephone system outlet and at least one data outlets in each Electrical Room.
 - b. Wall Mount Telephones.
 - 11. Communications Room:
 - a. Provide at least one telephone system outlet and at least one data outlets in each Communications Room.
 - b. Wall Mount Telephones.
 - 12. Provide telephone system and data outlets as required to support Contractor design and to accommodate intended facility staff work areas.
 - 13. Provide desktop phones, telephone system outlets and data outlets for employee desk work areas. Minimum of one desktop phone, telephone system outlet and data outlet for staff listed in staffing plan submitted in accordance with Section 01 81 05 - General Performance Requirements.
 - 14. At a minimum provide one telephone system outlet for each building.
 - 15. Provide a telephone for each telephone system outlet.
- K. Miscellaneous Networks:
 - 1. Provide other networks necessary to provide connectivity for devices that do not meet the guidelines in types of networks defined above.
 - 2. Do not interconnect networks with networks defined above without written approval from the COR.
 - 3. Provide components necessary..

1.06 EXTRA MATERIALS

- A. Spare Parts:
 - 1. Provide 20 percent spare fuses.
 - 2. Provide at least 20 percent spare of each type of surge suppression device.
 - 3. Provide 10 percent spare phones.
 - 4. Provide 20 percent spare network and communications cards.
- B. Spare parts shall be identical and interchangeable with similar parts furnished under this specification.
- C. Spare parts shall be packed in containers suitable for long term storage.
- D. Spare parts shall bear labels clearly designating the contents of equipment or components for which they are intended.
- E. Recommended spare parts list applicable to equipment furnished under this section. List shall include name of each part, component, module, or printed circuit card; item part number, manufacturer's name and address, quantity recommended, and approximate price (current at time list is prepared) of each item.

PART 2 PRODUCTS

2.01 PRIVATE AUTOMATIC BRANCH EXCHANGE SWITCH (PABX)

- A. Accommodate, at a minimum:
 - 1. Six Incoming Central Office (CO) trunk lines.
 - 2. 40 local extensions.
 - 3. Dual tone multi-frequency (DTMF) push-button telephones.
- B. Comply with requirements for connection to the local PSTN.
- C. Support, at a minimum:
 - 1. Automatic Ring Back: Allow users to pre-dial busy phone lines and as soon as the line gets free, they receive a ring back.
 - 2. Auto Attendant: A digital receptionist that automatically connects callers to desired extension number using a menu.
 - 3. Call Parking: Allows users to place outgoing calls on hold in a telephone unit, then continue conversation with another device.
 - 4. Call Forwarding: Route incoming calls depending on the pre-programmed criteria.
 - 5. Call Queuing: Allows users to create system for routing calls.

6. Call Pick-Up: Allows users to answer the incoming call on behalf of the recipient.
7. Call Waiting: Allows users to handle multiple ongoing calls simultaneously.
8. Call Transfer: Allows users to hand off live calls to another extension or user.
9. Do Not Disturb: Incoming calls to a specific extension are blocked.
10. Voicemail: Allows callers to leave a voicemail message.
11. Support intercom paging.

2.02 TELEPHONE SYSTEM

A. Telephones:

1. Cisco VOIP telephones, or equal.
2. Powered over Ethernet (POE).
3. Provide telephones suitable for location where installed. Where specialty phone construction or enclosures are required due to location or atmosphere supply them.
4. Desktop Telephones:
 - a. Cisco 7800 series IP Phones, or equal.
 - b. Display.
 - c. Speaker phone and handset.
 - d. Support for USB headsets.
5. Conference Telephones:
 - a. Cisco IP conference phone for large conference rooms.
 - b. Dial pad and display.
 - c. Includes wireless extension microphones.
 - d. Provides sufficient coverage to pick up and legibly transmit voice communication throughout the room where applied.
6. Wall Mount Telephones:
 - a. Cisco 3900 series IP phones, or equal.
 - b. Suitable for mounting on a wall.
7. Outdoor, wet, corrosive, or hazardous areas:
 - a. Use appropriate equipment and enclosures.
 - b. All components shall be listed for use in the areas where installed.

2.03 NETWORK SWITCHES

A. Industrial, managed Ethernet switch.

B. Network Switches:

1. All network switches shall be managed industrial switches which provide the following minimum features:
 - a. Supports linear, star, and ring topology.
 - b. Loop prevention.
 - c. Resiliency.
 - d. Segmentation.
 - e. Prioritization.
 - f. Time synchronization.
 - g. Security and diagnostics.
 - h. SNMP and web based management.
 - i. One Gbps throughput, minimum.
 - j. Status indicators.
 - k. IEEE 802.3 and 802.3af/at compliance.
 - l. Provide ports and connections, as required. Include a minimum of 20 percent spare ports of each type used at the switch.

C. Network Features:

1. Ethernet.
2. IP routing.
3. Stateful firewall, NAT.
4. SNMP and web based management.

2.04 FIBER BYPASS UNIT

A. Physical Features:

1. Fiber Ports: Two channel 100BaseFX, single-mode 1310nm, ST connector, minimum.
2. Power: Redundant 24 VDC inputs.
3. Low power consumption.
4. Optical Switching Time: 10 ms maximum.
5. Enclosure: Metal case.

2.05 ACCESSORIES

- A. Faceplates and Connectors: Use registered jack (RJ) 45 modular connector.

2.06 POWER

- A. Provide power distribution system to all communications components, including protection, to support full operation of the system. This distribution system shall include analog loop power supplies and contact interrogation voltages for dry contact inputs.
- B. Provide all fuses, circuit breakers, power supplies, transformers, and similar required to supply and transform power feeds at the desired voltage.
- C. Supply from an Uninterruptible Power Supply system (UPS) where required by Section 01 86 25 - System Control and Monitoring Performance Requirements.
- D. Circuit isolation and protection components:
 - 1. To provide a reliable power distribution system.
 - 2. Minimum guidelines for circuit isolation and protection components:
 - a. Isolate power circuits into a control panel or control enclosure.
 - b. Distribution within the cabinet or control enclosure shall be fused, with power supplies individually fused.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NFPA 70 and manufacturer's requirements.
- B. Enclosures:
 - 1. Provide all patch panels, network switches, or other network components not located in a communications room in protected lockable enclosures.
 - 2. Provide minimum NEMA 250 Type 1 or 12 enclosures for indoor installations and NEMA 250 Type 3R, 4 or 4X enclosures for outdoor installations. Identify and select equipment materials and enclosure types for the location where installed and the probability of exposure to water and hazardous or corrosive environments.
 - 3. Provide thermostatically controlled cabinet space heaters to control condensation in all cabinets not in a temperature controlled environment, or subject to condensation.
 - 4. Enclosures shall have louvers, or ventilation, as required to maintain the temperature of the equipment within manufacturer recommended range. The interior temperature shall be maintained at a minimum of at least 10 degrees Fahrenheit below the maximum operating temperature of the internal devices at the maximum ambient temperature.
 - a. Fans or other forced ventilation devices shall be provided as redundant pairs and shall be provided with temperature alarms.

- b. Louvers and openings shall be equipped with screens and changeable filter material to prevent the entrance of dust, insects and rodents.
- 5. Enclosures shall ensure sufficient space for cable installation.
- C. Telephone System:
 - 1. In accordance with manufacturer's recommendations.
 - 2. Mounting hardware and accessories to install the telephone sets.
 - 3. Make cable and conduit connections. Use watertight conduit hubs for conduit connections.
 - 4. Provide necessary hazardous area certified equipment where required.
 - 5. Make power connections to equipment.
 - 6. Make grounding connections.
- D. Provide Cable and Raceway in accordance with Section 01 86 26 - Electrical Performance Requirements.
- E. Provide grounding and bonding in accordance with TIA J-STD-607.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. Perform in accordance with Section 01 91 16 - Facility Commissioning.
- B. Telephone System:
 - 1. Notify Government in writing at least 15 days prior to beginning of field tests.
 - 2. Government personnel will witness and oversee testing.
 - 3. Demonstrate satisfactory voice quality of equipment.
 - 4. Telephone System Test Minimum Requirements:
 - a. Exercise basic call-handling capabilities.
 - b. Demonstrate Graphical User Interface (GUI) programs, use of controls, dialogs, and forms, continuity of prompts and general navigation.
 - c. Manual Call Testing: Use each phone to place and receive calls to and from other phones. Verify the calls in this test are completed successfully with high voice quality. Call in with a variety of phone types (i.e., cell phones, outside phone systems).
 - d. Multi-line Performance Test: Generate multiple simultaneous calls into the system and verify high voice quality.
 - e. Auto attendant features: Call transfer to designated voicemail or phone number.

5. Acceptance of equipment, or the waiving of tests thereof, shall in no way relieve the Contractor of the responsibility of furnishing equipment and materials meeting specification requirements.

C. Communications Cable:

1. Inspect coaxial connector integrity.
2. Provided performance testing for all cables installed by the Contractor.
3. Remove failed cables from project site upon attenuation test failure.
4. Perform testing for each outlet.
5. Performance Test - Fiber Optic cable:
 - a. Test each fiber using an Optical Time Domain Reflectometer (OTDR):
 - 1) Compare measured connector loss with specified connector loss of 0.5 decibels.
 - 2) Verify cable length.
 - 3) Reflectance accuracy: Plus or minus 2 decibels.
 - 4) Loss accuracy (Linearity): 0.02 decibel per decibel.
 - 5) Obtain an OTDR waveform for each fiber to:
 - a) Determine actual cable length.
 - b) Determine attenuation and splice loss.
 - c) Identify and locate splices and step discontinuities/possible fiber breaks.
 - 6) OTDR waveform for each fiber showing “A” and “B” range marks: Do not move or change location of either mark.
 - 7) Include an Analysis Summary Results Table for each fiber:
 - a) Indicate numerical values associated with each event.
 - b) Do not use question marks, dashes, or blanks.
 - 8) Include following information for each trace:
 - a) Trace name.
 - b) Operator’s name.
 - c) Date and time.
 - d) Fiber type being tested.
 - e) Bundle color.
 - f) Fiber color.
 - g) Fiber number.
 - h) Launch reel length.

- i) OTDR resolution.
 - j) Pulse width.
 - k) Wavelength.
 - l) Index of refraction.
 - m) Averaging number.
 - n) Receiver bandwidth.
 - o) Sampling point count.
 - p) End to end loss, decibels.
 - q) Reflectance, decibels.
 - r) Fiber Break, decibels.
 - s) Backscatter.
 - 9) Traces to be viewable and reproducible on a PC using latest version of Windows at time of award or later.
6. Performance Test – Category 6 cable:
- a. Inspect network cabling terminations for T568A color configuration.
 - b. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2.
 - c. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

END OF SECTION

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SECTION 01 86 30

INFORMATION SYSTEM SECURITY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Cost:
 - 1. Include in prices offered in Price Schedule 1 for other items of work.

1.02 DEFINITIONS

- A. Electronic Security System: Components or systems supplied to meet requirements of Section 28 10 01 – Security and Surveillance System.
- B. Industrial Control System: Industrial Control Systems as defined by NIST 800-53 and NIST 800-82, includes San Juan SCADA System, and other control system configurations such as skid mounted Programmable Logic Controllers (PLCs).
- C. Information System: As defined by Federal Information Security Modernization Act (FISMA) and Office of Management and Budget (OMB) guidelines.
- D. Personally Identifiable Information (PII): PII data is defined in OMB memorandum M-07-16.
- E. Water Treatment Plant (WTP): Facility for all work of this contract to be performed at location specified in Section 01 11 00 – Summary of Work.

1.03 ACRONYMS

- A. FTP: File Transfer Protocol
- B. HMI: Human Machine Interface
- C. I/O: Input/Output
- D. ICS: Industrial Control System
- E. OIT: Operator Interface Terminal
- F. PAC: Programmable Automation Controller
- G. PII: Personally Identifiable Information
- H. PLC: Programmable Logic Controller

- I. SPAN: Switch Port Analyzer
- J. TCP/IP: Transmission Control Protocol/Internet Protocol
- K. VLAN: Virtual Local Area Network
- L. VPN: Virtual Private Network
- M. WTP: Water Treatment Plant

1.04 REFERENCE STANDARDS

- A. International Society of Automation (ISA)
 - 1. ISA 62443-1-1(99.01.01)-2007 Security for Industrial Automation and Control Systems Part 1-1: Terminology, Concepts, and Models
 - 2. ISA 62443-2-1(99.02.01)-2009 Security for Industrial Automation and Control Systems Part 2-1: Establishing an Industrial Automation and Control Systems Security Program
- B. Federal Information Processing Standards (FIPS)
 - 1. FIPS 140-3-2019 Security Requirements for Cryptographic Modules
 - 2. FIPS 199-2004 Standards for Security Categorization of Federal Information and Information Systems
- C. National Institute of Standards and Technology (NIST)
 - 1. NIST SP 800-82-Rev2 Guide to Industrial Control Systems (ICS) Security
 - 2. NIST SP 800-53-Rev5 Security and Privacy Controls for Information Systems and Organizations
- D. Office of Management and Budget (OMB)
 - 1. M-07-16 Safeguarding Against and Responding to the Breach of Personally Identifiable Information, available from:
<https://www.whitehouse.gov/omb/information-for-agencies/memoranda/>

1.05 SUBMITTALS

- A. Submit the following in accordance with Sections 01 33 00 – Submittals, 01 33 26 – Electrical and Control Drawings and Data, 01 86 25 – System Control and Monitoring Performance Requirements, and 01 81 05 – General Performance Requirements.

B. RSN 01 86 30-1, Contingency Plans:

1. For Contractor supplied information systems or information system components.
2. Contingency plans are developed to address disruption, compromise or failure of the information system.
3. Address maintaining essential facility functions.
4. Provides restoration plan to bring full restoration of information system without deterioration of original information system security safeguards:
 - a. Includes restoration priorities and metrics.
 - b. Provides for recovery and reconstitution of information from information system to known state after disruption, compromise, or failure.

C. RSN 01 86 30-2, Approval Drawings:

1. Network diagram. Include:
 - a. Devices on communication networks at facilities that communicate via TCP/IP protocol.
 - b. Logical communication paths between devices.
 - c. Host names for each device.
 - d. Indication of any VLAN segregation.
 - e. Communication ports and interfaces for each connection.
 - f. IP addresses for each device.
 - g. Identification of remote access entry pathways.
2. System Architecture Drawing. Include:
 - a. Control system and maintenance components connected to, or otherwise capable of communicating with the facility networks.
 - b. Each component shall have a device tag, hostname (where applicable), manufacturer, model, operating system, and version number.
3. Dataflow Diagram. Include:
 - a. Direction of normal system communications between devices on the control network.
 - b. Corresponding ports and protocols used for communications.
 - c. Each device must have a device type label (workstation, server, PLC, etc.), hostname (where applicable), manufacturer, and model.

D. RSN 01 86 30-3, Preliminary Configuration Documentation:

1. Asset configuration files.
 - a. Configuration backup files for each asset in the Asset Management List.

- b. Technical justification for each asset that does not have an accompanying configuration backup.
 - 2. STIG exception document.
 - a. Narrative format or spreadsheet.
 - b. For each asset listed on the Asset Management List document each STIG configuration item that does not match the Government provided STIGs.
 - c. Provide a detailed technical justification for why the setting can not be applied as prescribed and relevant risk mitigation recommendations.
- E. RSN 01 86 30-4, Preliminary Asset and Account Management Lists
 - 1. Asset Management List:
 - a. Microsoft Excel spreadsheet format.
 - b. List of hardware connected to the communication networks at all facilities.
 - c. Format list with individual components listed in separate rows. Include the following information in separate columns and on the same row for each piece of equipment:
 - 1) Serial Number.
 - 2) Manufacturer.
 - 3) Model Number.
 - 4) Firmware revision number (if applicable).
 - 5) IP or other communication addresses.
 - 6) Operating system (if applicable).
 - 7) Host Name (if applicable).
 - 8) MAC Addresses.
 - 9) Physical Location.
 - 10) Device description.
 - 11) As-left username and passwords.
 - 12) Power and frequency requirements (only applicable to wireless technologies).
 - d. In a separate spreadsheet tab for each asset, include a list of installed software and firmware in the first column. Include the following minimum information in subsequent columns, on each row, for each software and firmware asset:
 - 1) Version.
 - 2) Patch version.

- e. In a separate spreadsheet tab for each component, include a list of services required for system operations in the first column, with the following information in the subsequent columns:
 - 1) Enabled or disabled status of each service.
 - 2) If each service is enabled, list the node, device, software, and/or system component requiring this service.
 - f. Spreadsheet shall be sortable and searchable.
 - 2. Account Management List
 - a. Microsoft Excel spreadsheet format.
 - b. Provide a separate spreadsheet for the Account Management List or include as a tab in the Asset Management List.
 - c. List each asset included in the asset management list. And include a list of all accounts for that asset in the first column. Include the following information in subsequent columns:
 - 1) Enabled or disabled status.
 - 2) If the account is enabled, list the service program, task, and/or function requiring this account to be enabled.
 - d. Spreadsheet shall be sortable and searchable.
- F. RSN 01 86 30-5, Pre-Testing Documentation
 - 1. Describe the methods and equipment used to perform testing and commissioning activities included in this Section as well as testing and commissioning related to network and control system component in Section 01 86 25 – System Control and Monitoring to demonstrate conformance with the requirements in this Section.
 - a. Include detailed procedures for these activities as well as the methodology, sequence, monitoring occurring for these activities.
 - b. Include individual steps as well as setpoint variations and component operation.
 - 2. As-installed Network Diagram, System Architecture Drawing and Dataflow Diagram. Document on the network diagram where any test equipment would be connected to the network.
- G. RSN 01 86 30-6, Final System Documentation:
 - 1. Updated versions of previously submitted diagrams, drawings and other documentation.
 - 2. Includes information on the following topics:
 - a. Information on configuration, installation, and operation of system:
 - 1) Include list of all ports and authorized services required for normal operation, emergency operation, or troubleshooting.

- 2) Document all disabled ports, connectors, and interfaces.
 - 3) Document any communications (e.g., protocols) required between network security zones, whether inbound or outbound, and identify each network component initiating communication.
 - 4) Document any method or equipment used to restrict communication traffic.
 - 5) Document any disconnection points between network security zones and provide methods to isolate zones to continue limited operations.
 - 6) Document testing and validation used to develop application whitelisting as required by this section.
- b. Effective use of security mechanisms and functions.
- c. Maintenance and support of system:
 - 1) Include information on how to reconfigure default settings.
- d. Known vulnerabilities.
- e. Use of administrative functions.
- f. Configuration settings including baseline configuration of information systems. Includes:
 - 1) Cyber security features.
 - 2) Software.
 - 3) Protocols, ports, and services.
 - 4) Documentation describing each item.
- g. Comprehensive list of all accounts (including, but not limited to, generic and/or default) for each configurable device.
- h. Provide documentation on any firewall rule sets and/or access control lists for normal and emergency operations.
3. Documentation certifying all known methods for bypassing computer authentication in procured products, often referred to as backdoors, have been permanently removed from system or otherwise permanently disabled.
4. Provide documentation on all ingress and egress pathways.
5. Documentation that all validated security updates and patches are installed and tested.
6. Backdoor attestation.
 - a. Signed letter that no known methods for bypassing computer authentication, often referred to as “backdoors”, exist in Contractor provided systems, and that such “backdoors” created by the contractor have been removed.
7. Wireless technology documentation.

- a. Documentation for wireless technologies (e.g. radio, microwave, Wi-Fi, Bluetooth, infrared, and AigBee) included in the Contractor provided systems. Include:
 - 1) Use, capabilities, and limits for the wireless devices.
 - 2) Evidence that wireless technologies and associated devices comply with operational and security requirements specified in the applicable wireless standards or specifications.
 - 3) Summary test data demonstrating that known attacks do not cause receiving wireless devices to crash, hang, be compromised, or otherwise malfunction. Include attacks documented in the Common Attack Pattern Enumeration and Classification [CAPEC] list, such as malformed packet injection, man-in-the middle attacks, or denial-of-service attacks) do not cause the receiving wireless devices to crash, hang, be compromised, or otherwise malfunction.
 - 4) Configuration control options that enable varying of the security level of the devices.
- H. RSN 01 86 30-7, Final Asse Management List and Account Management List:
 - 1. Indicate changes from prior received versions of the documents supplied.
- I. RSN 01 86 30-8, Final Configuration Documentation:
 - 1. Provide asset configuration files.
 - a. Provide configuration backup files for each asset in the Asset Management List.
 - b. Provide electronic files on encrypted removable media.
 - c. Provide evidence that backups were tested and verified as functional for restoring the system.
 - d. Provide technical justification for each asset that does not have an accompanying configuration backup.
 - 2. Final STIG exception documentation.
 - a. Narrative format or spreadsheet.
 - b. Indicate changes from prior received versions of the documents supplied.

1.06 QUALIFICATIONS

- A. Individuals participating in design related to information system security or implementing information system security requirements shall be knowledgeable in design of systems and components utilized. In addition, they shall have performed services for at least three installations of similar type in the past five years.

1.07 GENERAL REQUIREMENTS

- A. All Contractor supplied digital, or information system equipment and components shall meet these requirements, except where explicitly identified otherwise.
- B. Design, installation, and configuration of information systems shall meet requirements in NIST SP 800-53 and these specifications. Where there is conflict the more stringent or restrictive applies.
- C. Work with Government to fill out FIPS 199 forms for the installation.
- D. Digital and Information System Access Control:
 - 1. Where any Digital and Information System Access Control requirements cannot be met with current commercially available equipment or software provide documentation on installed system's deviations from requirements as well as risk mitigation strategies.
 - 2. Configure each component to operate using principle of least privilege.
 - 3. Provide method for protecting against unauthorized privilege escalation.
 - 4. Provide centralized and local account management capability.
 - 5. Account Authentication:
 - a. Include account authentication by approved method.
 - b. Configurable account password/authenticator solution to include requirements for the following:
 - 1) Ensure passwords/authenticators have sufficient strength of mechanism for intended use:
 - a) Minimum length of 12 or more case sensitive characters, utilize a minimum length of 20 characters where the components support that.
 - b) Minimum of one character from at least three of the following four categories: Upper case, lower case, numeric and special (non-alphanumeric) characters.
 - 2) Denial of repeated or recycled use of same password. Enforce at least one changed character when new passwords are created.
 - 3) Change/refresh passwords required at least every 60-days. Prohibit password reuse for 24 generations.
 - 4) Store and transmit only cryptographically-protected passwords.
 - 5) Change default passwords/authenticators prior to facility or sub-system commissioning.
 - 6) Allows use of temporary password for system logons with immediate change to permanent password.

- c. Passwords shall not be stored in clear text or hardcoded into software or scripts.
- d. Do not provide any auto-fill functionality during login or allow applications to retain login information between sessions.
- e. Multiple Session, Inactive Session Logout and Unsuccessful Logon Attempt:
 - 1) Provide inactive session logout with account-based and group-based configurable session-based logout and timeout setting
 - 2) Enforce limit of three consecutive invalid logon attempts by user during 15-minute period.
 - 3) Automatically lock account/node for 30-minutes for unsuccessful logon.
 - 4) Do not allow multiple concurrent logins using the same authentication credentials.
 - 5) Do not permit anonymous logins.
 - 6) Requirements do not apply to process control systems including San Juan SCADA System, components located in the Control Room.
- 6. Account Management:
 - a. Provide user accounts with configurable access and permissions associated with one or more organizationally defined user role(s), where roles are used.
 - b. Accounts shall be configurable into role-based functions.
 - c. Provide individual accounts for each user with customizable access privileges for each account. Accounts shall not be shared between users.
 - d. Monitor use of accounts.
 - e. Designated Government personnel shall be supplied with appropriate account and login credentials required to access, administer, operate, and maintain digital and information systems. Provide Government personnel designated as system administrators accounts with full access to information systems.
 - f. System administrators level privileges shall be required to make changes to account settings.
 - g. Remove accounts when no longer in use including removal of accounts for the following reasons:
 - 1) Remove accounts when accounts are no longer required.
 - 2) Remove account upon reassignment or termination of individual's employment.
 - 3) Remove account if determined individual's or group's authorization or credentials should be revoked.

- h. Modify account privileges when use of account changes including modification of accounts for the following reasons:

- 1) Individual's system usage or need-to-know changes.

E. Physical Security:

- 1. Maintain list of individuals with authorized access to locations in facility where information systems network, processing, data storage, or communication components reside including components with accessible ports.
- 2. Where information system components reside in locked cabinet or enclosure, list individuals with authorized access to interior of cabinet or enclosure.
- 3. Prevent unauthorized individuals from accessing locked locations:
 - a. Secure keys, combinations, and other physical access devices.
 - b. Control visitor and public access to locked locations.
 - c. Escort visitors and monitor visitor activity in locked locations.
 - d. Change combinations and keys when keys are lost, combinations are compromised, or individuals are transferred or terminated.
- 4. Remove individuals from access list when access is no longer required.

F. Network and Communications Configuration:

- 1. Do not implement connections to Department of Interior network or from Contractor supplied digital and information security components to Internet or other external systems unless explicitly authorized by the Government.
- 2. Utilize an IPSec VPN tunnels for transmission of the SCADA/Control Data with the remote facilities.
- 3. Upon request provide Government Personnel access, including administrative access, to network components and the components software and configuration files, including firewalls.
- 4. Network components shall allow the use of unique routable network address spaces (i.e. address spaces other than 192.168.0.0/16, 172.16.0.0/12, and 10.0.0.0/8 must be supported) that work within the Government's network.
- 5. Provide disconnection points between security zones and provide methods to isolate the zones to continue limited operations.
- 6. Coordinate cyber security services and devices functions to insure that they do not interfere with each other.
- 7. Implement automatic scanning of any removable media that is introduced to the information system and document and provide justifications for components where this cannot be implemented.
- 8. Develop logical network topology incorporating security zones, in accordance with recommendations in NIST SP 800-53. Provide the following minimum access control capabilities with system:

- a. Network segmentation via use of firewalls, routers, layer 3 switches, and similar at appropriate locations.
- b. ICS systems and Electronic Security Systems shall both represent separate security zones that shall not interface with outside systems except at approved interface points with approved boundary protection controls.
- c. Provide boundary protection that:
 - 1) Monitors and controls communications at external boundary of system and key internal boundaries within system.
 - 2) Implements subnetworks for publicly accessible system components physically and logically separated from internal organizational networks.
 - 3) Connects to external networks or information systems only through managed interfaces consisting of boundary protection devices.
- d. Setup all firewall, or barrier device, locations with the following characteristics:
 - 1) Deny all communication by default and only allow communication by exception.
 - 2) Restrict communication traffic between different network security zones.
 - 3) Ports and services frequently used as attack vectors should not be opened through firewall or barrier device. If service, or function, is required and justified employ extra countermeasures to compensate for the risk.
 - 4) Only enable required ports and services through firewall, or barrier device.
 - 5) Provide FIPS 140-3 compliant end-to-end encryption.
- e. Malicious Code Protection:
 - 1) Provide protection mechanisms at system entry and exit points to detect and eradicate malicious code.
 - 2) Update malicious code protection mechanisms whenever new releases are available in accordance with configuration management policy and procedures.
 - 3) Configure malicious code protection mechanisms to:
 - a) Perform periodic scans of system.
 - b) Real-time scans of files downloaded from external sources, as files are downloaded, opened, or executed.
 - c) Block and quarantine malicious code.
 - d) Send alert to system administrator in response to malicious code detection.

9. Use of un-encrypted network transactions for authentication, Telnet, FTP, or VPN shall be prohibited.
 10. Information System Monitoring:
 - a. Monitor system to detect:
 - 1) Attacks and indicators of potential attacks.
 - 2) Unauthorized local, network, and remote connections.
 - b. Identify unauthorized use of system.
- G. Auditing and Logging of Events:
1. Provide network time synchronization capability with network components, computer, servers, etc. For control components, such as Programmable Logic Controllers time synchronization may be via IRIG B or network time synchronization signal.
 2. Synchronize network and control components to the same authoritative time source, in this case the site master clock referenced in Section 01 86 25 – System Control and Monitoring Performance Requirements.
 3. Logging of Events:
 - a. Provide logging of all events, including access events (including successful and unsuccessful account logon events and administrative/privileged account use), account management events, application failures, application start-up and shutdown, major application configuration changes for all information system components. Where possible forward logs to central server for long term storage.
 - b. Logs shall include information on type of event, event description, date, and time when event occurred, source address, destination address, user/process identifier, host name or other identifier on which host the event occurred, component where event occurred, user or subjects impacted (if applicable), outcome of event, success/failure indications, and any filenames involved. Record time stamps that can be mapped to Coordinated Universal Time (UTC) or Greenwich Mean Time (GMT).
 - c. Audit software must collect and store security log files with ability to transfer to external media.
 - d. Review and analyze event records at least weekly. Report findings to COR.
 4. Protect audit or logging information tools from unauthorized access, modification, and deletion.
- H. Provide approved anti-virus protection on components where applicable.
- I. System Use Notification:
1. Information systems with monitors or other graphic displays shall provide display system use notification:

- a. Notification: Message or banner that appears before system grants access to user.
 - b. Notifies users of the following:
 - 1) They are accessing a government information system.
 - 2) Information system usage may be monitored, recorded, and subject to audit.
 - 3) Unauthorized use of information system is prohibited and subject to criminal and civil penalties.
 - 4) Use of information system indicates consent to monitoring and recording.
- J. Configuration Management:
- 1. Apply Security Technical Implementation Guides (STIGs) furnished by the Government.
 - 2. Configuration Settings:
 - a. Provide and document configuration settings for software and hardware employed within information systems.
 - b. Identifies, document, and approve any deviations from established configuration settings for individual components within information system.
 - c. Monitor and control changes to configuration settings.
 - 3. Baseline Configuration:
 - a. Develop, document and maintain a current baseline configuration of all Contractor supplied information systems. Provide baseline configuration and documentation to designated Government personnel at completion of facility commissioning.
 - b. Identify and document any deviations from established baseline configuration settings for individual components within information system.
 - c. Configure information systems to provide only desired capabilities.
 - 4. Backup Configuration Files:
 - a. Provide the capability to create full and incremental backups of software and settings on Contractor supplied components. Include backups for each asset on the Asset Management List.
 - b. Provide complete initial configuration backups of each component prior to final delivery. Backups must be tested and verified as functional for restoring the system.
 - c. Backup configuration files should be stored on encrypted removable media. If it is not possible to store some of the backup configuration files on removable media document where the backup configuration files are stored and how they are protected from loss due to the loss of components, intrusions into the system, or other risks.

- d. Provide detailed technical justification for each asset that does not have configuration backups.
- K. Unused Software Components or Ports:
 - 1. Remove or disable and document all software components not required for system operation and/or maintenance. If components cannot be removed or disabled, Contractor shall document specific technical justification and provide risk mitigation strategies. Components to be removed and/or disabled shall include, but not be limited to:
 - a. Games.
 - b. Device drivers for product components not procured/delivered.
 - c. Messaging services (e.g., email, instant messenger, peer to peer file sharing).
 - d. Source code.
 - e. Software compilers in user workstations and servers.
 - f. Software compilers for unused programming languages.
 - g. Unused administrative utilities, diagnostics, network management, and system management functions.
 - h. Backups of files, databases, and programs used only during system development.
 - 2. Disable all services and ports not required for normal operation, emergency operations, or troubleshooting.
- L. Media Use:
 - 1. Use of portable storage devices on systems when such devices have no identifiable owner is prohibited.
 - 2. Any portable storage devices, including transient portable storage devices, must be included on the Asset Management List.
- M. Personally Identifiable Information (PII): Do not store PII on Government equipment or components that will be turned over or supplied to Government.

1.08 CONTROL SYSTEM REQUIREMENTS

- A. These requirements are for ICS systems and in addition to requirements listed elsewhere in this section. ICS systems include, but are not limited to, systems and components provided to meet requirements in Section 01 86 25 – System Control and Monitoring.
- B. Design, installation, and configuration of ICS systems shall meet recommendations in ISA 62443-1-1, ISA 62443-2-1, and NIST SP 800-82. Requests for exceptions shall be made in writing and include description of exception requested.

- C. Develop logical network topology incorporating multilevel security zones, in accordance with recommendations in ISA 62443-1-1, ISA 62443-2-1, and NIST SP 800-82. Provide the following minimum access control capabilities with system:
 - 1. Network segmentation via use of firewalls, routers, layer 3 switches, and similar at appropriate locations. ICS systems at remote locations shall represent separate protection zones, and interface shall require security perimeter utilizing firewall and similar between them.
 - 2. Throughput of security components, including firewall and similar, shall not limit performance of control system.
- D. Remove or disable software components not required to provide specified system functions and capabilities or required for operation or maintenance of system. This shall be performed prior to Source Quality Testing and Field Quality Testing of components.
- E. Permit only approved applications to run via an application whitelisting solution.

1.09 PHYSICAL SECURITY REQUIREMENTS

- A. Locations of Equipment:
 - 1. ICS and Electronic Security Equipment:
 - a. Locate all communications system equipment, ICS equipment, Electronic Security System equipment, including workstations, servers, network components and accessible communications ports within security perimeter:
 - 1) Components used solely for business network or telephone system are not required to be located within security perimeter.
 - b. Rooms inside physical security perimeter:
 - 1) Secured Control Room and Data Rooms(s), in facility can be considered within physical security perimeter where provided with card reader access to room and camera monitoring to room entry in accordance with Section 28 10 01 – Security and Surveillance System. These are the only locations at WTP where entire room can be considered within physical security perimeter.
 - 2) Locate ICS servers in Control Room or Data Room(s).
 - c. Rooms or locations outside a physical security perimeter:
 - 1) Provide physical security perimeter by locating equipment within locked enclosure:
 - a) Monitor entry into enclosure with electronic door position switches.
 - b) Locate all PLCs, servers, network, communication ports, and similar inside locked enclosures not accessible from exterior of enclosure.
 - 2) OITs/HMIs/Displays:

- a) OITS, HMIs, and other displays may be located on front panel of enclosures.
 - b) Where system status displays are mounted in publicly accessible locations secure network connection to display.
- 2. All Other Equipment:
 - a. Locate all network components and accessible communications ports within secured site boundary.
 - b. Secured site boundary is area within project fenced-in area, which requires entry through one of the facility entry gates.
 - c. Where network components or communication ports are located outside of secured site boundary provide physical security perimeter by locating equipment within locked enclosure. Monitor entry into enclosure with electronic door position switches.
- B. Physical Access Authorizations and Control:
 - 1. Develop and maintain list of individuals with authorized access to site and locations where ICS resides:
 - a. Review access list at least annually.
 - b. Remove individuals from list when access is no longer required.
 - 2. Maintain physical access audit logs for entry and exit points:
 - a. Provide physical access points to control access to areas within facility officially designated as publicly accessible.
 - b. Escort visitors and monitor visitor activity physical access control.
 - c. Secure keys, combinations, and other physical access devices.
 - d. Inventory physical access audit logs for all entry and exit points at least annually.
 - e. Change combination and keys at least annually or when keys are lost, combinations are compromised, or individuals are transferred or terminated.
- C. Visitor Access Records: Maintain visitor access records to facility where ICS resides for 1-year, minimum.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

- A. Coordinate with CO to setup accounts and passwords for Government personnel on Contractor supplied components and equipment, including:

1. Assign system administrator function to appropriate Government personnel designated by CO.
 2. Changing all default accounts and passwords and coordinating with Government to remove Contractor accounts and passwords after completion of the work.
- B. Contractor shall not publish Government account and password information
- C. Prior to delivery of procured product to Government, Contractor shall remove or disable any accounts not needed for normal or maintenance operations, including any guest and/or Contractor accounts.

3.02 FIELD TESTING

- A. Perform in accordance with Section 01 91 16 – Commissioning.
- B. Government may witness Contractor performed testing and inspection activities.
- C. Review and update Contractor supplied documentation during testing and commissioning activities. Document STIGs tested during testing activities and the devices that they were applied to.
- D. Include any network packet capture files taken during testing. Include information on the location the network packet capture took place.
- E. Complete the following requirements as part of the Startup testing activities included in Section 01 91 16 – Commissioning. Provide documentation on the completion of these tests with the testing and commissioning documentation required in Section 01 91 16 – Commissioning.
1. Vulnerability Scanning:
 - a. Scan for vulnerabilities in information systems and hosted applications.
 - b. Employ vulnerability scanning tools and techniques that facilitate interoperability among tools and automate parts of vulnerability management process.
 - c. Document and report false positives from vulnerability scans.
 - d. Analyze vulnerability scan reports and results from assessments of information system security controls.
 - e. Remediate legitimate vulnerabilities within:
 - 1) 30-days for high-risk vulnerabilities.
 - 2) 90-days for moderate risk vulnerabilities.
 - f. Share information obtained from vulnerability scanning process and assessments of information system security controls with designated Government personnel.

2. Capture network traffic from configured SPAN port or network tap. Provide network capture logs and other documentation with the test reports and commissioning documentation documenting captured traffic.
 - a. Traffic to include typical network communications among all components and be representative of normal operations.
 - b. Period of traffic capture to be minimum of 4 hours.
 - c. Summarize traffic capture results including:
 - 1) Enumerating all hosts.
 - 2) Enumerating all conversations with source address destination address, port numbers, and protocol names.
 - d. Uniquely name all files so that the file contents correspond to, and can be identified using the network diagram provided.
3. Verify disconnection points are established between the network security zones. Validate cybersecurity services running on procured product (e.g., virus checking and malware detection) do not conflict with other such services running on the procured product
4. Verify and provide documentation with the test reports that vendor-configured or manufacturer default accounts, usernames, passwords, security settings, security codes, and other access methods are changed, disabled, or removed at the start of commissioning.
5. Verify that all validated security updates and patches are installed and tested.
6. Verify and document physical and cyber security features including authentication, encryption, access control, event and communication logging, monitoring, and alarming to protect the device and configuration computer from unauthorized modification or use.
7. Verify configuration backups are functional.
8. Provide field marked copies of the network diagram, system architecture drawings and dataflow diagram with the test report documentation.

F. Remedial Action:

1. If weaknesses or deficiencies are identified during monitoring activities or assessments of system develop a written action plan with activities, schedule, and milestones to document planned remedial actions to correct identified weaknesses or deficiencies.
2. Include the Remedial Action plan with the test reports and commissioning documentation that document the results of the test or commissioning activity where the weakness or deficiency was identified. Update action plan based on findings from further information system security assessments and monitoring activities.
3. Update commissioning punch list with the current status of the remediation action.

END OF SECTION

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SECTION 01 86 33

ELECTRONIC SAFETY AND SECURITY PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. FPS: Frames Per Second.
- B. PTZ: Pan/Tilt/Zoom.

1.03 REFERENCE STANDARDS

- A. Architectural Barriers Act (ABA)
1. ABAAS Architectural Barriers Act Accessibility Standards
- B. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C2 National Electric Safety Code
- C. National Electrical Manufacturer's Association (NEMA)
1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- D. National Fire Protection Association, Inc. (NFPA)
1. NFPA 70 National Electrical Code (NEC)
- B. National Institute of Standards (NIST)
1. FIPS Federal Information Processing Standard
- C. Underwriters Laboratories (UL)
1. UL 325 Standard for Door, Drapery, Gate, Louver and Window Operators and Systems

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 - Electrical and Control Drawings and Data, and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

- C. RSN 01 86 33-1, Operation and Maintenance Manual.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's instructions. Include instructions with equipment at time of shipment.

1.06 PERFORMANCE REQUIREMENTS

- A. Design, develop, and install a security system for the WTP. The scope detailed below should be taken as minimum design requirements.
- B. Provide equipment necessary to make the system complete and operational. Provide software essential for the system to meet the functional requirements.
- C. Meet requirements in the Security Vulnerability Assessment and Security Plan as detailed in Section 01 81 05 - General Performance Requirements.
- D. Provide information security in accordance with the requirements in Section 01 86 30 - Information System Security Performance Requirements.
- E. Provide an ABAAS compliant system with ABAAS compliant placement of card readers and other Access Control System components.
- F. Provide electric contact based alarms to the WTP Control System, referenced in Section 02 86 25 System Control and Monitoring, from both the Video Surveillance and Access Control System. Do not provide network, or other communication link between these systems and any components of the San Juan SCADA System.
- G. Video Surveillance:
1. Automatic control and recording of each camera in the system.
 2. Manual control of each camera in the system via keyboard, mouse and monitor.
 3. IP based digital video surveillance system.
 4. Open architecture system.
 5. Allows multiple video feeds to be arranged on a display for simultaneous viewing.
 6. Allows simultaneous live viewing and recording.
 7. Allows full resolution or low resolution video, based on bandwidth limitations.
 8. Supports multi-streaming to allow a minimum of three simultaneous users from remote (off-site) locations to simultaneously stream video. Supports streaming full resolution, low resolution and still shots to remote locations.
 9. Supports video analytics like video motion detection.
 10. PTZ camera control, with full remote control via IP network. Supports continuous scan of project site.

11. Provides setup and management of system the Security System Workstation.
 - a. Viewing both live and recorded camera images.
 - b. Adjusting video surveillance system settings.
 - c. Logging and display of events on the system.
 - d. System hardware status.
12. Capable of live streaming camera images at full resolution at 30 fps.
13. On-Site Storage Requirements: 10 days at 10 fps, a resolution of 1080p, minimum, H.264 compression with 25 percent spare storage for future growth in the video surveillance system.
14. Placement:
 - a. Intrusion Detection:
 - 1) For intrusion detection cameras shall be placed to so that the intruder represents at least 10 percent of the image height (no less than 70 pixels) at normal camera image resolution.
 - 2) All cameras shall be placed to provide intrusion detection, unless larger images, or facial recognition, is required.
 - b. Facial Recognition:
 - 1) For facial recognition detection cameras shall be placed so that the intruder represents at least 50 percent of the image height (no less than 360 pixels) at normal camera image resolution.
 - 2) Locations where facial recognition is required, includes the following minimum locations:
 - a) Visitor's Entrance.
 - b) Control room and server or data room entry.
15. Camera Locations:
 - a. Applies to all WTP locations.
 - b. Interior Process Areas:
 - 1) PTZ cameras.
 - 2) Coverage for interior process areas.
 - 3) Coverage for building entrances.
 - c. Office Areas:
 - 1) PTZ cameras.
 - 2) Coverage for hallways and all building entrances.
 - d. Site Perimeter:
 - 1) PTZ cameras.

- 2) Coverage for the site perimeter.
 - e. Exterior Process Areas:
 - 1) PTZ cameras.
 - 2) Coverage for exterior process areas.
 - f. Roadways and Parking Areas:
 - 1) PTZ cameras.
 - 2) Coverage for roadways and parking areas located on the site.
 - g. Entry Gates:
 - 1) Fixed cameras.
 - 2) Coverage for entry or access gates into the site.
 - 3) Additional cameras located in the gate access pedestal with the card reader.
 - h. Control Rooms and Server Rooms, and IT/Communications Room:
 - 1) Fixed cameras.
 - 2) Entry into Control Rooms and Server Rooms.
 - i. Main Building Entrance/Visitor Entrance:
 - 1) Fixed cameras.
 - 2) Entry through the Visitor Entrance (Entry Vestibule/Lobby).
- H. Access Control System:
 - 1. Control entry into the site, into the buildings and within the buildings.
 - 2. IP/network based integrated system.
 - 3. Provides setup and management of system the Security System Workstation.
 - a. Entry and modification of user access cards and access codes.
 - b. Logging and display of events on the system.
 - c. System hardware status.
 - d. Remote lockdown.
 - 4. Supports a minimum of three simultaneous users from remote (off-site) locations to simultaneously access the system.
 - 5. Primary Power Supply: Access control components from the facility power system and shall not rely solely on a local battery power supply and shall be connected to a utility supplied power source.
 - 6. Develop and implement egress plans to allow egress from the secured locations for emergency events, such as a fire event. Egress plans shall be in accordance with all national, state and local codes.

7. Backup Power Supply:
 - a. Battery supplied backup power for the access control system to allow its continued operation upon loss of power. Sized for a minimum duration of 90 minutes with doors operating throughout that period.
 - b. Allow continue operation of the electronic access control system for the doors throughout this period.
8. Door Access Control:
 - a. Provide door access control utilizing card readers with keypads to allow entry to the building based on two factor authentication with individual employee access cards and individual access codes. System shall be capable of being set to bypass access codes during specific time periods and other conditions as agreed to by the Government.
 - b. Provide all necessary electronic locks, door hardware and other components required to implement specified system.
 - c. Provide mortise locks for doors providing entry to buildings or structures without card readers and keypads. Mortise locks are not required for roll-up doors which require access to the interior of the building or structure to operate.
 - d. Provide integrated mortise locks for doors with card readers and keypads with the mortise lock allowing the user to bypass the card reader and keypad to open the door.
 - e. Support settable time period to control time duration doors are unlocked.
 - f. Manual Keys:
 - 1) Provide a master key capable of operating all manual locks on entry doors and gates.
 - 2) Provide separate sub-master keys for the buildings and for the control room, lab, server room and IT/communications rooms.
 - g. Minimum Card Reader with Keypad Locations:
 - 1) Building/structure entry doors. Provide card readers with keypads on at least one door allowing access to the interior spaces within each building. If building interior walls do not allow all interior spaces to be access through one access door locate card readers and keypads to ensure that all interior spaces are accessible through a door with a card reader with keypad.
 - 2) Each control room, server room, and IT/communications room door shall have card reader with keypad for entry into the room.
 - 3) Interior doors separating public or visitor access areas where unescorted members of the public may be located from personnel zones and process/chemical areas.

- 4) Doors on opposite sides of the building for all buildings longer than 100 feet in any direction.
 - 5) Doors or entry points between office or administrative areas and process areas.
 - 6) Interior door between entry vestibule and lobby.
 - 7) Doors for the lab.
 - 8) Doors for the Control Room, Server Room, or other IT/communications rooms.
9. Door/Gate/Hatch Position Monitoring:
 - a. Utilized balanced magnetic contracts to provide door or gate position monitoring unless the installation arrangement requires alternative method to monitor position. Video analyzation alone is not sufficient.
 - b. Utilize wide-gap, balanced magnetic contacts on doors.
 - c. Provides specific indication of which entry point opened.
 - d. Minimum Locations:
 - 1) Doors or entry points for entering a building or structure. This includes personnel doors, equipment doors, and roll-up doors.
 - 2) Doors or entry points between office or administrative areas and process areas.
 - 3) Doors or gates associated with visitor entry to the site/building.
 - 4) Doors entering the lab, Control Room, Server Room, or other IT/communications rooms.
 - 5) Enclosures containing San Juan SCADA System or network components.
 - 6) Gates allowing entry to the site or through fences.
 - 7) All doors or entry points requiring card reader with keypad entry.
 - 8) Access hatches for vaults.
10. Provide egress method that meets all applicable codes while maintaining security at the WTP to the extent possible.
11. Emergency Services Access:
 - a. Emergency services access, including fire department, via key locked access box for key storage, appropriately keyed for emergency services access.
 - b. Accessible outside of building.
 - c. Acceptable to the local fire marshal.
12. Automatically call Government designated phone number upon unauthorized entry. Phone number will be given at time of commissioning.

13. Provide hardwired (not network or communication based) alarms to the SCADA system for system alarm or unauthorized entry.
- I. Intercoms:
1. Provide intercoms to allow communication with the Control Room at the following locations:
 - a. Gate Access Pedestals.
 - b. Building Entry Vestibule.
- J. Network:
1. Provide network access to security system components in accordance with the security requirements in Section 01 86 29 - Communications Performance Requirements and Section 01 86 33 – Information System Security Performance Requirements.
 2. Provide high speed data network for security system components.
 - a. Network shall be designed to be scalable and facilitate future expansion of the system.
 - b. The network shall be designed to have 50 percent spare base system capacity without exceeding the performance limits.
 - c. Provide fiber optic cable for connections between network switches and other locations where required.
 3. Supports live streaming camera images at full resolution at 30 fps.
- K. Provide power distribution to components in accordance with the requirements in Section 01 86 26 - Electrical Performance Requirements including providing all components required to transform and distribute power.
- L. Provide overcurrent, transient and surge protection for system components.
- M. Licenses:
1. Provide software licenses required to operate, maintain, setup and program systems with the specified functionality for a minimum of two years after Final Acceptance of the WTP.
- N. Furnish two copies of system software, to include:
1. Software required to re-install system software required for the system to function properly.
 2. Copies supplied shall contain the final version of all furnished software.
 3. Operating system software.

4. Database and application software, including all software required for setup, maintenance and operation of the Video Surveillance System and Access Control System.
5. Data archiving/backup and retrieval software.
6. Licensing in the Government's name for all software.
7. Provide a complete restorable external backup of every software component. Archive point shall be latest software versions prior to Contractor demobilization and include punch list changes made after Commissioning.

PART 2 PRODUCTS

2.01 VIDEO MANAGEMENT SOFTWARE

- A. March Networks command suite of video management tools, as distributed by March Networks, 303 Terry Fox Drive, Suite 200, Ottawa, Ontario, Canada, K2K 3J1, 800-563-5564, www.marchnetworks.com; or equal, having the following essential characteristics:
 1. Windows based.
 2. Record and store video and data.
 3. Organize retrieve, playback, save and export video.
 4. Side-by-side viewing of archived and live video.
 5. Search tools, including smart search, visual finder, timeline, thumbnails, motion histograms.
 6. Simultaneous multiple views from the same camera for comparison.
 7. Different tasks can be performed on separate monitors.
 8. Support multi-sector archiving to allow different recording parameters on different sectors. Recording parameters shall be selectable for specific scenarios, with different resolution and retention requirements.
 9. Alarm and event configuration, with configurable camera response based on alarms or events.
 10. System Management:
 - a. Customizable user interface based on job responsibility.
 - b. User audits.
 - c. Health monitoring and alerts.
 - d. Generates charts which display data on system performance and recording performance.
 - e. Mass firmware and configuration audits.

- B. Access Control System Software shall be locally installed and supported by computing and storage resources at the site and shall not utilize the ‘cloud’ or other distributed computing resources located off site.

C.

2.02 SECURITY SYSTEM WORKSTATION

- A. Provide a minimum of one Security System Workstation located in the facility control room.
- B. Allows the user to perform the following minimum functions:
 - 1. Operate and manage the Video Surveillance System and Access Control System for the facility.
 - 2. Access stored video footage.
 - 3. Provides live viewing of video footage from any of the security system cameras.
 - 4. Control cameras.
 - 5. Access and perform setup and modification functions for the access control keypad and card reader system.
 - 6. Modify the Access Control System to program new cards, add and remove users, and change card credentials and access.
 - 7. Print and export configuration information.
 - 8. Export video footage.
- C. Number of Processors/Core: six, minimum.
- D. Processor: 2.4 GHz, minimum.
- E. RAM: 32 GB, minimum.
- F. Hard Drive: 500 GB, minimum.
- G. Includes a mouse and full function QWERTY keyboard.
- H. Minimum of one 24-inch monitor:
 - 1. Touchscreen.
 - 2. Flat panel.
 - 3. LED.
 - 4. Resolution: 3840 x 2160 pixels, 4K UHD, minimum.
 - 5. Usable in all lighting conditions.
 - 6. Response rate: Not more than 5ms.

- I. DVD-RW drive.
- J. Provide hot plug redundant power supply.
- K. Ports:
 - 1. 10/100/1000 Base-T Ethernet ports: 2, minimum.
 - 2. USB ports: 5, minimum.
 - 3. HDMI ports: 2, minimum.
 - 4. Additional ports as required.
- L. Operating System:
 - 1. Microsoft Windows Operating System provide the highest edition supported by the video management software.
 - 2. Version currently supported by Microsoft.
- M. Minimum ports:
 - 1. 4 USB Type-A ports.
 - 2. 2 USB Type-C ports.
 - 3. Serial port
 - 4. Keyboard port
 - 5. Mouse port.
 - 6. 2 RJ45 network ports
 - 7. Additional ports as necessary to support accessory components.
- N. Other Software:
 - 1. Video Management Software.
 - 2. Microsoft Office Professional Suite.
 - 3. Adobe Acrobat Professional.
 - 4. Other software as required.
- O. Display the Government's System Use Notification banner.

2.03 SERVERS

- A. Provide servers to meet specified system functionality, including the digital video storage requirements.
- B. Type: Rack mount for industrial server rack.
- C. CPU: Current generation.

- D. RAM: 16 GB, minimum.
- E. Storage:
 - 1. 9 TB, minimum and as required to provide specified video storage.
 - 2. SATA drives.
 - 3. RAID 5, minimum.
- F. Provide rack mounted LCD display and keyboard located in the industrial server rack with the servers to provide user interface to the servers. Provide switch or other user interface to switch display and keyboard between the servers where necessary.
- G. Provide hot plug redundant power supply.
- H. Ports:
 - 1. 1GbE Base-T Ethernet ports: 4, minimum.
 - 2. Additional ports as required.
- I. Operating System:
 - 1. Microsoft Operating System, provide the highest edition supported by the video management software.
 - 2. Version currently supported by Microsoft.
- J. Other Software:
 - 1. Video management software.
 - 2. Other software as required.

2.04 NETWORK SWITCHES

- A. NDAA Compliant.
- B. Network switches: Managed industrial switches which provide the following minimum features:
 - 1. Supports linear, star, and ring topology.
 - 2. Loop prevention.
 - 3. Resiliency.
 - 4. Segmentation.
 - 5. Prioritization.
 - 6. Time synchronization.
 - 7. Security and diagnostics.

8. Provide ports and connections, as required. Include a minimum of 20 percent spare ports of each type used at the switch.

2.05 CAMERAS

A. General:

1. IP/network cameras.
2. Support H.264 video compression.
3. Power over Ethernet PoE, where available.
4. Provide heaters, wipers, blowers or other devices necessary to provide a clear image from installed camera location.
5. Provide camera mounting system, including pole mount, building mount, and similar, as appropriate for location where installed.
6. Supports 1080p image resolution, minimum, at 60 frames per second.

B. Pan/Tilt/Zoom (PTZ) Dome Cameras:

1. Pendant, heavy duty.
2. Auto-focus.
3. Automatic image stabilization.
4. Zoom: 18x optical minimum.
5. Supports 360 degree pan.

C. Outdoor cameras to include the following:

1. Day/Night functionality.
2. NEMA 4X, weatherproof.
3. Dome: Clear polycarbonate.
4. Operating Temperature: Suitable for location.
5. High Powered PoE injector for heater element.

2.06 ACCESS CONTROL SYSTEM COMPONENTS

- A. Provide all necessary components, including site controllers, door controllers, keypads, card readers, electronic locks, power supplies, batteries, and similar required to implement specified system.
- B. All access control components shall have a primary power source supplied from the facility power system and shall not rely solely on a local battery power supply.
- C. System and provided key cards shall support the use of both combination keypad and card readers as well as proximity card readers.

- D. Provide 50 key cards and all components needed to program the cards.
- E. Keypad and Card Reader:
 - 1. Card reader: Proximity type.
 - 2. Keypad: 10 button keypad, minimum.
 - 3. System capable of being set to bypass keypad.
 - 4. Compatible with Site Control Unit and Access Control System Software.
 - 5. Visual Indication:
 - a. Successful badge and code entry.
 - b. Alarm.
 - 6. Vandal resistant anti-pull-off design.
 - 7. Heavy duty all metal escutcheons.
 - 8. Battery backup with continuous power connection to power supply.
 - 9. Weatherproof, intended for outdoor installation.
 - 10. UL listed.
 - 11. Conform to requirements in FIPS 201.
- F. Site Control Unit:
 - 1. Millennium Enhanced Site Control Unit as manufactured by Millennium Group, 16 Tech Circle Suite 225, Natick, MA 01760, 866-455-5222, www.mgiaccess.com; or equal, having the following essential characteristics:
 - a. Supervisory Communications Monitor Relay.
 - b. Alarm Event Buffer: 100 priority event history.
 - c. Transaction History Buffer: 20,000 event on board storage.
 - d. Tamper Protection.
- G. Access Control System Software:
 - 1. Millennium Ultra as distributed by Millennium Group, 16 Tech Circle Suite 225, Natick, MA 01760, 866-455-5222, www.mgiaccess.com; or equal, having the following essential characteristics:
 - a. Compatible with existing Millennium Ultra systems.
 - b. Supports access and entry via specified methods.
 - c. Integrates with electronic locks, keypads and card readers.
 - d. Active directory login integration. Allows for limitation of system user permissions and daily activities.
 - e. Conditional and unconditional lock-down via any system event.

- f. March Networks video system integration.
 - g. Event management, including pre-set system responses to system events such as unauthorized entries, intrusions or any specified event.
 - h. Hardware management.
 - i. Hardware status indicators.
 - j. Scheduling management, system administrator can set and edit card holder access schedules.
 - k. Site management allows the system administrator to create and manage cardholder access restrictions through a single management screen.
 - l. User and account management. Allows assignment of multiple credentials for system access to individual cardholders.
 - m. Embedded photo badging allowing the creation of custom badge layouts for access card credentials
 - n. Active mapping with floor / building plan layouts.
 - o. Integration with fire alarm system.
2. Access Control System Software shall be locally installed and supported by computing and storage resources at the site and shall not utilize the 'cloud' or other distributed computing resources located off site.

2.07 BALANCED MAGNETIC CONTACT

- A. Separate magnet housing and contact.
- B. Metal housing.

2.08 ENCLOSURES

- A. NEMA 250 Type 1 or 12 enclosures for indoor installations and NEMA 250 Type 4X enclosures for outdoor installations. Identify and select equipment materials and enclosure types for location installed and probability of exposure to water and hazardous or corrosive environments.
- B. Thermostatically controlled cabinet space heaters to control condensation in all cabinets not in a temperature-controlled environment, or subject to condensation.
- C. Enclosure's design shall allow free and easy access to internal components.
- D. Enclosures shall maintain temperature of equipment within manufacturer recommended range.
- E. Doors: Lockable.
- F. Finishes: Manufacturer's standard finishes.

- G. Overall enclosure assembly: Provide nameplate with equipment.

2.09 NETWORK RACKS

- A. Network Racks, include:
1. 19-inch Electronic Industries Association (EIA) rails.
 2. Depth, at a minimum, to accommodate deepest equipment to be mounted in rack with additional space to accommodate connections to rear of equipment.
 3. 25 percent spare space.
 4. Perforated lockable doors, front, and rear.
 5. Power outlets.
 6. Cable management system.
 7. Leveling feet and bolt down brackets.
- B. Design shall allow free and easy access to internal components.
- C. Design racks to maintain components mounted in the rack within manufacturer's specified operating temperature range.
- D. Manufacturer's standard anti-corrosion coating.

2.10 ENTRY GATE OPERATOR

- A. Electric gate operator capable of opening and closing the gate under installed conditions.
- B. Overload protection.
- C. UL listed.
- D. Programmable.
- E. Weatherproof enclosure.
- F. Surge protection.
- G. Provide gate operators such that a complete system complies with UL 325. The installed system shall meet the requirements for a Class III installation, at a minimum. If gate is utilized in an area exposed to the general public the installed system shall meet the requirements for a Class II installation, at a minimum.
- H. Mechanical disconnect or release to allow the gate to be moved manually.
- I. Backup battery supply capable of powering gate controls and operating the gate in the event of the loss of facility power.
- J. Lockable enclosure.

K. Anti-condensation heater.

L. Control:

1. Methods of initiating gate entry:
 - a. Card reader with keypad.
 - b. Remote operation from Control Room.
2. Methods of initiating gate exit:
 - a. Vehicle sensed by loop detector.
 - b. Remote operation from Control Room.
3. Emergency Services Access:
 - a. Emergency services access, including fire department, via keyed switch or gate operating device located in a locked box keyed for emergency services access.
 - b. Accessible outside of gate.
 - c. Acceptable to the local fire marshal.

M. Sensors:

1. Limit switches (as applicable) to prevent gate over travel.
2. Inside and outside vehicle detection loops.
3. Additional sensors as required to meet the requirements of UL 325 and provide entrapment protection.

N. Gate Access Pedestal:

1. Accessible from the driver's side of the vehicle while the driver is in vehicle.
2. Dual height pedestal at 42-inch and 72-inch to accommodate cars and truck entry.
3. Provide bollards near Gate Access Pedestal to minimize potential for damage to the pedestal.
4. Include (at each height):
 - a. Card reader with keypad for employee access through the gate. Integrated with the site security system.
 - b. Intercom to allow visitors to call facility from the gate.
 - c. Camera to view driver.

O. Include all required devices.

2.11 SURVEILLANCE SIGNS

A. Aluminum, 10 inches by 14 inches, minimum.

- B. Signs shall read “RESTRICTED AREA MONITORED BY VIDEO CAMERA”.

2.12 SURGE SUPPRESSION DEVICES

- A. Designed to protect outdoor cameras.

2.13 CABLE AND RACEWAY

- A. In accordance with Section 01 86 26 - Electrical Performance Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with manufacturer’s recommendations.
- B. In accordance with Section 01 86 26 - Electrical Performance Requirements.
- C. Mount each security keypad panel within easy access from its door.
- D. Mount servers and other security system components in Server Room or Control Room.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. Perform inspection, testing and commissioning in accordance with Section 01 91 16 - Facility Commissioning and Section 01 86 33 – Information System Security Performance Requirements.
- B. Government will witness test. Notify COR in writing at least 20 days prior to the beginning of the security and surveillance system testing.
- C. Demonstrate the functionality, camera coverage, performance, and stability of the hardware and software.

END OF SECTION

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SECTION 01 86 34

FIRE DETECTION AND ALARM PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. FACU: Fire Alarm Control Unit.
- B. IDC: Initiating Device Circuit.
- C. NAC: Notification Appliance Circuit.
- D. NICET: National Institute for Certification in Engineering Technologies.

1.03 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)
- | | |
|-------------|--|
| 1. NFPA 70 | National Electrical Code (NEC) |
| 2. NFPA 72 | National Fire Alarm and Signaling Code |
| 3. NFPA 101 | Life Safety Code |

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.05 PERFORMANCE REQUIREMENTS

- A. Design and provide an automatic fire detection and alarm system for each structure as required by applicable codes and as follows:
1. Provide a fully addressable fire alarm system for the following locations:
 - a. Any buildings containing process areas or office areas
 - b. All other areas where a fire alarm system is required by code.
 2. Provide smoke alarms in any buildings or enclosed structures not provided with fire alarm systems. Wire alarm contacts from smoke alarms for remote annunciation.

- B. Detection, Alarm, Notification Methods: In accordance with NFPA 101, NFPA 72 and all applicable codes.
- C. Single Source Responsibility:
 - 1. Obtain components from a single source that assumes responsibility for compatibility.
 - 2. Components shall be of a single manufacturer.
- D. Devices and components shall be new and manufacturer's current model.
- E. Ventilation fans, Air handling unit (AHU), air conditioner, combination fire smoke dampers, louvers and other dampers and ventilation system controls into fire alarm system operation as required and to control smoke and prevent fire from escalating.
- F. Fire Alarm System, include at a minimum:
 - 1. FACUs.
 - 2. Releasing Panel, where applicable.
 - 3. Fire Alarm Remote Annunciators.
 - 4. Fire alarm transponders.
 - 5. Automatic smoke and heat detection, including duct smoke detection.
 - 6. Manual alarm initiation.
 - 7. Audible and visual notification devices.
 - 8. Alarm annunciation (local and remote).
 - 9. Network connections.
 - 10. Integration of ventilation fans, air handling unit (AHU), air conditioner, combination fire smoke dampers, louvers and other dampers and ventilation system controls into fire alarm system operation as required and to control smoke and prevent fire from escalating.
 - 11. Sprinkler waterflow and pressure switches.
 - 12. Sprinkler system and standpipe system valve supervisory alarm switches.
 - 13. Elevator recall, where required.
 - 14. Smoke control system, where required.
 - 15. Door and enclosure interfaces, where required.
 - 16. Damper interfaces.
 - 17. Interface modules, interposing, auxiliary and time delay relays, enclosures, raceway, wiring, accessory components, and similar required for complete and functional system in accordance with the Specification.
- G. Basic Performance:

- a. Any SLC between FACUs shall be wired Class X in accordance with NFPA 72.
 - b. IDCs shall be wired Class B in accordance with NFPA 72.
 - c. NACs shall be wired Class B in accordance with NFPA 72.
 - d. Circuits associated with fire alarm systems shall be supervised for integrity.
 - e. Equipment associated with fire alarm system shall take advantage of equipment's internal trouble detection features, where available.
 - f. Activation of system into 'alarm mode' shall occur by actuation of any alarm initiating device. System shall remain in 'alarm mode' until initiating device is reset and FACU is reset and restored to 'normal mode.'
 - g. Any fire system wiring that extends outside of building or structure shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on submittal drawings.
2. Fire alarm system network:
- a. Provide network connections between all FACUs and the FACU located in the Admin Building.
 - b. All signals generated at locations other than the Admin Building will be displayed on the master FACU located in the Admin Building and communicated to monitoring location.
3. Fire alarm notification devices:
- a. Provide an alarm notification system throughout the buildings and structures of the locations identified that meets sound level requirements in listed codes. System shall provide evacuation notification coverage for all levels and platforms throughout locations.
4. Fire alarm initiation devices:
- a. Provide fire alarm initiation devices as required by all listed codes.
 - b. Include manual pull stations at exits for all locations on every level at every egress point, facility or building exits and Control Room.
 - c. Include devices for monitoring sprinkler system or other suppression systems, where applicable.
 - d. Include duct detectors for ventilation fans and HVAC units where required by listed codes.
 - e. Automatic Detection:
 - 1) Design and provide smoke detection to cover locations with fire alarm systems. Areas of coverage include occupiable areas in buildings and structures, elevator hoistways, elevator lobbies, and stairwells.

- 2) Monitoring operation of sprinkler systems, where they exist, may be provided in lieu of smoke detectors, where it meets requirements in listed codes.
 - 3) System provided shall meet or exceed all listed codes.
5. System Interface:
 - a. Provide system trouble alarm and system initiation alarm from the fire alarm system to the SCADA System.
 - b. Transmit signal to local fire department in event of a fire.
 - c. Network site fire alarm panels together to provide remote annunciation of events.
- H. Certify that documents they produce meet and comply with all listed codes and system is designed in accordance with said codes.
- I. Noting non-compliance on drawings or documents is not acceptable.
- J. Communicator:
 1. Provide a dual path communicator for the fire alarm control panels which is capable of supporting either cellular (GSM) or IP communication and settable to either cellular only, IP only or both.
 2. Supports HSPA+, HSPA, EDGE and GPRS communication protocols and compatible with Honeywell AlarmNet system.
 3. Cellular communicator shall be intended for interface with the fire alarm control panels supplied and shall interface with the primary and secondary communication ports from the fire alarm control panel.
 4. Cellular communicator shall be housed in the FACP enclosure or in its own enclosure and powered from the fire alarm control panels.
 5. Includes an external antenna.
- K. Includes system programming and setup functions for an operational and functional system at the time of system turnover.
- L. Conditions:
 1. Devices shall be rated for and have an operating temperature range suitable for conditions at location where installed.
 2. Suitable enclosures shall be provided as required to ensure installed condition of device meets manufacturer's recommendations.
 3. Where water may be present or splash hazards exist, devices shall be installed in manner suitable for wet locations.
 4. Where devices are located in areas identified as "Integrated" in Section 01 81 20 - Programming Performance Requirements the following requirements apply.

- a. Panels should be flush mount.
 - b. Detection devices should be low profile in a color similar to the color of the surface they are mounted on.
 - c. Horns should be flush mount.
 - d. Strobes and horn strobes should be flush mount where possible.
 - e. No cable or raceway should be exposed.
- M. Coordinate system design and installation with the following:
 - 1. Section 01 81 20 - Programming Performance Requirements.
 - 2. Section 01 83 00 - Building Performance Requirements.
 - 3. Section 01 86 13 - Fire Suppression Performance Requirements.
 - 4. Section 01 86 19 - HVAC Performance Requirements.
 - 5. Section 01 86 25 - System Control and Monitoring Performance Requirements.
 - 6. Section 01 86 33 - Electronic Safety and Security Performance Requirements.

1.06 QUALIFICATIONS

- A. Designer:
 - 1. Professional engineer with a Fire Protection PE or NICET Level III certified, experienced in design of this type.
 - 2. Minimum of three prior projects designing fire protection systems.
 - 3. Shall meet any additional requirements required by the State of New Mexico or local Authority Having Jurisdiction for performing this role.
- B. Manufacturer:
 - 1. Company specializing in manufacturing products specified in this section with minimum 5 years documented experience.
 - 2. Shall meet any additional requirements required by the State of New Mexico or local Authority Having Jurisdiction for performing this role.
- C. Installation Supervisor:
 - 1. Provide a certified technician with minimum NICET Level III certification to supervise installation, adjustment, final connections and system testing.
 - 2. Shall meet any additional requirements required by the State of New Mexico or local Authority Having Jurisdiction for performing this role.

1.07 EXTRA MATERIALS

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

1. Smoke detectors, heat detectors, manual pull stations, monitor modules and control modules: Quantity equal to two percent of amount of each type installed, but no less than one (1) unit of each type.
2. Keys: Ten extra sets for access to locked and tamperproof components.
3. Audible and Visual Notification Appliances: Two percent of each type installed but no less than one (1) unit of each type.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM COMPONENTS

A. Power Supply:

1. The fire alarm system shall derive its normal power from a 120 VAC, 60 Hz dedicated supply. Standby power shall be provided by batteries, which are sized according to the requirements in NFPA 72:
2. Each power source shall be supervised.
3. Battery Chargers: Completely automatic with constant potential charger maintaining the battery fully charged under all service conditions.

B. Fire Alarm Control Unit (FACU):

1. FACU shall be designed specifically for fire detection and notification applications and shall contain a microprocessor with a 10/100 Ethernet media access controller.
2. Programmable, with multiple levels of passwords. Allows uploading of setting files from external computer.
3. Provide FACU with protection from damage due to lightning or voltage and current transients.
4. Display:
 - a. Integral touchscreen graphic liquid crystal display (LCD).
 - b. Allows fire alarm verification (by device or zone).
 - c. Provides sufficient information to identify location of devices in alarm and perform system troubleshooting.
5. System shall be capable of the following operations:
 - a. Acknowledge/Silence:
 - 1) Silences audible alert of troubles and supervisory conditions at FACU. Occurrence of any new conditions in the system shall cause the audible alert to re-assert.
 - 2) This operation shall also silence audible alert at any remote annunciators.

- b. Alarm Silence: Silences all alarm notification appliances and returns them to normal condition after an alarm condition.
 - c. System Reset: Causes all electronically-latched initiating devices, as well as all associated output devices and circuits, to return to their normal condition.
 - d. Alarm Activate (Drill): Activates all notification appliance circuits without activating the Digital Alarm Communicator/Transmitter (DACT).
 - e. Lamp Test: Activate system LEDs and light each segment of LCD.
- 6. FACU shall have lockable enclosure.
- C. Releasing Panel:
 - 1. Shall meet the requirements for an FACU, designed for use with a fire suppression system.
 - 2. Alert the main FACU panel that the suppression system has released.
- D. Annunciator:
 - 1. Provide annunciator for the fire alarm system in the Control Room.
 - 2. Graphically display the layouts of all the locations included in the site fire alarm systems and provides / indication of the location(s) where the fire alarm system has received an alarm signal from an initiation device.
- E. Manual Pull Station.
- F. Fire/Smoke Detectors:
 - 1. Photoelectric smoke detectors.
 - 2. Projected beam detectors.
 - 3. Thermal detectors.
 - 4. Rate compensated detectors.
 - 5. Detectors required for fire suppression systems.
- G. Warning Devices:
 - 1. Horns.
 - 2. Strobes.
 - 3. ADA standards compliant strobes.
 - 4. Combination horn/strobes.

2.02 WIRE AND CABLE

- A. Wire and cable for shall be UL listed and labeled for application and intended use.

- B. Wire and cable shall be provided in accordance with requirements in NFPA 70 Article 760.
- C. Conductor size shall be determined by calculations and manufacturer's requirements or recommendations and these requirements.
- D. Type of cable chosen should be based on fire system requirements, specification requirements and applicable code requirements. Consideration should also be given to length of cable runs and potential interference.
- E. Non-Power Limited Circuits:
 - 1. 600-volt rated insulation.
 - 2. Rated for a minimum of 75 degrees C continuous operating temperature, wet or dry.
 - 3. Conductors:
 - a. Solid-copper conductor.
 - b. Minimum conductor size:
 - 1) Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2) Line-Voltage Circuits: No. 12 AWG, minimum.
 - 4. Overall Jacket:
 - a. Type: PVC (Polyvinyl chloride) or equal.
 - b. Flame-retardant.
 - 5. Insulation Type:
 - a. Type: PVC (Polyvinyl chloride) or equal.
 - 6. Suitable for:
 - a. Installation in raceways.
 - b. Wet or dry installation.
 - c. Installation conditions for location where installed, including plenums where applicable.
- F. Power Limited Fire Alarm Circuits:
 - 1. 300-volt rated insulation.
 - 2. Colored insulation matching approved color-code.
 - 3. Rated for a minimum of 75 degrees C continuous operating temperature, wet or dry.
 - 4. Conductors:
 - a. Solid-copper conductor.
 - b. Minimum Conductor Size:

- 1) Signaling Line Circuit: No. 18-AWG, minimum.
 - 2) Notification Appliance Circuit: No. 14-AWG, minimum.
5. Shield.
6. Overall Jacket:
 - a. Type: PVC (Polyvinyl chloride) or equal.
 - b. Flame-retardant.
7. Insulation Type: PVC (Polyvinyl chloride) or equal.
8. Suitable for:
 - a. Installation in raceways.
 - b. Wet or dry installation.
 - c. Installation conditions for location where installed, including plenums where applicable.

2.03 UTILITY LOCKS AND KEYS

- A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.
- B. Key operated manual fire alarm stations shall have a single standardized lock and key separate from control equipment.
- C. All keys shall be delivered to COR.

2.04 SOFTWARE AND LICENSES

- A. Provide software licenses required to operate systems.
- B. Two (2) copies of licensed software.

PART 3 EXECUTION

3.01 GENERAL

- A. Install work as shown on approved drawings, as specified herein, and in accordance with all listed codes and manufacturer's diagrams and recommendations.
- B. Ground equipment in accordance with listed codes, manufacturer's recommendations and Section 01 86 26 - Electrical Performance Requirements.
- C. Raceway:
 1. Install conduit and raceway in accordance with the requirements in these specifications, fire system manufacturer's recommendations, listed codes, Section 01 86 26 - Electrical Performance Requirements.

2. Conduit shall not block access to any existing equipment or fixtures.
 3. All conduit shall be installed parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Except where prevented by location of other work, a single conduit or conduit group shall be centered on structural members.
- D. Cables and Conductors:
1. Install cables and conductors in accordance with the requirements these specifications, fire system manufacturer's recommendations, listed codes, Section 01 86 26 - Electrical Performance Requirements.
 2. Fire system wiring shall be installed in conduit. Wiring for fire system shall not be installed in conduits, junction boxes or outlet boxes with conductors of other systems.

3.02 CONTRACTORS QUALITY ASSURANCE

- A. Testing activities shall be conducted in accordance with the requirements of the Authority Having Jurisdiction.
- B. Operational Test: Per NFPA 72:
1. Perform testing in witness of Government representative, facility operators, and representative of the Authority Having Jurisdiction, if applicable.
 2. Include verification of operation of each device and remote system interface including SCADA system alarms.
- C. Test Reports:
1. Include completed record of completion in accordance with NFPA 72.
 2. Supply test reports bound together showing field tests performed to prove compliance with specified performance criteria, upon completion and testing of installed system.
 3. Document readings, test results and indicate final position of controls.
 4. Supply dates of testing and correctional items found during testing with remedies.
 5. Supply contact information including address, telephone, website for local certified fire alarm technician.

END OF SECTION

SECTION 01 86 46
WATER TREATMENT PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Public Health Association (APHA)/American Water Works Association (AWWA)/Water Environment Federation (WEF)
1. Standard Methods for the Examination of Water and Wastewater
- B. American Water Works Association (AWWA)
1. AWWA C653 Disinfection of Water Treatment Plants
- C. ASTM International (ASTM)
1. ASTM E2516 Cost Estimate Classification System
- D. National Electrical Manufacturers Association (NEMA)
1. NEMA MG 1 Motors and Generators
- E. Navajo Nation Environmental Protection Agency (NNEPA)
1. Primary Drinking Water Regulations
- F. State of New Mexico
1. 20.7.10 NMAC Drinking Water Regulations
 2. New Mexico Environment Department (NMED) Construction Program Bureau “Recommended Standards for Water Facilities”

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

- C. RSN 01 86 46-1, Emergency Action Plan:
 - 1. Coordination plan for outside emergency services including response time and a site visit where a rescue requires special capabilities or equipment.
 - 2. Provide Emergency contacts and procedures to be used during an onsite emergency.
- D. RSN 01 86 46-2, Testing Protocol.
- E. RSN 01 86 46-3, Completed Testing Protocol.
- F. RSN 01 86 46-4, Testing Phase:
 - 1. Functional test protocol.
 - 2. Functional test report.
 - 3. Performance test report.
 - 4. Monitored test report.
- G. RSN 01 86 46-5, Operation Phase:
 - 1. Operation status reports.
 - 2. Reporting documents to regulatory agencies.
 - 3. Demonstration test report.
 - 4. Amended demonstration test report.

1.04 SYSTEM DESCRIPTION

- A. WTP includes equipment, materials, and appurtenances for a functioning water treatment process.
- B. Treat raw water to meet specified requirements.

1.05 PROJECT CONDITIONS

- A. Section 51 45 14 – Pilot Scale Results Report.

1.06 BASIC FUNCTION

- A. Meet applicable approving agency drinking water regulations including Navajo Nation EPA (NNEPA).
- B. Incorporate the design standards detailed in the Navajo Nation Primary Drinking Water Regulations and the NMED “Recommended Standards for Water Facilities”.
- C. Unless otherwise noted, design in accordance with industry standards defined as AWWA Water Treatment Plant Design.

1.07 PROCESS REQUIREMENTS

- A. Required water treatment process
 - 1. Phase 1 and Phase 2: Conventional Treatment (coagulation, flocculation, sedimentation, media filtration) optimized for maximum TOC removal.
 - 2. Phase 1 Only: Granular Activated Carbon following Conventional Treatment.
- B. Space for potential future desalination
 - 1. Provide a space for a potential future desalination (nanofiltration) system near a logical tie-in location that would reduce the total dissolved solids concentration by 200 mg/L.
 - 2. Due to the low likelihood of being implemented, do not provide WTP modifications (e.g. blind flange) that would reduce the cost of future installation.
- C. Design Equipment with minimal replacement required during WTP 50-year operating lifecycle.
- D. Design WTP process for seamless, automated, operation from WTP inlet to WTP distribution system discharge.
- A. Provide storage buffer as needed to operate water treatment equipment efficiently.
- B. Process Pumps:
 - 1. Do not use throttling valves to maintain head conditions.
 - 2. Install pump to minimize corrosion at the pump mount interface. Use materials, coatings or elevate surface.
- C. For major pieces of equipment, provide drains and overflows that drain to waste.
- D. Chemical Storage:
 - 1. Drums, Totes, and Tanks: Refer to Section 01 89 35 - Storage Tank Performance Requirements for additional requirements.
 - a. Volume, Greater of:
 - 1) 30 days of chemical supply for the Average Day Demand at average design dosage.
 - 2) 14 days of chemical supply as computed by the Maximum Day Demand at maximum design dosage.
 - b. Bulk Delivery, if applicable: Design chemical storage tank capacities for a minimum of 1.5 full tanker trucks.
 - c. Delivery Area / Fill Station:
 - 1) Provide secondary containment capable of containing a full delivery tanker spill.

- 2) Plumb containment area to waste ponds and provide ability to isolate containment area during filling operations.
 - 3) Exterior lighting adequate for all sides of delivery vehicles for night deliveries. Manual light switch.
 2. Bulk Storage Tanks, if applicable:
 - a. Fill ports:
 - 1) Individually hard piped to tank's fill station.
 - 2) Pipe accessible throughout entire length (not buried, not behind walls).
 - b. Lockable fill caps.
 - c. Provide maintenance access to the tank top, including ladder, safety rail, and hand railing.
- E. Chemical Feed:
 1. Pumps:
 - a. Peristaltic metering pumps for chemical feed systems.
 - b. Utilize the same manufacturer for peristaltic metering pumps.
 - c. Provide a spare pump for each chemical feed system and each pump size.
 - d. Pump control: Flow-paced.
 - e. Pump head with leak sensor and open head sensor.
 2. Chemical injectors:
 - a. Retractable injection quill for chemical feed points with two stainless steel chains to prevent injector blowout.
 - b. Saf-T-Flo EB series; or equal, having the following essential characteristics:
 - 1) A chemical solution tube within a larger process connection pipe.
 - 2) Retractable solution tube.
 - 3) Process connection isolation valve.
 - 4) Integrated check valve.
 - 5) Confirm quill material chemical compatibility and installation suitability with the quill manufacturer.
 3. Acid dilution mixing nozzles and system to mitigate damage from exothermic reaction with process fluid. Damage includes but is not limited to peeling exterior pipe coating at injection point.
- F. Disinfection:
 1. As required by NNEPA or this section, whichever is more stringent.

2. Primary Disinfection with Free Chlorine.
3. San Juan Lateral Distribution System (Reach 4) and Shiprock Connection:
 - a. No additional contact time (CT) shall be provided to accomplish primary disinfection at the WTP (no additional clearwell storage beyond needs for WTP and pumping operation).
 - b. At an initial dose of 0.6 mg/L:
 - 1) If sufficient CT within WTP boundary: Provide monitoring equipment for chlorine dosing and regulatory compliance.
 - 2) If sufficient CT not provided within WTP boundary:
 - a) Government will provide additional contact time in the Treated Water pipeline.
 - b) Government will measure chlorine residual at Pumping Plant 2 and at Shiprock Turnout Building. Refer to 01 86 29- Communications Performance Requirements for connection requirements
4. Liquid Chlorine:
 - a. Sodium hypochlorite system.
 - 1) Develop a 50-year lifecycle cost analysis (ASTM E2516 Class 3) to determine optimal sodium hypochlorite supply approach of:
 - a) Delivered chlorine with on-site storage.
 - b) On-site generated chlorine.
 - 2) Cost discount rate assumption:
 - 3) Cost escalation assumptions:
 - a) Electricity: #%/year.
 - b) Chemicals: #%/year
 - c) Delivery: #%/year
 - 4) Provide system with lowest lifecycle cost.
 - b. On-site Sodium Hypochlorite Generation System (if lowest lifecycle cost):
 - 1) Automatic and on-demand production controlled from the WTP SCADA system.
 - 2) In an emergency situation, capable of receiving and dosing commercially available bulk sodium hypochlorite (up to 15 percent solution).
 - 3) Dedicated room for on-site hypochlorite generation system.
 - 4) 30 days of salt storage computed with Average Day Demand at the average dosage.

- 5) 3 days of sodium hypochlorite solution storage computed with Maximum Day Demand at maximum dosage.
- 6) Include one redundant generation unit/skid plumbed into system.

G. Clearwell:

1. Two parallel storage and pumping trains:
 - a. Provide the volume required for treated water pump station design and WTP operations (such as filter backwash).
 - b. At Maximum Day Demand, combined volume and pumping capacity of two parallel trains shall be sufficient for WTP operation and treated water pumping.
 - c. At Average Day Demand, volume of each train shall be sufficient for WTP operation and treated water pumping.
 - d. Provide piping, valves or gates to allow for the isolation/draining of each train for maintenance while allowing operation of other train.
2. Feed pipes:
 - a. Separate pipes into each clearwell section.
 - b. Phase 1: Separate pipes into each section can be connected to a common pipe from the treatment process.
 - c. Phase 2: Separately connect Phase 2 train to clearwell through its own pipe.
 - d. Isolate pipes with valves for maintenance.
3. Pump intake in accordance with Section 01 89 44 - Treated Pump Performance Requirements. Sump design volume to hold greatest of:
 - a. Pump minimum runtime as determined by NEMA MG 1 or motor manufactures recommendation.
 - b. WTP maximum shut down volume, plus clearwell sump design water surface volume.
4. Complete Clearwell Drainage:
 - a. Drain to minimum pump submergence level. Send remaining water to WTP head or to waste ponds via one of following methods:
 - 1) Floor drains connected to recycling pump / system.
 - 2) Submersible pump located in clearwell or clearwell building that connects to water recycling system.
 - b. Maximum one train drain time: 8 hours.

H. Residuals Handling System:

1. Further treat waste generated from treatment process to at least 20% solids.

2. Utilize solids drying beds for dewatering instead of mechanical processes.
 - a. Size sludge drying beds to provide 1 year of solids storage at the Phase 1 Average Day Demand.
 - b. Decant of sludge drying beds water is required.
 - c. Provide additional solids drying beds to allow for solids drying and cleanout.
3. Recycle water from residuals handling facility in accordance with Federal (Filter Backwash Recycling Rule), Tribal, State, county, and local regulations.
4. Wastewater holding pond for detaining off spec water from the WTP with eventual recycling or discharge. May combine with backwash waste pond.
5. Provide associated assessment, monitoring infrastructure (such as monitoring wells), and testing of residual storage ponds and drying beds in accordance with Federal, Tribal, State, county, and local regulations.
6. Provide means for draining and discharging the 42-inch Treated Water pipeline at WTP. Length of 42-inch pipeline from the WTP to next isolation valve downstream is approximately 5,500 feet.

I. Process Monitoring:

1. Process Sample Lines:
 - a. Continuous flow sample lines to the laboratory according to Table 01 86 46A - Online Continuous Analyzer and Continuous Flow Sample Line Requirements.
 - b. Refer to Section 01 81 10 - General Pipe Performance Requirements and Section 01 89 19 - Process Piping Performance Requirements.
2. Online continuous analyzers:
 - a. For a minimum of the following water quality parameters listed in Table 01 86 46A - Continuous Analyzer and Flow Sample Line Requirements.
 - b. Transmit analyzer data to the WTP Facility SCADA system.
 - c. Additional online analyzers as needed based on the Contractor's water treatment processes.
 - d. Turbidity: Hach TU5300, or equal, with the following essential characteristics:
 - 1) Range: 0 - 200 nephelometric turbidity units (NTU).
 - 2) Detection Limit: 0.002 NTU.
 - 3) Accuracy: +/- 2 percent of reading from 0 – 20 NTU.
 - 4) Resolution: 0.001 NTU.
 - 5) Includes automatic cleaning module.
 - e. Free Chlorine:

- 1) Capable of measurement without a reagent.

Location	Continuous Flow to Lab	Turbidity	Conductivity	Oxidation Reduction Potential (ORP)	pH	Temperature	UV254	Free Chlorine
Raw water before recycle	x		x	x	x	x		
Recycle loop	x	x				x		
Raw water after recycle	x	x			x	x		
After each filter	x	x						
Combined filter	x	x						
Treated water	x	x			x	x	x	x
At pH adjustment locations (as determined by the Contractor)					x			

1.08 RAW WATER QUALITY

- A. Refer to Section 51 00 30 – Influent Water Quality Basis of Design.
- B. Refer to documents listed in Project Conditions for additional Raw Water quality data.
- C. Source Water Quality:
 1. Values used for the design are the responsibility of the Contractor to define and gain COR approval.
 2. Perform additional water quality sampling and analysis as needed.
 3. San Juan Generating Station Reservoir will be operated to minimize solids loading including the River pumping plant being shut down during high solids events.

1.09 FINISHED WATER QUALITY REQUIREMENTS

- A. Treated/Finished Water quality requirements at the start of the Treated Water pipeline(s):
 1. Not for the entire distribution system (e.g., DBP requirements not included).
 2. Meet requirements of Table 01 86 46B - TOC Requirements in lieu of disinfection byproduct (DBP) requirements.

Table 01 86 46B - TOC Running Annual Average Requirements (mg/l)

Phase	Timing	100 Percent of the Time	95 Percent of the Time
Phase 1	Average Day Flow of 14.5 MGD and below	≤ 1.0	≤ 0.9
Start of Phase 2	Average Day Flow of 14.5 MGD	≤ 1.4	≤ 1.3
End of Phase 2	Average Day Flow of 28.9 MGD	≤ 1.7	≤ 1.6

3. Meet the requirements shown in Table 01 86 46C - Primary and Secondary Water Quality Requirements and Table 01 86 46D - Biological Contaminant and Indicator Requirements.

Table 01 86 46C - Primary and Secondary Water Quality Requirements

Contaminant Level	100 Percent of the Time	95 Percent of the Time
NNEPA Maximum Contaminant Level (MCL)	10 percent below	20 percent below
NNEPA Secondary Maximum Contaminant Level (SMCL)	SMCL	10 percent below

Table 01 86 46D - Biological Contaminant and Indicator Requirements

Water Quality Parameter	Requirements
Turbidity	< 0.27 NTU 95 percent of the time

4. When demonstrating compliance with water quality requirements, provide sampling and analysis techniques according to the standards set by USEPA, NNEPA, and the “Standard Methods for the Examination of Water and Wastewater”.
5. Finished water may be blended with well water in the distribution system. Consult with the Government when determining optimal Treated/Finished Water quality. Provide the ability to control Treated Water as follows:
 - a. pH adjusted to between 7.6 and 8.3, with pH adjustment capable over that entire range.
 - b. Alkalinity adjusted to at least 50 mg/L as CaCO_3 .
 - c. Phosphate addition for lead and copper corrosion.
6. Design and construct treatment processes to provide adequate treatment for proposed or pending regulations as of November 2019 by the USEPA and NNEPA.

1.10 WTP RECOVERY

- A. Minimum overall water recovery for combined processes:
 - 1. Greater than or equal to 95 percent.
 - 2. Requirement exempted during winter maintenance and startup activities.
- B. Obtain discharge permits if required. If discharge permits cannot be obtained, provide a zero liquid discharge WTP.

1.11 FUTURE INSTALLATION REQUIREMENTS

- A. Refer to Section 01 81 05 - General Performance Requirements.

1.12 BENCH AND PILOT TESTING

- A. Completed Testing:
 - 1. Refer to documents listed in Project Conditions.
 - 2. Testing does not represent a preference for a WTP process.
- B. Bench Scale Testing: Provide jar testing to demonstrate coagulation and sedimentation design values.

1.13 PERMITTING REQUIREMENTS

- A. Obtain permits from jurisdictional agencies which may include:
 - 1. Army Corps: Refer to Section 01 57 30 - Water Pollution Control.
 - 2. New Mexico State Land Office.
 - 3. New Mexico Environment Department.
 - 4. Navajo Nation Department of Transportation.
 - 5. Navajo Nation EPA.
 - 6. Office of the State Engineer.
 - 7. San Juan County.
 - 8. US EPA.

1.14 SPACE AND LAB EQUIPMENT REQUIREMENTS

- A. Water Treatment Processes:
 - 1. Locate flocculation / sedimentation, media filters, and GAC inside a building(s).
 - 2. Locate other processes and chemical storage inside or outside as dictated by best management practices given the site's location and climate and cost-benefit determination.

B. Laboratory:

1. Dedicated area for shipped sample collection and preparation.
2. Dedicated area (s) for sample prep and equipment use including cup sinks for wasting samples.
3. Dedicated area for DI water tanks and wall mounted system. Elevate tank if water flowing by gravity to ensure a reasonable water flow rate for rinsing.
4. Two Adjacent Sinks and Drying Rack.
5. Full size fume hood with tap water and cup sink. Vented chemical storage cabinets underneath.
6. Phenolic or epoxy resin counter tops and sinks.
7. Dedicated Area for Sample Lines:
 - a. Sample lines from sample points for regulatory sampling and from key points in each process and process train.
 - b. Sample sink:
 - 1) Sample valves on each sample line.
 - 2) Allows for continuous flow without splashing.
 - 3) Do not send water to septic system.
8. Chemical storage for acids, bases, flammables, and dry chemicals.
9. Casework:
 - a. Steel.
 - b. Base cabinets: Mix of drawer cabinets and door cabinets with adjustable height shelf.
 - c. Wall units: Approximate 50 percent open shelving and 50 percent cases.
10. Refrigerator for sample storage with digital temperature control.
11. Lab glassware washer with flask scrubber.
12. Equipment required by NNEPA, including a minimum of:
 - a. Benchtop turbidimeter, Hach TU5200, or equal, with the following essential characteristics:
 - 1) Meets USEPA Method 180.1.
 - 2) Range: 0 - 200 nephelometric turbidity units (NTU).
 - 3) Detection Limit: 0.002 NTU.
 - 4) Accuracy: +/- 2 percent of reading from 0 – 20 NTU.
 - 5) Resolution: 0.001 NTU.
 - b. TOC analyzer, Sievers M5310 C Lab, or equal, with the following essential characteristics:

- 1) Limit of Detection: ≤ 0.1 mg/L.
- 2) Precision: $< 1\%$ RSD.
- 3) Include autosampler.
- c. pH/ORP/conductivity meter and probes, Hach HQ440D, or equal.
- d. Benchtop UV-Visible spectrophotometer, Hach DR6000, or equal.
- e. Jar tester, Phipps & Bird 7790-910, or equal, with the following essential characteristics:
 - 1) 6 cell.
 - 2) Programmable rapid mix, flocculation and settling regimes.
 - 3) Illuminated.
 - 4) Square 2 L beakers with sample ports.
- f. Auto-titrator for hardness and alkalinity, Hach AT1000, or equal.
- g. Analytical balance, Mettler-Toledo ME204TE, or equal, with the following essential characteristics:
 - 1) Repeatability: 0.1 mg.
 - 2) Linear deviation: 0.2 mg.
 - 3) Settling Time: < 3 seconds.
13. Supplies and equipment to perform QA/QC on instrumentation according to manufacturer and method recommendations.
- C. Provide unimpeded and ergonomic access to process equipment for operation and maintenance.

1.15 REDUNDANCY AND OPERATION RANGE REQUIREMENTS

- A. Allow different facilities to operate throughout flow capacity range with one major process or equipment unit out of service.
- B. Redundancy for maintenance during operation.
 1. Maximum Downtime: 24 hours at Maximum Day Demand.
 2. Include residuals handling system in process train unless otherwise noted.
 3. Treatment of most adverse Raw Water quality conditions found in Table 01 86 46B - Monthly San Juan River Water Quality Summary with minimum and maximum WTP flow rates.
 4. Minimum of two parallel process trains:
 - a. Maintain Average Day Demand finished water production rate with one process out of service for clearwell and coagulation / sedimentation basins.

- b. Maintain Maximum Day Demand finished water production rate for other processes with one train out of service OR in backwash mode.
- 5. Provide hydraulic flexibility in process trains so flow can be shifted from one process train to another train at intermediate points in each process train. Do not take an entire process train out of service when taking one unit process out of service.
- 6. Major equipment shall have at least one redundant unit:
 - a. Major equipment includes, but is not limited to, air compressors, pumps, and other rotating equipment.
 - b. Rotating equipment commonly used for multiple process trains shall be in the duty/standby arrangement.
- 7. Chemical storage and feed facilities installed with a minimum of one redundant metering pump of each capacity for each chemical so the chemical feed shall continue with one pump out of service.

1.16 DURABILITY REQUIREMENTS

- A. Deterioration Resistance of Water Treatment Process Equipment:
 - 1. Use materials resistant to corrosion from water, water vapor, or chemical exposure.
 - 2. Use materials resistant to rot and biological degradation.
- B. Use materials not damaged by common hand tools.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 STARTUP, TESTING, AND DEMONSTRATION

- A. The Contractor may submit alternate procedures for Government approval.
- B. Perform in accordance with Sections 01 91 13 - Building Commissioning and 01 91 16 - Facility Commissioning.
- C. Dispose of water and waste produced in accordance with applicable Federal, Tribal, State, and local regulations.
- D. The Government may witness startup, testing, and demonstration operations.

- E. The Government will provide Raw Water to the WTP site boundary. Contractor shall provide chemicals, utilities, water quality analyses, qualified labor, and other items needed for operation and maintenance through the completion of the Operation and Maintenance Period specified in Section 01 91 16 - Facility Commissioning.
- F. Clean and disinfect the WTP in accordance with AWWA C653 and in accordance with Section 01 81 05 – General Performance Requirements. Dispose of flush water in accordance with permits detailed in Section 01 57 30 - Water Pollution Control.

END OF SECTION

SECTION 01 89 09

COATING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Master Painters Institute (MPI)
1. APL Approved Product List
(www.paintinfo.com)
- B. NSF International (NSF)
1. NSF 61 Drinking Water System Components – Health Effects
 2. NSF 372 Drinking Water System Components – Lead Content
- C. The Society for Protective Coatings (SSPC)

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 QUALIFICATIONS

- A. Coating Applicators:
1. SSPC certified for application.
 2. Completed training in application of coating materials.
 3. Skilled and experienced in application of coating materials
 4. Tradesman level: Experience as a blast-cleaner, painter, and applicator. Personnel not qualified to tradesman level, shall document training and experience to the same level as a formalized tradesman education.
- B. General:
1. Nationally recognized manufacturers of protective coatings regularly engaged in the production of such materials for essentially identical service conditions.

2. Minimum of 5 years' verifiable experience in manufacture of specified product.
3. Provide compatible products of same manufacturer for coating system components.

1.05 PERFORMANCE REQUIREMENTS

- A. Provide coating and linings appropriate for use and environment.
- B. For piping color code, refer to Section 01 81 10 - General Pipe Performance Requirements.
- C. Protect adjacent services during application.
- D. Surface preparation and coating applications: Follow SSPC and manufacturer's recommendations and specified requirements, whichever is more stringent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Abrasives:
 1. Produce a minimum depth of profile of 1 mil for atmospheric service and a minimum 3 mils for burial/immersion service.
 2. Use sharp angular abrasive.
- B. Coatings:
 1. Specified in Coating Tabulations or manufacturer's recommendations, whichever is more stringent. Approved alternative may be considered by COR.
 2. In contact with potable water: NSF 61 and NSF 372 approved.
 3. Materials from APL.
 4. Volatile Organic Compounds (VOC): Do not exceed maximum permitted by Federal, Tribal, State, and local regulations.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Testing:
 1. Thickness and Continuity Testing:
 - a. Measure coating thickness specified in mils with a magnetic type, visual inspection, and wet film thickness gauge when applicable. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

- b. After repaired and recoated areas have dried sufficiently, retest each repaired area.

COATING TABULATIONS

Tabulation No. 01

Manufacturer- and shop-coated products including but not limited to:

- a. Metal surfaces of doors, doorframes, and door shoes.
 - b. Metal building components.
 - c. Metal building frame and structural steel.
 - d. Electrical cabinets.
 - e. Pump motors.
 - f. Valve motor operators.
 - g. Air compressors.
 - h. Emergency generators.
 - i. Manufactured treatment plant.
 - j. Overhead cranes and crane rails.
 - k. Flow meters.
- 1. Coated with manufacturer's standard surface preparation and applied permanent coating.
 - 2. Repair damaged areas with same shop applied primer and finish coat materials or compatible materials.
 - 3. Compatible UV-resistant top coat for exterior applications.

Tabulation No. 02

Items to be coated for interior and exterior atmospheric service:

- a. Exterior surface of steel, iron, and other ferrous metals including tanks, piping, valves, conduit, structural components, and other equipment. For interior surfaces see Tabulation No. 03. For water storage tanks see Tabulations No.s 04 and 05.
- 1. Materials: Zinc, epoxy, and polyurethane.
 - 2. Required Coats: Primer, intermediate, and finish coats.
 - 3. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation.

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Tabulation No. 03	
<p>Items to be coated for interior and exterior immersion or burial service:</p> <ol style="list-style-type: none"> Steel pipe and fittings. Cast iron or ductile iron pipe and fittings. Pump bowls and columns. Steel or cast iron valves. Fasteners. <ol style="list-style-type: none"> Materials: Epoxy, polyurethane, cement mortar lining, and fusion bonded epoxy. For liquid applied coatings: Surface preparation SSPC-SP10 and minimum system 24 mils DFT. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation. 	
<p>Notes:</p> <ol style="list-style-type: none"> Surfaces in contact with potable water shall be NSF 61 approved. 	
<p>For girth weld area option 1:</p> <p>Category: Heat shrink sleeves.</p> <p>Application: Follow manufacturer's recommendations and instructions to apply heat shrink sleeve.</p> <p>Repair: Repair damage or defective sleeve areas per manufacturer's instructions. Replace sleeve for areas exceeding 6 square inches.</p>	<p>Follow manufacturer's surface preparation and application instructions to apply sleeve and any subsequent repairs.</p>
<p>For girth weld area option 2:</p> <p>Category: Liquid applied girth weld coating, compatible and approved by the epoxy or polyurethane pipe coating manufacturer.</p> <p>Application: Follow manufacturer's recommendations and instructions to apply girth weld coating.</p> <p>Repair: Repair damage or defective areas per manufacturer's instructions.</p>	<p>Follow manufacturer's surface preparation and application instructions to apply girth weld coating and any subsequent repairs.</p>

Tabulation No. 04

Items to be coated for exterior atmospheric service:

- a. Exterior of water storage tanks, exposed ferrous piping, and valves.
 - 1. Two coats of epoxy and a compatible UV-resistant top coat.
 - 2. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation.

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Tabulation No. 05

Items to be coated for interior and exterior immersion and burial service:

- a. Bolted or welded steel water storage tank interior, and interior and exterior ferrous surfaces of piping, and valves.
 - 1. NSF 61 approved system for surfaces in contact with potable water.
 - 2. Compatible UV-resistant top coat for exterior applications.
 - 3. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation.

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Tabulation No. 06

Items to be coated for interior atmospheric service:

- a. Gypsum board systems, steel or wood trim and wood doors.
 - 1. Materials: Latex and alkyd.
 - 2. Coats: Primer and finish.
 - 3. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation.

Tabulation No. 07

Items to be coated for interior and exterior chemically-exposed service including chemical containment areas:

- a. Interior surfaces of concrete masonry units and concrete.
 1. For polymer chemical storage and pumping areas: Provide a raised, chemical-resistant final coat texture such as broadcast aluminum oxide or manual roller finish.
 2. Materials: Epoxy, polyurethane, or polyurea.
 3. Compatible UV-resistant top coat for exterior applications.
 4. Follow manufacturer's recommendations for material, number and thickness of coats, and surface preparation.

Tabulation No. 08

Items to be coated for interior atmospheric service:

- a. Concrete floors.
 1. Materials: Sealer and hardener: Lapidolith manufactured by Contech, Inc., Sonneborn Division of BASF, 889 Valley park Dr., Shakopee MN 55379, Flouhard manufactured by L&M Construction Chemicals, 14581 Calhoun Road, Omaha NE 68152, or Con-O-Lith manufactured by Conspec 636 S. 66th terrace, Kansas City, KS 66111; or equal, having the following essential characteristics:
 2. Contains magnesium fluosilicates, zinc fluosilicates, or sodium flousilicates individually or in combination with a wetting agent.
 3. Colorless aqueous solution.
 4. Coats: Three.
 5. Follow manufacturer's recommendations for thickness of coats and surface preparation.

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Tabulation No. 09

Items to be coated for exposed surfaces of exterior concrete or masonry surfaces to receive a clear water repellent:

- a. Exterior surfaces of above grade concrete masonry unit walls:
 - 1. For surfaces not to be color topcoated: MPI APL No. 117, Water Repellent Coating.
 - 2. Follow manufacturer's instructions for number of coats and thickness per coat.

Notes:

- 1. Approved Materials: Materials from Master Painters Institute – Approved Products List.

Tab NM-04.DOCX

Tabulation No.10

Items to be coated for exposed surfaces of interior or exterior concrete masonry units (CMU), other than chemical exposure or CMU's to receive a clear sealer.

- a. Blockfiller – Use following for porous surfaces, if applicable:
 - No. 4, Interior/Exterior
Latex Block Filler
Finish coats:
- b. Interior Latex Coatings for specified gloss, use, two coats minimum:
 - No. 43, satin flat
 - No. 52, eggshell-like
 - No. 53, flat
 - No. 54, semigloss
 - No. 114, gloss

Notes:

- 1. Follow manufacturer's instructions for thickness per coat.
- 2. Colors and gloss selected by the COR approval.
- 3. Approved Materials: Materials from Master Painters Institute – Approved Products List.

Tab NM-07.DOCX

Tabulation No. 11

Items to be coated for atmospheric service of exterior surfaces of plastic piping and conduit and exterior surfaces of non-ferrous metal piping and conduit to include galvanized piping:

- a. Bonding primer for plastic substrate: MPI APL No. 69, Bonding Primer, solvent based.
- b. Finish coats: Water-borne light industrial coatings for specified interior or exterior service exposure and gloss, use:

Interior No. 151, eggshell-like

Interior No. 153, semigloss

Interior No. 154, gloss

Exterior No. 161, eggshell-like

Exterior No. 163, semigloss

Exterior No. 164, gloss

Notes:

- 1. Follow manufacturer's instructions for thickness per coat.
- 2. Colors selected per state safety color regulations.
- 3. Approved Materials: Materials from Master Painters Institute – Approved Products List.
- 4. Compatible UV-resistant top coat for exterior applications.

Tab NM-13.DOCX

END OF SECTION

SECTION 01 89 16

SITE PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO GDHS Policy on Geometric Design of Highways and Streets
- B. ASTM International (ASTM)
1. ASTM F2656/F2656M Crash Testing of Vehicle Security Barriers
- C. Federal Highway Administration (FHWA)
1. FP14 Standard Specifications for the Construction of Roads and Bridges on Federal Highway Projects
- D. International Code Council, Inc. (ICC)
1. IBC International Building Code
- E. National Association of Architectural Metal Manufacturers (NAAMM)
1. ANSI/NAAMM FP 1001 Guide Specifications for Design of Metal Flagpoles
- F. United States Access Board
1. ADA/ABA American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTION

- A. Provide elements required for finished durable site.
- B. Includes grading, drainage, erosion control, pavement and other outdoor improvements for water treatment plant (WTP)

1.05 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. Comply with IBC, ADA/ABA, and AASHTO GDHS.
 - 2. Maximum Road and Driveway, Grade: 12 percent.
 - 3. Minimum Travel Lane Width: 12 feet.
 - 4. Refer to Section 01 86 46 - Water Treatment Performance Requirements for pond requirements.
- B. Grading:
 - 1. Balance cut and fill within project ROW including WTP.
 - 2. Borrow or disposal sites outside project ROW will require Cultural Resources Investigation and CO approval. Refer to Section 01 57 90 - Preservation of Historical and Archaeological Data for additional grading information.
 - 3. Work with the Bureau of Indian Affairs, and the COR to minimize invasive species.
 - 4. Dust Control:
 - a. As needed.
 - b. Biodegradable in areas to be revegetated areas.
- C. Erosion Control: Provide stable surfaces.
 - 1. By grading or erosion protection.
 - 2. Engineered means such as rip rap or erosion control blanket.
- D. Storm water management:
 - 1. In accordance with Authority having Jurisdictions.
 - 2. Including storm sewers, ditches and detention ponds.
- E. BIA N36 Road Improvements:
 - 1. Provide west bound left turn lane. Obtain permits, perform design and construct in accordance with BIA requirements.
 - 2. BIA has supported turn lane in initial discussion with Reclamation.
 - 3. BIA Contact Information:

Shiprock Agency, Branch of Road Maintenance
304 N Auburn Ave, Suite E
Farmington, NM 87401
(505) 258-7172

F. Exterior Pavements and Surfacing:

1. Accommodate anticipated traffic for facility type and user.
2. Roadways and Driveways:
 - a. Paved surfaces:
 - 1) Primary vehicular access to the site.
 - 2) Areas requiring frequent vehicular access, including main entrance, freight docks, loading and unloading zones.
 - b. Granular surfaces:
 - 1) Secondary vehicular access to areas requiring intermittent vehicular access.
 - 2) Except when pavement analysis indicates flexible or rigid pavement required.
 - c. Facilitate drive or pull-through operations for material deliveries.
3. Parking Areas at Main Processing Building:
 - a. Paved surfaces as required for vehicular parking.
 - b. Separate visitor and employee parking areas.
 - 1) Employee parking area located in proximity to Main Process Area.
 - 2) Visitor parking area located in proximity to main site entrance gate.

G. Walkways, pedestrian ramps, and exterior stairs at Main Process Area:

1. Provide paved surfaces for frequent pedestrian movement.
2. Provide accessible path between parking areas, outdoor seating areas, and WTP main entrance in accordance with ADA/ABA.

H. Barriers:

1. Minimize visual impact of buildings and tanks. Mitigation measures may include earthen berms, privacy woven fabric within fencing, and building and tank siting.
 - a. Install berms at the southeast property corner to minimize visual impact of the site to adjacent property. Extend from southeast corner 200 feet north and from southeast corner 200 feet west.
2. Site Entry Vehicular Gates:
 - a. Minimum of two WTP site entry locations.

- 1) Public/Employee site entrance gate.
 - 2) Service gate.
 - b. Provide electric gate operators and Gate Access Pedestal for each entry gate in accordance with Section 01 86 33 - Electronic Safety and Security Performance Requirements.
 - c. Provide security panel/control access with intercom to Main Process Area Control Room at each site entry location.
 3. Perimeter site enclosure fence within 0.5 feet of the WTP property line unless site configuration for visual impact minimization to adjacent property requires otherwise.
- I. Landscaping and Revegetation:
1. No additional landscaping required.
 2. Seed disturbed soils.
- J. Entry Signage:
1. Provide Modest Signage Near Site Entry Gates:
 - a. Identify material service gate separate from public/employee gate.
 - b. Project descriptor: San Juan Lateral WTP, or approved equal, 8-inch high lettering.
 - c. Navajo Gallup Water Supply Project, 6-inch high lettering.
 - d. Site address in 4-inch high lettering. Helvetica Medium font, capital letters.
 - e. Include agency names and logos in full color on porcelain enameled steel plaques flush mounted to the sign concrete:
 - 1) U.S. Department of the Interior, Bureau of Reclamation.
 - 2) Navajo Tribal Utility Authority.
 - 3) City of Gallup.
 - f. Stained Cast in place concrete sign, minimum 8-inch thick wall, 66 inches above grade, minimum 15 feet wide. Footing, reinforcing, and other concrete requirements by Contractor or as specified herein.
 - g. Type 316 stainless steel lettering, hand tooled, brushed, raised mounting with stainless steel studs.
 - h. Light with luminaire and light pole matching site lighting.
 - i. Submit entry signage drawings, lettering sample, and color chips for Government approval prior to fabrication.
- K. Locate flagpoles near Main Process Area entry. Install in accordance with Federal law, including 36 U.S.C. 173-178.

1.06 FUTURE

- A. Allocate 3.5 acres for a future onsite San Juan Lateral maintenance facility on the WTP property but outside of the perimeter fence including the building, utility services, and associated parking. Show in Future Installation Plan, refer to Section 01 81 05 - General Performance Requirements.

PART 2 PRODUCTS

2.01 STORM SEWER

- A. Refer to Sections 01 81 10 - General Pipe Performance Requirements and Section 01 89 19 - Process and Utility Pipe Performance Requirements.

2.02 FLAGPOLES

- A. Three Ground-Mounted Flagpoles:
1. Each flagpole capable of flying one flag.
 2. For US, State, and Navajo Nation's flags. Height in accordance with Federal law.
 3. Minimum flag size: 4 by 6 feet.
 4. Provide lighting meeting Section 01 86 26 - Electrical Performance Requirements.
 5. In accordance with ANSI/NAAMM FP 1001.

2.03 FENCES AND BARRIERS

- A. WTP Site Enclosure Chain Link Fence:
1. Minimum height: 6 feet.
 2. Barbed wire: 3-strand.
 3. Privacy link woven fabric. Color: Refer to Section 01 81 05 - General Performance Requirements.
- B. Vehicular Site Entry Gates:
1. Minimum ASTM F2656 PU 40 rating for a pick-up truck traveling at 40 mph.
 2. Automatic, motorized sliding gate operator for each vehicular gate.
 3. Prevention of pedestrian access.
 4. Vehicle ground loop on the interior side of each vehicular gate.
 5. Provide lighting meeting Section 01 86 26 - Electrical Performance Requirements.
 6. Match proposed fencing color.

- C. Pedestrian Site Entry Gates:
 - 1. Provide one manual, pad lockable pedestrian grate at each site entry location.
 - 2. Provide lighting meeting Section 01 86 26 - Electrical Performance Requirements.
 - 3. Match proposed fencing material and color.
- D. Visual Barrier: Earthen berms at WTP. Refer to Section 01 81 05 - General Performance Requirements on physical security.

2.04 SITE FURNISHINGS

- A. Covered Outdoor Seating and Tables: Durable materials to withstand outdoor elements.
- B. Waste Receptacles: Outdoor rated.

2.05 PAVEMENTS AND SURFACING

- A. BIA N36: Comply with BIA requirements.
- B. Concrete, gravel, asphalt, road base and other pavement materials: Comply with FP14.
- C. Pedestrian Areas:
 - 1. High Pedestrian Traffic Areas: Concrete.
 - 2. Other Areas: Gravel surfacing or in accordance with ADA/ABA.

2.06 SITE ENTRY SECURITY

- A. Refer to Sections 01 86 29 - Communications Performance Requirements and Section 01 86 33 - Electronic Safety and Security Performance Requirements, for intercom and security panel/control access performance requirements, respectively.

2.01 SEED

- A. Weed seeds classified by State Seed Department:
 - 1. Prohibited noxious weeds: None allowed.
 - 2. Restricted noxious weeds: 0.5 percent maximum, by weight.
- B. Seed Mixture:
 - 1. Purity, minimum: 85 percent.
 - 2. Germination, minimum: 85 percent.
 - a. Germination test: Less than 1-year old at time of seeding.
 - 3. Uniform mixture shown in Table 32 92 20A – Seed Mixture.

Table 32 92 20A – Seed Mixture

Common Name	Cultivar	Seeding Rate (Pounds pure live seed per acre)
Western Wheatgrass	<i>Arriba</i>	3
Streambank Wheatgrass		2
Intermediate Wheatgrass	<i>Oahe</i>	3
Indian Ricegrass	<i>Paloma</i>	2
Blue Grama		2
Sideoats Grama		2
Little Bluestem		2
Rocky Mountain Penstemon		1

PART 3 EXECUTION

3.01 USE OF TOPSOIL

- A. Do not use topsoil removed by stripping for backfill or constructing embankments.

3.02 STOCKPILE

- A. Transport and stockpile topsoil as necessary prior to final hauling and placing.
- B. Do not compact topsoil in stockpile.
- C. Protect stockpile from contamination and erosion.
- D. Seed with a ground cover approved by COR when storage in stockpiles is prolonged.

3.03 SEEDING APPLICATION

- A. Seeding in Project Areas:
1. Apply seed and mulch by one of the following methods:
 - a. Broadcast seeding followed by mulching or hydromulching.
 - b. Drill seeding followed by mulching or hydromulching.
 - c. Hydroseeding.
 2. Apply seed mixture at rate specified in applicable Table 32 92 20A – Seed Mixture. Double rate of seed application if broadcast seeding.
 3. Seed between July 15 and November 15.

- B. Seeding Under Erosion Control Blanket:
 - 1. Prior to placing erosion control blankets apply seed mixture at rate specified in Table 01 89 16A – Seeding. Double rate of seed application if broadcast seeding.
 - 2. Seed between July 15 and November 15.

3.04 BROADCAST SEEDING

- A. Broadcast seed only in areas not accessible for drilling or hydroseeding.
- B. Mechanical Broadcasting:
 - 1. Equipment: Centrifugal type.
 - 2. Designed and regulated to apply seed uniformly at proper rate per acre.
- C. Hand Broadcasting:
 - 1. By hand broadcaster.
 - 2. By hand.
 - 3. Uniformly applied.
- D. Cover seed with soil to depth of 1/4-inch to 1/2-inch immediately after broadcasting:
 - 1. Use hand rake or float.
 - 2. Do not use log chain or similar devices.

END OF SECTION

SECTION 01 89 19
PROCESS PIPING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Reference standards listed are not inclusive. Standards define the level of quality of materials and installation methods.
- B. American Society of Mechanical Engineers (ASME)
1. ASME B31.3-16 Process Piping Code
- C. American Water Works Association (AWWA)
1. Water Treatment Plant Design
- D. International Code Council (ICC)
1. IBC International Building Code
2. IFC International Fire Code
3. IPC International Plumbing Code
- E. NSF International (NSF)
1. NSF 61-2018 Drinking Water System Components – Health Effects
- F. New Mexico Environment Department (NMED) Construction Programs Bureau
1. NMED Water Facilities Standards-2006 Recommended Standards for Water Facilities
- G. Navajo Nation Environmental Protection Agency (NNEPA)
1. Surface and Ground Water Protection Department Domestic Wastewater Regulations

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.

- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTION

- A. Refer to Section 01 81 10 - General Pipe Performance Requirements.

1.05 PERFORMANCE REQUIREMENT

- A. General: Follow industry standards, ASME B31.3, and applicable AWWA standards for design, construction, and testing of process piping systems.
1. Joint restraint as required:
 - a. Balance all thrust forces.
 - b. Restrained couplings and expansion joints as required.
 2. All Products in contact with process water to be in compliance with NSF 61.
 3. Design and install process piping system in accordance with:
 - a. AWWA “Water Treatment Plant Design”.
 - b. IBC, IPC, and IFC.
 - c. Life Safety requirements in Section 01 81 05 – General Performance requirements.
 - d. ASME B31.3 and applicable AWWA guides and standards.
 4. Chemical Pipe:
 - a. Containing materials classified as toxic, reactive, flammable, corrosive, explosive, or combustible per IFC.
 - b. Designed in accordance Life Safety requirements in Section 01 81 05 – General Performance Requirements and IFC.
 5. Process Sample Pipe, Tubing, and Taps:
 - a. Conveying process fluids from sample point to laboratory.
 - b. Ensure pipe material does not impact water quality (e.g. leaching of metals or organic carbon).
- B. Valves:
- C. Provide isolations valves at equipment to allow removing equipment for service and avoid draining of pipe line.
- D. Air relief valves shall be provided to remove pockets of air from the systems. Provide Affidavit of Compliance per the applicable AWWA standard for AWWA valves.

- E. Provide backflow prevention devices at locations of potential cross connection to the potable water system. Provide backflow prevention devices in accordance with NNEPA requirements and listed in the most current ASSE Seal Authorization Booklet.
- F. Labeling: Refer to Section 01 81 10 - General Pipe Performance Requirements.

1.06 DURABILITY

- A. Corrosion Resistance: In accordance with Section 01 89 27 - Cathodic Protection Performance Requirements.
- B. Provide means of protection electrical equipment from drips, sprays or other potential exposures from piping systems per NFPA 70.
- C. Convenience:
 - 1. Locate piping systems in a neat orderly fashion.
 - 2. Do not locate pipes in inconvenient, inaccessible locations.
 - 3. Ensure manholes, gate and valve operators, and pipe couplings are easily accessible to WTP operation staff. Provide comfortable space around pipe runs within plant to allow for access and maintenance disassembly.
 - 4. Locate pipes in parallel pipe layouts where possible.
- D. Condensation and Odors:
 - 1. Provide protection from condensation for pipe inside the buildings.
 - 2. Provide insulation to prevent condensation where it may form.
- E. Properly vent chemical, toxic or obnoxious odors away from human occupancy areas.

1.07 QUALIFICATIONS

- A. Pipe designers shall be registered professional engineers with a minimum of 5 years of experience designing process piping systems in accordance with AWWA and ASME.
- B. Pipe welding and brazing in accordance with ASME B31.3.

PART 2 PRODUCTS

2.01 GENERAL

- A. Piping components to conform with standard piping components list per ASME B31.3 Tables 326.1 and A326.1.
- B. Where dissimilar materials meet, provide dielectric fittings.

PART 3 EXECUTION

3.01 GENERAL

- A. Coat pipe (as required) in accordance with Section 01 89 09 - Coating Performance Requirements.
- B. Non-metallic piping methods of pipe joining in accordance with ASME B31.3.

3.02 CHEMICAL PIPING

- A. Provide enough pull boxes (pre-cast concrete 5-foot by 5-foot) so chemical carrier lines can be accessed and removed if needed. Provide hatch for each pull box.
- B. Install chemical feed lines in accordance with NNEPA requirements.

END OF SECTION

SECTION 01 89 23
YARD PIPING AND VALVES PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Reference standards listed are not inclusive. Standards define the level of quality of materials and installation methods.
- B. ASSE International (ASSE)
1. Seal Authorization Booklet <http://www.asse-plumbing.org/seal/sealbook.pdf>
- C. American Society of Mechanical Engineers (ASME)
1. ASME B31.3 Process Piping Code
2. ASME BPVC IX Boiler and Pressure Vessel Code – Section IX – Welding and Brazing Qualifications
- D. ASTM International (ASTM)
1. ASTM A53/A53M Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- E. American Water Works Association (AWWA)
1. Water Treatment Plant Design, 5th Edition, 2012
2. AWWA C651 Disinfecting Water Mains
- F. Code of Federal Regulations (CFR)
1. 29 CFR 1910.147 Control of Hazardous Energy
- G. International Code Council (ICC)
1. IBC International Building Code
2. IFC International Fire Code
3. IPC International Plumbing Code
- H. National Fire Protection Association (NFPA)
1. NFPA 70 National Electric Code

- I. NSF International (NSF)
 - 1. NSF 61 Drinking Water System Components – Health Effects
- J. Navajo Nation Environmental Protection Agency (NNEPA)
 - 1. Surface and Ground Water Protection Department Domestic Wastewater Regulations

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTIONS

- A. Refer to Section 01 81 10 - General Pipe Performance Requirements.

1.05 PERFORMANCE REQUIREMENT

- A. Follow industry standards for the design and construction of yard piping systems.
- B. Products in contact with process water: Comply with NSF 61.
- C. Design in accordance with IBC, IFC, IPC, NFPA 70, and life safety requirements in Section 01 81 05 – General Performance Requirements.
- D. Design and construct water Treatment piping systems in accordance with:
 - 1. AWWA Water Treatment Plant Design.
 - 2. Applicable AWWA, and ASME standards.
- E. Storm Drainage: Farmington XX.
- F. Potable Water: Farmington XX.
- G. On-site Sewage Disposal System:
 - 1. Meet or exceed Navajo Nation Domestic Wastewater Regulations for design criteria applicable to the On-site Wastewater Treatment System.
 - 2. Protect the On-site Sewage Disposal System by providing a separate means of disposal from accidental chemical spills during chemical deliveries or from a large water volume from inside the building.
 - 3. System Hydraulics: Gravity flow is preferred.

- H. Valves:
 - 1. Provide isolation valves at equipment to allow removing equipment for service and avoid draining of pipe line.
 - 2. Provide pressure relief valves to prevent over pressurization of piping systems.
- I. Provide air relief valves to remove pockets of air from the systems.
- J. Fire: Meet local code and pipe manufacturer's requirements.

1.06 STRUCTURAL CRITERIA

- A. Design cover of buried piping and components for applied loads.
- B. Support piping and components in accordance with ASME B31.3 and applicable AWWA guides to allow movement of the pipe without undue stress on piping, tubes, fittings, components, or foundations. Allow for surge, thermal expansion and contraction.
- C. Structural Design and Flexibility Analysis of Components and Supports: In accordance with IBC, and B31.3. Include thrust loads in flexibility analyses.
- D. Design structural supports with consideration of insulation.

1.07 DURABILITY

- A. Corrosion Resistance: In accordance with Section 01 89 27 - Cathodic Protection Performance Requirements.

1.08 QUALIFICATIONS

- A. Pipe designers shall be registered professional engineers with a minimum of 5 years of experience designing yard piping systems in accordance with AWWA and applicable standards.
- B. Pipe welders: Certified in accordance applicable AWS standards and/or ASME BPVC.

PART 2 PRODUCTS

2.01 GENERAL

- A. Flanged fittings shall not be buried.
- B. Industry standard and applicable ASTM, or AWWA standard.

2.02 PIPING

- A. Water, Fire, Sanitary and Storm: Farmington XX.

B. Black Steel Pipe:

1. Services: Gas.
2. Pipe: Schedule 40, black steel, ASTM A53, Grade B, seamless, plain end.
3. Fittings: Standard weight, steel, socket weld.
4. Coating: Conform to IAPMO IS 13-91, PS 37-90, and PS 22-84.
5. Wrap: 3M Scotchwrap 50 with 50 percent overlap.
6. Follow IAPMO Standard IS 13-84.

2.03 VALVES AND OPERATORS

A. General:

1. Welded or soldered valve ends not allowed.
2. Comply with Standard piping components list in accordance with ASME B31.3 Tables 326.1 and A326.1.
3. Suitable for lock out tag out in accordance with 29 CFR 1910.147. Manual isolation valves shall have lockable handles.

B. Air Valves: AWWA C512 for applicable air and vacuum valves.

PART 3 EXECUTION

- A. Exterior Piping: Install per manufacturer's recommendations and applicable code.
- B. Install per Farmington TC as applicable.
- C. Provide sufficient earth cover to prevent freezing.
- D. Provide insulating components where dissimilar metals are joined together.

3.02 FIELD QUALITY CONTROL

- A. Field Hydrostatic Testing: Test in accordance with applicable AWWA standard, ASME B31.3 and industry standards.
 1. Do not allow hydrostatic testing for buried pipe when snow or standing water is on the ground. Suspend testing if precipitation accumulates on the ground.
 2. Comply with applicable test standard for buried pipe except as noted below:
 - a. AWWA C605 for PVC.
 - b. AWWA C600 for Ductile Iron.
 - c. AWWA C604 for Steel.
 - d. ASTM F2164 for HDPE.

3. Test pipeline with hydrostatic pressure equal to elevations listed for each section below:
 - a. Pipe downstream of clear well pumping plant to Reach 4A: Elevation 5,403 feet.
 - b. Pipe connecting to Reach 3: Elevation 5,440
 - c. Pipe hydraulically separated from either region should be tested at minimum 1.25 times the working pressure of the system at the highest elevation and no less than 1.5 times the working pressure of the system at the lowest elevation.
4. Prior to starting test, maintain pressure in pipe for 24-hours.
5. Test for 96-hours or as approved by Reclamation.
6. Measure volume of water required to maintain pressure during test:
7. Acceptance criteria:
 - a. Testing allowance shall not exceed 10 gallons per inch nominal diameter per mile.
 - b. Test pressure shall not drop by more than 5 psi during test period.
 - c. Repair any visible leakage detectable by any means as approved by Reclamation.

3.03 ACCEPTANCE TESTS

- A. Disinfection and bacteriological tests required for potable water piping in accordance with AWWA C651. Refer to Section 01 81 10 – General Pipe Performance Requirements.

END OF SECTION

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SECTION 01 89 27

CATHODIC PROTECTION PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. Cathodic Protection:
1. Sacrificial Protection: Reduction of corrosion of a metal in an electrolyte by electrically coupling it to a more anodic metal. This form of cathodic protection is also called galvanic anode cathodic protection.
- B. Structure-to-Electrolyte Potential:
1. Also referred to as structure-to-soil, pipe-to-soil, and structure-to-water potentials.
 2. The 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 without any external current (e.g. prior to energizing a cathodic protection system, and with no galvanic couple, pH cell, interference currents, or the like present), or after such a current source has been disconnected for an extended time. 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 difference between polarized and native potentials.
- C. Structure: Metallic pipes and fittings or other metalwork being protected and monitored.
- D. Electrolyte: An electrically conductive solution, such as soil or water. The terms for these specific conductive solutions may be substituted for the word “electrolyte” in these definitions.

- E. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to the underlying structure and acting to physically and electrically isolate metal from electrolyte.
- F. Cable: Metallic conductors other than protected structures and anodes.
- G. Portable Voltmeter: Portable instrument for measuring voltage drops across electrical components or potential (voltage) differences between a structure and a stable reference electrode:
 - 1. Minimum input impedance of 10 megohm.
 - 2. Should be capable of measuring DC voltages between plus or minus 0.1 volts and plus or minus 100 volts.
 - 3. When measuring structure potentials using a digital instrument, connect the positive terminal of voltmeter to structure and common (negative) terminal to reference electrode. Read magnitude and polarity of voltage directly as shown on instrument display.
 - 4. When measuring structure potentials using an analog instrument with a needle that swings only in 1 direction, reverse connections and interpretation of polarity by the user is required.
- H. Reference Electrode: An electrode whose open circuit potential is constant under similar conditions of measurement; used for measuring relative potentials of other electrodes (e.g. protected structures). Sometimes referred to as a reference half-cell. A copper / copper sulfate reference electrode (CSE) is often used.
- I. Test Station and Anode Junction Box: A location for conducting tests on a protected structure, normally having an enclosure containing terminals of cables from one or more structures.

1.03 REFERENCE STANDARDS

- A. ASTM International (ASTM)
 - 1. ASTM B3 Soft or Annealed Copper Wire
 - 2. ASTM B843 Magnesium Alloy Anodes for Cathodic Protection
- B. National Association of Corrosion Engineers (NACE)
 - 1. NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
 - 2. NACE SP0196 Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Steel Water Storage Tanks

3. NACE SP0193 External Cathodic Protection of On-Grade Metallic Storage Tank Bottoms
 4. NACE TM0497 Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems
- C. National Electrical Manufacturer’s Association (NEMA)
1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.05 QUALIFICATIONS

- A. All cathodic protection systems shall be designed and tested by, or such activity directed and certified by, a NACE certified Cathodic Protection Specialist.

1.06 PERFORMANCE REQUIREMENTS

- A. Provide cathodic protection for all buried metallic components of pipe, fittings, and tank bottoms. Provide cathodic protection for metallic surfaces in immersion service in tanks. The cathodic protection system shall have the following characteristics:
1. A minimum service life of 20 years with ability to replace anodes at that point.
 2. Meet protection criteria in accordance with NACE SP0169, NACE SP0196, or NACE SP0193.
 3. Isolate buried metal pipe from metal in concrete and grounding equipment.
 4. No interference with normal operations.
 5. Compatible with protective coatings on the protected structures, as specified in Section 01 89 09 - Coating Performance Requirements.
 6. Test stations or junction boxes accessible for measuring polarized structure-to-electrolyte potentials and anode current output (using shunt).
 7. Minimize the number of test stations by bonding nearby metalwork, as possible (e.g. on fittings).
 8. Include, for tanks and air chambers, ability to adjust and balance anode current output (e.g. with variable resistor).

PART 2 PRODUCTS

2.01 GENERAL

- A. All components shall be rated for intended service environment (e.g., cable, anodes, and similar).

2.02 CABLE

- A. Single-Conductor: Stranded, plain, annealed copper cable.
1. 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.
 - c. Black insulation.
- B. Unspliced lengths to permit installation from terminus to terminus (e.g., anode to test station) free of splices and without stress.
1. Gauge:
 - a. No. 6 AWG or larger for electrical continuity joint (jumper) bonds.
 - b. No. 12 AWG or larger for structure cables and anodes.

2.03 EXOTHERMIC METALLURGICAL BONDS

- A. Exothermic metallurgical bond system by ThermOweld, 4102 South 74th East Avenue, Tulsa, OK 74145; or equal, having the following essential characteristics:
1. Designed for:
 - a. Cathodic protection systems.
 - b. Metallic substrate materials.
 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 conductor.

2.04 DIELECTRIC COATING FOR METALLURGICAL BONDS

- A. Dielectric Material: Royston Handy Cap, manufactured by Royston Laboratories, Inc., 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 intended environment.

2.05 TEST STATIONS

- A. Test Stations: TESTOX Series 100 or Series 700, manufactured by Gerome Electric Supply Co., 336 East Main Street, 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 the number and size of cables and required accessories.
 6. Equip with 0.01 ohm calibrated shunt for each anode such that the 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.
 9. Refer to Drawing 1695-D-355.

2.06 ANODE JUNCTION BOX ENCLOSURE

- A. Enclosed within a NEMA 250, Type 3-R, lockable cabinet constructed of No. 16-gauge or thicker galvanized steel or fiberglass that is weatherproof, lockable, and vented for heat dissipation.
- B. Specifically constructed for cathodic protection system installations.
- C. Protected as required for permanency.
- D. Sufficient number of terminals with associated hardware for number and size of cables and required accessories.
- E. Equip with 0.01 ohm calibrated shunt for each anode such that current output of each anode can be determined.
- F. Equip with variable resistors for each anode such that current output of each anode can be adjusted.
- G. Engraved 1/4-inch minimum NEMA grade C phenolic panel.
- H. Solderless, pressure-type terminals.

- I. Identified terminals.
- J. Equip with combination bracket for pole or wall mounting.
- K. Anode junction box cables in accordance with cable requirements of this Section.

2.07 GALVANIC ANODES

A. Buried Applications:

1. Galvanic Anodes: 20D2 UltraMag High Potential Magnesium Anode manufactured by Farwest Corrosion Control Co., 480 Artesia Boulevard, Gardena, CA 90248; or equal, having the following essential characteristics:
 - a. Minimum of 20 pounds of magnesium anode material per anode.
 - b. High potential magnesium anode material specifically designed for cathodic protection systems.
 - c. Anode material meeting or exceeding requirements of ASTM B843 and having minimum potential of -1.700 volts referenced to a copper/copper sulfate reference electrode (CSE).
 - d. Contain a mild steel core that extends entire length of anode. Mild steel core shall be centered within anode material and exposed on 1 end of anode for factory made anode-to-cable connection.
2. Factory anode-to-cable connection, exposed mild steel core, and exposed copper cable potted in epoxy.
3. Silver-solder connection between the anode cable and mild steel core.
4. Anode cable in accordance with cable requirements of this section.
5. Anode pre-packaged in a chemical backfill specifically intended for type of buried anode used.
 - a. Chemical Backfill: Approximately 75 percent ground hydrated gypsum, 20 percent powdered bentonite, and 5 percent anhydrous sodium sulfate.
6. Anode packaged in a plastic or heavy paper bag of sufficient thickness to protect electrode, backfill, and cloth bag during normal shipping and handling.
7. Store prepackaged anodes off ground and protect against weather, condensation, and mechanical damage.

B. Submerged Applications:

1. Galvanic Anodes: Extruded rod ProMag Standard Potential Magnesium Anode manufactured by Farwest Corrosion Control Co., 480 Artesia Boulevard, Gardena, CA 90248; or equal, having the following essential characteristics:
 - a. Standard potential magnesium anode material specifically designed for cathodic protection systems and the intended environment.

- b. Anode material meeting or exceeding the requirements of ASTM B843 and having a minimum potential of -1.5 volts referenced to a copper/copper sulfate reference electrode (CSE).
 - c. Contain a mild steel core that extends entire length of anode. The mild steel core shall be centered within anode material and exposed on one end of the anode for the factory made anode-to-cable connection.
- 2. Factory anode-to-cable connection, exposed mild steel core, and exposed copper cable potted in epoxy.
- 3. Silver-solder connection between the anode cable and mild steel core.
- 4. Anode cable in accordance with cable requirements of this section.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation and testing shall be performed or directed by a Cathodic Protection Specialist certified by NACE International.
- B. Cable:
 - 1. Inspect for insulation defects prior to backfilling. Replace cable if insulation is damaged.
 - 2. Install without kinks, stresses, or splices.
 - 3. For buried horizontal segments of cable:
 - a. Minimum burial depth: 30 inches.
 - 1) 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 and anode junction box terminals with crimped, ring-tongue connectors.
 - 5. Identify origin of cables terminating in an enclosure:
 - a. Cable identification as to the distinct originating structure or anode.
 - b. Printed letters on a shrinkable label attached to cables clearly visible within enclosure.
 - c. Encase printed labels in clear heat shrink tubing.

C. Structure Connections:

1. One test cable and one bond cable per structure at each test station and anode junction box.
2. Connect cables to structures by exothermic metallurgical bond.
 - a. Make exothermic metallurgical bond in accordance with bonding supply manufacturer's instructions.
 - b. Bonds shall not damage linings inside pipes, fittings, or tanks.
 - c. Test metallurgical bond integrity by striking side of weld nugget with a 16-ounce hammer in presence of the COR.
 - d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with an approved dielectric metallurgical bond coating.
 - 1) Allow dielectric material to cure before repair of the damaged structure coating or lining. Repair dielectric coatings/linings in accordance with Section 01 89 09 - Coating Performance Requirements.

D. Buried Metalwork:

1. Electrically isolate pipe and fittings from other metal (e.g. 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.
3. Electrical Continuity Joint (Jumper) Bonds (when required):
 - a. Provide metallurgical bonds at mechanical type joints (e.g., non-welded joints) between ferrous parts to be included in a particular cathodic protection system to ensure electrical continuity.
 - b. Minimum of 2 cables per bond joint.
 - c. Bond cable installed with sufficient slack to prevent stress or tugging. Allow for minimum 1/2-inch of joint movement.
 - d. Jumper Bond Locations:
 - 1) Between non-welded ferrous pipe sections and ferrous pipe and fittings.
 - 2) Between restraints and fittings for non-metallic pipe.
4. Galvanic Anodes:
 - a. Install horizontally or vertically:
 - 1) Location:
 - a) Minimum 1 anode length from non-metallic pipe.
 - b) Bond together all metalwork within 100 ft of each other.

- 2) Depth: At or below invert of pipe structure being protected.
- b. Remove outer water resistant covering on pre-packaged anodes before installation. Do not damage wettable covering containing backfill and magnesium.
- c. Do not support anodes by their cables.
- d. Do not wet pre-packaged anodes until in ground, surrounded with compacted earth, and covered by at least 1 foot of compacted backfill.
- e. Do not connect anodes to structures at test stations; energizing systems only at time of testing.
- f. Connect individual galvanic anodes to structures through individual calibrated 0.01 ohm shunts within the test station or anode junction box for current measurement. (one shunt for each anode).
- g. Connect individual anodes to structure through variable resistors within test station or anode junction box to allow for adjusting output current from individual anodes (if necessary).

E. Tanks:

1. Galvanic Anodes:

- a. Install anodes vertically in a ring/box configuration. Space anodes equidistant from each other.
- b. Anodes hung from 3/16-inch diameter coated stainless steel wire support ropes at top and bottom of anodes such that bottoms of anodes are located approximately the same distance from the bottom of tank as from the sidewall of the tank.
- c. Where wire support ropes hold anodes, the anodes shall be wrapped with a double thickness of dielectric barrier material to a width of 3 to 4 inches.
- d. Wire ropes attached to tank sidewalls using welded brackets.
- e. Anode Cables:

- 1) Run anode cables to roof of tanks and out single port to junction box.
- 2) Run cables through a galvanized conduit outside of tank to junction box.
- 3) Protect cables from damage inside tanks.
- 4) Do not connect anodes to structures at junction boxes; energizing systems only at time of testing.
- 5) Connect individual galvanic anodes to structure through individual calibrated shunts within junction box for current measurement.

- 6) Connect individual galvanic anodes to structure through variable resistors within junction box to allow for equalizing current from individual anodes.
 2. Permanent Reference Electrodes:
 - a. Install 2 permanent copper/copper sulfate reference electrodes in water storage tank.
 - b. Installation:
 - 1) Reference electrodes placed on opposite sides of tank.
 - 2) Reference electrodes installed on bottom anode-to-tank wall support rope with dielectric tape and non-metallic cable ties.
 - 3) Protect reference electrode cable from damage inside tank.
 - 4) Run reference electrode cables to roof of tanks and out single port with anode cables to junction box.
 - 5) Terminate reference electrode cables in junction box.
 3. Junction Box:
 - a. Locations:
 - 1) Against or mounted to outside tank wall.
 - 2) Minimum 4 feet from ground level.
 - b. Contain the following cables:
 - 1) Current carrying cable from the protected structure.
 - 2) Current carrying cable from each anode terminating in junction box.
 - 3) Cable from the protected structure for determining structure-to-water potentials.
 - 4) Reference electrode cables for water storage tanks.
- F. Energize and adjust all cathodic protection systems to meet protection criteria in accordance with NACE SP0169, NACE SP0196, or NACE SP0193.
- G. Test cathodic protection for all buried metallic components of pipe, fittings, and tank bottoms and metallic surfaces in immersion service in tanks. The testing shall have the following characteristics:
 1. Tested or directed by a NACE certified Cathodic Protection Specialist.
 2. Test in accordance NACE TM0497.
 3. Record location and date of test and type of reference electrode used.
 4. Include, but not be limited to, static structure-to-electrolyte potentials, polarized structure-to-electrolyte potentials, anode current output, effectiveness of isolation joints, and effectiveness of continuity bonds.

END OF SECTION

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SECTION 01 89 34

TREATED WATER PIPING AND VALVES PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME)
1. ASME B1.1 Unified Inch Screw Thread, UN and UNR Form
 2. ASME B16.1 Gray Iron Pipe flanges and Flanged Fittings Class 25, 125, and 250
 3. ASME B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
 4. ASME B16.34 Valves – Flanged, Threaded and Welding End
 5. ASME B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
- B. ASTM International (ASTM)
1. ASTM A53/A53M Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 2. ASTM A139/A139M Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
 3. ASTM A240/A240M Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
- C. American Water Works Association (AWWA)
1. AWWA C200 Steel Water Pipe - 6 In (150 mm) and Larger
 2. AWWA C206 Field Welding of Steel Water Pipe
 3. AWWA C207 Steel Pipe Flanges for Waterworks Service, Sizes 4 In Through 144 In. (100 mm Through 3,600 mm)
 4. AWWA C219 Bolted, Sleeve-Type Couplings for Plain-End Pipe

5. AWWA C542 Electric Motor Actuators for Valves and Slide Gates
 6. AWWA C604 Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
 7. AWWA M11 Steel Pipe: A Guide for Design and Installation
- D. American Welding Society (AWS)
1. AWS D1.1/D1.1M Structural Welding Code – Steel
- E. National Electrical Manufacturer’s Association (NEMA)
1. NEMA 250 Enclosures for Electrical Equipment (1,000 Volts Maximum)
- F. NSF International (NSF)
1. NSF 61 Drinking Water System Components – Health Effects
 2. NSF 372 Drinking Water System Components – Lead Content
- G. Occupational Safety and Health Administration (OSHA)
1. OSHA 1910.212 General Requirements for All Machines

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 BASIC FUNCTIONS

- A. Refer to Section 01 81 10 - General Pipe Performance Requirements.

1.05 PERFORMANCE REQUIREMENTS

- A. General:
1. Design pressure: Maximum surge pressure or pump shut-off pressure, whichever is greatest.
 2. Pumps and surge tanks shall not take thrust loads.
 3. Wetted parts of valves, pipe, gaskets, and equipment shall meet NSF 61 or NSF 372.

4. Provide isolation valves at equipment to allow removal of equipment. Provide means for draining pipe to support O&M activities.
- B. Piping:
1. Design pipe in accordance with AWWA M11.
 2. Provide filling line for pumps at start up. Cavitation of isolation valves on pump start up is not permitted.
 3. Design exposed pipe systems using couplings, mechanical joints, flanges, and threaded (for pipes less than 3 inches) connections to facilitate maintenance and operations activities.
 4. Route valve discharge piping to nearest drains.
- C. Valves:
1. Provide industry standard valves that allow for lockout/tagout procedures. Where applicable, provide lockable device in closed or open position.
 2. Air valves: in accordance with AWWA M51.
 3. Valves with weight and levels shall be protected by an OSHA 1910.212 approved safety guard.
- D. Drains: Provide easy accessibility for drain valves.

PART 2 PRODUCTS

2.01 PIPING

- A. Steel Pipe:
1. In accordance with AWWA C200, Table 1 - Steel Plate, Sheet or Coils for Fabricated Pipe.
 2. Standard and schedule steel pipe: ASTM A53, grade B.
- B. Fittings: Industry standard.
- C. Flanges, Flange Bolts, and Flange Gaskets: In accordance with AWWA C207 or ASME B16.5.
- D. Couplings: In accordance with AWWA C219, C227, or C606.
- E. Connections:
1. Flanged or threaded suitable for connection to equipment provided.
 2. Isolation between dissimilar metals:

- a. For flanged connections: Provide insulating gasket set. Include insulating bolt sleeves, washers, and gaskets to prevent galvanic corrosion of mating components.
 - b. For threaded connections: Provide dielectric pipe unions to prevent galvanic corrosion of mating components.
 3. Flanged valve connections: ASME B16.1, ASME 16.34, ASME 16.42 or ASME B16.5.
 4. Threaded flange connections: ASME B1.1 and ASME B16.34.
 5. Bell and spigot connections not allowed.
- F. Dismantling Joints:
1. AWWA C219.
 2. Provide tie rods.
 3. Flanged ends.

2.02 PIPE FABRICATION

- A. Fabricate steel piping in accordance with AWWA C200.
- B. Longitudinal, girth, and spiral joints, other than field welds:
1. Double-welded butt joints with complete penetration.
 2. Stagger longitudinal joints.
 3. Longitudinal, girth, and spiral joints shall not intersect at outlet connections.

2.03 VALVES

- A. Per industry standards.

2.04 VALVE ACCESSORIES

- A. Valve Operators and Actuators: Industry Standards.
1. Electric Actuators:
 - a. AWWA C542.
 - b. Electrical housing shall be minimum NEMA 250, Type 4X.
 - c. Actuators shall be furnished and sized by the valve supplier and shall be factory mounted.
 - d. Actuators shall be sized to produce at least 1.5 times the operating torque required.
 - e. Motor: AWWA C542.

- f. Gearing: Metallic double reduction self-locking, fully enclosed and have roller bearing on shafts.
- g. The actuator shall include a HAND/OFF/REMOTE weatherproof selector switch and OPEN/STOP/CLOSE weatherproof selector switch or pushbuttons.
- h. Actuators shall include a mechanical or digital indicator that shall provide continuous visual indication of valve position.
- i. If valve designed operation requires, actuators shall be designed to fail the valve open or closed on loss of power or loss of control signal.

B. Valve Boxes:

- 1. Provide equipment necessary to actuate buried valves.
- 2. Lid marked with “WATER”.
- 3. Valves in yard: Concrete collar (square or round) surrounding valve box at yard surface.
- 4. Nameplate. Stamped or laser etched with valve information:
 - a. Valve size and type.
 - b. Valve identification number.
 - c. Flow direction.

C. Exposed Valve Tags: 1-1/2-inch diameter stainless steel tag for each valve and valve operator bearing its unique valve designation tag number.

2.05 CONTRACTOR SOURCE QUALITY TESTING

A. Tests may be Government witnessed. Notify Government a minimum of 30 days before test.

B. Piping:

- 1. AWWA C200.
- 2. Straight sections of metal piping manufactured and hydrostatically tested in accordance with ASTM A53 or ASTM A139 need not be retested.

C. Valves:

- 1. Shop test valves in accordance with applicable standard and manufacturer’s recommended testing requirements.
- 2. Shop leakage test:
 - a. Resilient seated valves:
 - 1) Leak test valves in both directions
 - 2) Spray or high velocity leakage is not acceptable.

- 3) If valve is not drip tight, valve is unacceptable.
- 4) If valve leaks, adjustments shall be made until valve is drip tight with no leakage.
- 5) After any adjustments are made, inspect valve position indicator and correct if necessary.
- b. Metal seated valves:
 - 1) Leak test valves in both directions.
 - 2) Allowable leakage: Per applicable standard.
3. Supply documentation certifying test procedure and pressures used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 1. Install flanges to piping so bolt holes straddle vertical centerline when installed.
 2. Contact between pipe and rebar not allowed.
 3. Provide supports and bracing as required to hold steel piping in place and prevent distortion during erection.
- B. Pipe:
 1. Buried pipe in accordance with AWWA C604.
 2. Couplings, gaskets, isolation kits, anchor bolts and other appurtenances in accordance with manufacturer's instructions.
- C. Field Joints:
 1. Welded field joints in accordance with AWWA C206.
 2. Allowable Field Joints:
 - a. Pipe 4 inches in diameter or less: Threaded couplings.
 - b. Pipe 4 inches in diameter and larger: AWWA C207.
 - c. Welded joints in accordance with AWWA C206. Prepare field welded surfaces and recoat in accordance with Section 01 89 09 - Coating Performance Requirements.

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. As recommended by AWWA M11.
- B. No leakage allowed.

- C. Pipe Nondestructive Testing of Field Welds:
 - 1. Test welds in accordance with AWWA C206 and this paragraph.
 - 2. Complete inspections and tests as work progresses in presence of COR and in accordance with AWS D1.1.
- D. Valves:
 - 1. Open and closing valve through its full range of operation 3 times.
 - 2. Acceptable leakage rate:
 - a. Resilient seated valves: No leakage is acceptable. Valves shall be bubbletight.
 - b. Metal seated valves: Per applicable standard.

3.03 FIELD QUALITY CONTROL

- A. Field Testing: Test in accordance with applicable AWWA standard, ASME B31.3 and industry standards.
- B. Zero leakage allowed.

3.04 ACCEPTANCE TESTS

- A. Disinfection and bacteriological tests required for potable water piping in accordance with AWWA C651. Refer to Section 01 81 10 – General Pipe Performance Requirements.

END OF SECTION

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PART 1 GENERAL

A. In accordance with Section 01 81 05 - General Performance Requirements.

A. American Concrete Institute (ACI)

- ## B. American Institute of Steel Construction

1. AISC 360 Structural Steel Buildings

C. American National Standards Institute (ANSI)

- | | | |
|----|------------------|---|
| 1. | ANSI A14.3 | Ladders – Fixed – Safety Requirements |
| 2. | ANSI A1264.12017 | Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail Systems |

D. American Society for Testing and Materials (ASTM)

- Storage Tank Performance Requirements
01 89 35 - 1

- | | | |
|---|-----------------------------|--|
| 7. | ASTM D2563 | Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts. |
| 8. | ASTM D3299 | Filament Wound Glass-Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks |
| E. American Water Works Association (AWWA) | | |
| 1. | AWWA C652 | Disinfection of Water Storage Facilities |
| 2. | AWWA D100 | Welded Steel Tanks for Water Storage |
| 3. | AWWA D110 | Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks |
| 4. | AWWA D115 | Tendon-Prestressed Concrete Water Tanks |
| F. Code of Federal Regulations (CFR) | | |
| 1. | 29 CFR Part 1910, Subpart D | Occupational Safety and Health Administration (OSHA) Standards – Walking-Working Surfaces |
| G. International Code Council, Inc. (ICC) | | |
| 1. | IBC | International Building Code |
| H. NSF International (NSF) | | |
| 1. | NSF 61 | Drinking Water System Components – Health Effects |
| 2. | NSF 372 | Drinking Water System Components – Lead Content |
| I. Occupational Safety and Health Administration (OSHA) | | |
| 1. | OSHA 3124-12R | Stairways and Ladders: A Guide to OSHA Rules |
| J. Post Tension Institute (PTI) | | |
| 1. | PTI TAB.1-06 | Post-Tensioning Manual, Sixth Edition |

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 DESIGN REQUIREMENTS

- A. Design shall be prepared and sealed by designer, erection engineer, and Contractor meeting requirements in accordance with Section 01 81 05 - General Performance Requirements.
- B. Above Ground Tanks:
1. Design above ground tanks in accordance with Table 01 89 35A – Tank Options and storage tank tabulations.

Table 01 89 35A – Water Storage Tank Options

Tank Designation	Standard
Welded Steel Tanks for Water Storage	AWWA D100
Wire and Strand-Wound, Circular, Prestressed Concrete Water Tanks	AWWA D110
Tendon-Prestressed Concrete Water Tanks	AWWA D115

2. Other above ground non-potable or potable storage tanks needed for the water treatment process in accordance with Table 01 89 35B – Chemical Storage Tank Options.

Table 01 89 35B – Chemical Storage Tank Options

Tank Designation	Standard
Fiberglass Reinforced Plastic (FRP)	ASTM D2563 ASTM D3299
XLHDPE: Cross-linked High Density Polyethylene	ASTM D1998
Stainless Steel	ASTM A240
Baked Phenolic Lined or Carbon Steel	ASTM A131 grade B, ASTM A516 grade 70, ASTM A573, or ASTM A662

3. General requirements as applicable per tank type:
 - a. Provide systems controls and monitoring in accordance with Section 01 86 25 - System Controls and Monitoring Performance Requirements.
 - b. Provide steel pipe and threaded fittings, flanges, gaskets, bolts, and nuts in accordance with Section 01 89 34 - Treated Water Piping and Valves Performance Requirements as needed.
 - c. Provide valves and associated equipment in accordance with Section 01 89 34 – Treated Water Piping and Valves Performance Requirements.
 - d. Design tank in accordance with jurisdictional environmental regulations.

- e. Inspection and testing in accordance with applicable AWWA standard.
 - f. Disinfect tank in accordance with AWWA C652.
 - g. Provide COR with 30 days' notice prior to shop tests and two business days' notice prior to field tests so that the Government may witness the testing.
 - h. Non-plastic/non-fiberglass: Provide cathodic protection and associated appurtenances.
 - i. Provide pressure transmitter and storage tank connection pipe heating system as needed.
 - j. Design to comply with OSHA requirements.
 - k. Design to comply with NSF 61 and NSF 372 requirements.
 - l. Coatings: In accordance with manufacturer's recommendations and Section 01 89 09 - Coating Performance Requirements.
 - m. Provide at least one side and one top access hatch on each chemical tank. Provide access hatches with a minimum inside diameter of 24 inches.
 - n. Ladders and Guardrails:
 - 1) Designed to meet requirements set forth in OSHA 3124.
 - 2) Designed to meet the load requirements as prescribed by 29 CFR Part 1910, Subpart D, ANSI A14.3, and ANSI A1264.1.
 - 3) Designed and fabricated in accordance with the applicable requirements in AISC 360.
 - 4) Materials and welding shall conform to all applicable requirements of AISC 360.
 - 5) Provide ladders with safety rail fall arrest system. Do not use cable fall arrest system or ladder cage.
 - o. Chemical Storage Tanks:
 - 1) Level Indicator: Provide a sight glass with bottom valve drain for each opaque chemical storage tank.
4. Foundation Requirements:
- a. Concrete Tank Underdrain:
 - 1) Foundation drain system with an HDPE liner in locations where ground water is not a design consideration.
 - 2) Gravel Drain.
 - 3) PVC Collection System
 - a) Daylight
 - b) Slots compatible with filter gravel.

- b. Foundation drain system with a non-woven geotextile liner in locations where ground water is a design consideration.
- c. Tank foundation in accordance with Section 01 82 13 - Geotechnical and Foundation Performance Requirements.

PART 2 PRODUCTS

2.01 TANK OPTIONS

Tabulation No. 01
Steel Tanks: Welded Steel Tanks for Water Storage: Design in accordance with AWWA D100.
General Requirements: Provide self-supporting steel dome, umbrella, or ellipsoidal roof without rafter support.

Tabulation No. 02
Concrete Tanks: Wire and Strand- Wound Circular, Prestressed Concrete Water Tanks
General Requirements: <ul style="list-style-type: none">1. Design in conformance with ACI 350, and AWWA D110 and PTI TAB.1.2. Earthquake resistance based on ACI 350.3 and the requirements of AWWA D110.3. Design and detail wall, foundation and roof per ACI 350 and AWWA D110.

Tabulation No. 03
Concrete Tanks: Tendon-Prestressed Concrete Water Tanks.
General Requirements: <ul style="list-style-type: none">1. Design in conformance with ACI 350, and AWWA D115 and PTI TAB.1.2. Base design on AWWA D115 and ACI 350 load combinations.3. Design for earthquake resistance based on ACI 350.3 and the requirements of AWWA D115.

Tabulation No. 04
Fiberglass Reinforced Plastic (FRP) for Chemical Storage: Filament Wound Glass-Fiber-Reinforced Thermoset Resin Chemical Resistant Tanks.
General Requirements: <ol style="list-style-type: none">1. Design in accordance with ASTM D32992. Refer to Section 01 86 46 - Water Treatment Performance Requirements

Tabulation No. 05
Cross-Linked High Density Polyethylene (XLHDPE) Tanks for Chemical Storage: Polyethylene Upright Storage Tanks.
General Requirements: <ol style="list-style-type: none">1. Refer to Section 01 86 46 - Water Treatment Performance Requirements

PART 3 EXECUTION

3.01 SERVICES OF ON-SITE ERECTION ENGINEER

- A. Furnish the services of an on-site erection engineer to supervise and be responsible for erecting storage tanks. Onsite during installation of the storage tank.
- B. Coordinate the work of the erection engineer with COR.

3.02 FIELD QUALITY TESTING

- A. Test water storage tanks in accordance with applicable AWWA standards.
- B. Leakage test water storage tanks in accordance with applicable AWWA standards.
 1. Acceptance criteria: zero leakage.
 2. Repair leaks in the tank in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 01 89 37
AIR CHAMBERS PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. American Institute of Steel Construction (AISC)
1. AISC 360 Structural Steel Buildings
- B. American National Standards Institute (ANSI)
1. ANSI A14.3 Ladders – Fixed – Safety Requirements
 2. ANSI A1264.1 Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrail Systems
- C. American Society of Mechanical Engineers (ASME)
1. ASME 31.3 Process Piping
 2. ASME BPVC-VIII Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels
 3. ASME BPVC-IX2017 Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications
- D. ASTM International (ASTM)
1. ASTM A36/A36M Carbon Structural Steel
 2. ASTM A283/A283M Low and Intermediate Tensile Strength Carbon Steel Plates
 3. ASTM B88 Seamless Copper Water Tube
- E. American Water Works Association (AWWA)
1. AWWA C512 Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
- F. Code of Federal Regulations (CFR)

1. 29 CFR Part 1910, Subpart D Occupational Safety and Health Administration (OSHA) Standards – Walking-Working Surfaces
- G. Compressed Air and Gas Institute (CAGI)
 1. CAGI S5.1 Measurement of Sound from Pneumatic Equipment
- H. NSF International (NSF)
 1. NSF 61 Drinking Water System Components – Health Effects
 2. NSF 372 Drinking Water System Components – Lead Content
- I. Occupational Safety and Health Administration (OSHA)
 1. OSHA 3124-12R Stairways and Ladders: A Guide to OSHA Rules

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.04 PERFORMANCE REQUIREMENTS

- A. General:
 1. Design tanks and appurtenant features in accordance with ASME BPVC Section VIII, Division I.
 2. Design to comply with NSF 61 and NSF 372 requirements.
 3. Designed to comply with OSHA requirements.
 4. Dielectrically isolate dissimilar metals. Provide dielectric insulating unions as necessary to prevent galvanic corrosion between dissimilar metals.
- B. Pressure vessel level control equipment:
 1. Provide air chamber level control and monitoring system:
 - a. Shutdown treated water pumping plant in the event of high or low water levels in the air chamber.
 - b. Control the start/stop of the associated air compressor to maintain the air chamber water level within the required control band.

- c. Provide notification of an automatic release of air from the air chamber if a reduction in pressure is required.
 - d. If multiple air chambers are utilized, provide indication and interlocks as needed.
2. Provide switch modules and associated equipment to control the automatic operation of the air compressor, air chamber emergency alarms, and pump shutdown:
 - a. EMERGENCY PUMPS OFF (Main pumps are locked out, alarm light on auxiliary control panel is lit, and pumping plant rotating alarm beacon is energized when the water in the air chamber reaches this level in the tank).
 - b. COMPRESSOR ON (Air compressor to start when the water in the air chamber reaches this level).
 - c. COMPRESSOR OFF (Air compressor to stop when the water in the air chamber reaches this level).
 - d. AIR RELEASE (Alarm light on auxiliary control panel is lit when the water in the air chamber reaches this level).
3. Provide tank volumes in accordance with Table 01 89 37A - Air Chamber Volume Requirements or as accepted by Reclamation.

Table 01 89 37A - Air Chamber Volume Requirements

Volume	Description	Volume, ft3
1	Volume between the tank top and the Emergency Off Level	6,900
2	Volume between the Emergency Off Level and the Compressor On Level	1,800
3	Volume between the Compressor On Level and the Compressor Off Level	2,000
4	Volume between the Compressor On Level and the Air Release Level	3,200
5	Volume between the Air Release Level and the tank bottom	7,900

- C. Pressure vessel ladders and guardrails:
1. Designed to meet requirements set forth in OSHA 3124.
 2. Designed to meet the load requirements as prescribed by 29 CFR Part 1910, Subpart D, ANSI A14.3, and ANSI A1264.1.
 3. Designed for dead, live, and any combination of loads thereof, in accordance with the IBC.
 4. Designed and fabricated in accordance with the applicable requirements in AISC 360.

5. Materials and welding shall conform to all applicable requirements of AISC 360.
6. Provide exterior ladder from the floor to the top of the pressure vessel including side rails.

D. Air Compressor Unit:

1. A single air compressor to provide required pressure and flow to air chamber(s). Spare installed compressor to be provided, cycled periodically.
 - a. A rotary screw compressor may not be used for intermittent use.
2. Capable of continuous operation at required pressure and air flow without overheating.
3. Sound level:
 - a. Test after compressor is installed and operating.
 - b. Noise level: Measured in accordance with CAGI S5.1.
 - c. Maximum noise level, including unloader blowoff: OSHA requirements.
4. If test readings show equipment exceeds specified noise level, install soundproofing enclosure on air compressors to lower noise level to specified limit.

1.05 QUALIFICATIONS

- A. Welder/welding operator performance qualifications of the ANSI/ASME BPVC.
- B. Government may witness the welding of qualification test plates and physical testing of specimens taken from these plates. Notify the Government 2 days prior to qualification test plate welding.
- C. Certification of tests and results from a testing laboratory approved by the Government may be accepted in lieu of witnessing tests.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. General requirements in accordance with ASME BPVC Section VIII, Division I.
 1. Steel Plate:
 - a. Tank skirts and other structural elements: ASTM A283, grade C or D and ASTM A36.
 - b. Pressure vessels: ASTM A516, grade 70 with 4.1 additional tension test.

- B. Pipe, Flanges, Gaskets, Bolts, and Nuts: Refer to Section 01 89 34 - Treated Water Piping and Valves Performance Requirements.
- C. Instrumentation: Refer to Section 01 86 27 - Instrumentation Performance Requirements.
- D. Valves and Accessories: Refer to Section 01 89 34 - Treated Water Piping and Valves Performance Requirements.
- E. Air Release Valve:
 - 1. AWWA C512.
 - 2. Purpose: Release air from air compressor to maintain a minimum water level in the air chamber in the event of an air compressor malfunction.
 - 3. Locate at AIR RELEASE level.
 - 4. Provide air release valve with a minimum capacity 10 percent greater than the amount being delivered by the air compressor.
- F. Pressure Safety Valves:
 - 1. Provide pressure safety valves in between the air compressor and the check valve in the air compressor piping.
 - 2. Provide pressure safety valve on air chamber:
 - 3. Designed in accordance with requirements of ASME BPVC Section VIII, Division I.
 - 4. Suitable for air service.
 - a. Bronze or iron body, stainless steel trim. Isolate dissimilar metals.
 - b. Threaded inlet and outlet.
- G. Ladders:
 - 1. Designed to meet load requirements as prescribed by 29 CFR Part 1910 Subpart D, ANSI A14.3, and ANSI A1264.1.
 - 2. Designed and fabricated in accordance with the applicable requirements in AISC 360.
 - 3. Material and welding shall conform to all applicable requirements of AISC 360.
 - 4. Provide ladders with safety rail fall arrest system. Cable fall arrest system or ladder cage not allowed.
- H. Air Compressor, air piping, and appurtenances: In accordance with ASME B31.9.

2.02 FABRICATION

- A. Fabricate pressure vessels in accordance with ASME BPVC Section VIII, Division I.
- B. Stamp finished tank with official ASME code symbol.

2.03 CONTRACTOR SOURCE QUALITY TESTING

- A. In accordance with designer and manufacturer's requirements.
- B. Perform pressure test in the shop or in the field as necessary. Provide Government 30 days' notice of shop test or 2 days' notice for field test.
- C. Test pressure: Per ASME BPVC Section VIII, Division I.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with Manufacture's requirements.

3.02 COATING

- A. Coat interior and exterior in accordance with Section 01 89 09 - Coating Performance Requirements.

END OF SECTION

SECTION 01 89 39

MECHANICAL SYSTEMS PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 REFERENCE STANDARDS

- A. Compressed Air and Gas Institute (CAGI)
- | | | |
|----|---------------|--|
| 1. | CAGI BL 300 | Performance Test Code for Electric Driven
Low Pressure Air Compressor Packages |
| 2. | CAGI / BL 100 | Mechanical Vibration – Evaluation of
Machine Vibration by Measurements on
Non Rotating Parts – Rotary Positive
Displacement and Centrifugal Blowers |

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. Construction Progress Submittals:
- | | |
|----|--|
| 1. | CAGI Performance Data sheets for dryers, and blowers. |
| 2. | Performance test reports for compressors, dryers, and blowers. |

1.04 DESCRIPTION

- A. Specification section covers basic requirements of mechanical systems not otherwise addressed in other specification sections.
- B. Perform vibration analysis on rotating equipment and provide appropriate anchoring devices. Perform blower vibration analysis in accordance with CAGI BL 100.
- C. Limit sound pressure level of mechanical equipment to 80 dBA at 3 feet from equipment.
- D. Provide rotating and vibrating equipment with flexible hose connectors when connecting to fixed piping systems.
- E. Provide industrial oil water separators at locations at which oil may enter drainage systems, including but not limited to compressed air condensate drains.

- F. Process Blowers System (low pressure compressed air system): Process air supply provided at a pressure at or below 30 psig.
1. Positive displacement rotary lobe blowers.
 - a. Three lobe.
 - b. Roller bearings, minimum L10 rating of 100,000 hours.
 2. Inlet filters with differential pressure gauge.
 3. Inlet silencers.
 4. Discharge pressure and temperature sensor/switch with high alarm to SCADA.
 5. Discharge pressure relief valve vented to safe location.
 6. Design blower systems with a minimum of one spare blower.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

3.01 GENERAL

- A. Install all components in accordance with the manufacturer's written instructions unless otherwise specified.
- B. Install vibration dampening or isolation devices on rotating equipment.
- C. Seismically restrain rotating equipment.
- D. Provide manufacturer recommended spare parts.
- E. Test sound pressure levels for general rotating electric machines in accordance with ISO 2151.

3.02 BLOWER SYSTEMS

- A. Test each blower system in accordance with CAGI BL 300.
- B. Test sound pressure levels for blowers in accordance with ISO 2151.
- C. Field test blower systems.

END OF SECTION

SECTION 01 89 44
TREATED WATER PUMP PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. AOR: Allowable Operating Region.
- B. NPSHA: Net Positive Suction Head Available.
- C. NPSHR: Net Positive Suction Head Required.
- D. POR: Preferred Operating Region.
- E. Pumping unit: Pump and motor.
- F. Treated Water pump: Pump used to convey treated water to Reach 4A and Shiprock Turnout.

1.03 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association (ABMA)
- | | | |
|----|---------|---|
| 1. | ABMA 9 | Load Ratings and Fatigue Life for Ball Bearings |
| 2. | ABMA 11 | Load Ratings and Fatigue Life for Roller Bearings |
- B. American National Standards Institute (ANSI), Hydraulic Institute (HI)
- | | | |
|----|-------------------|---|
| 1. | ANSI/HI 1.1 - 1.2 | Rotodynamic Centrifugal Pumps for Nomenclature & Definitions |
| 2. | ANSI/HI 1.3 | Rotodynamic Centrifugal Pumps for Design and Application |
| 3. | ANSI/HI 2.1 - 2.2 | Rotodynamic (Vertical) Nomenclature |
| 4. | ANSI/HI 2.3 | Rotodynamic (Vertical) Pumps for Design and Application |
| 5. | ANSI/HI 5.1-5.6 | Sealless Rotodynamic Pumps for Nomenclature, Definitions, Applications, Operation, and Test |
| 6. | ANSI/HI 9.1-9.5 | Pumps – General Guidelines |

7.	ANSI/HI 9.6.1	Rotodynamic Pumps Guideline for NPSH Margin
8.	ANSI/HI 9.6.2	Rotodynamic Pumps for Assessment of Applied Nozzle Loads
9.	ANSI/HI 9.6.3	Rotodynamic (Centrifugal and Vertical) Pumps – Guideline for Allowable Operating Region
10.	ANSI/HI 9.6.4	Rotodynamic Pumps for Vibration Measurements and Allowable Values
11.	ANSI/HI 9.6.5	Rotodynamic Pumps Guideline for Condition Monitoring
12.	ANSI/HI 9.6.6	Rotodynamic Pumps for Pump Piping
13.	ANSI/HI 9.6.7	Rotodynamic Pumps – Guideline for Effects of Liquid Viscosity on Performance
14.	ANSI/HI 9.6.8	Rotodynamic Pumps – Guideline for Dynamics of Pumping Machinery
15.	ANSI/HI 9.8	Intake Design for Rotodynamic Pumps
16.	ANSI/HI 11.6	Rotodynamic Submersible Pumps: for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests
17.	ANSI/HI 12.1-12.6	Rotodynamic Centrifugal Slurry Pumps
18.	ANSI/HI 14.6	Rotodynamic Pumps for Hydraulic Performance Acceptance Tests
C.	American Society of Mechanical Engineers (ASME)	
1.	ASME BPVC-IX	Boiler and Pressure Vessel Code - Section IX - Welding and Brazing Qualifications
D.	American Welding Society (AWS)	
1.	AWS D1.1/D1.1 M	Structural Welding Code - Steel
E.	International Standard Organization (ISO)	
1.	ISO 21940	Mechanical vibration. Rotor balancing. Procedures and tolerances for rotors with rigid behavior
F.	National Electrical Manufacturers Association (NEMA)	
1.	NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA MG 1	Motors and Generators

- | | | |
|--------------------------------|------------|---|
| 3. | NEMA MG 10 | Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors |
|
G. NSF International (NSF) | | |
| 1. | NSF 61 | Drinking Water System Components – Health Effects |
| 2. | NSF 372 | Drinking Water System Components – Lead Content |

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence:
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.

1.05 EXTRA MATERIALS

- A. Spare Parts:
 - 1. Provide spare parts that are new and not refurbished.
 - 2. Properly packaged for long-term storage.
 - 3. Furnish spare parts that are interchangeable with and of the same materials and workmanship as corresponding original pump and motor parts.
 - 4. Clearly mark or tag each part to identify size and type of pumping unit it is intended.
 - 5. Furnish the manufactures recommended spare parts and the following spare parts for each size of pumping unit at a minimum:
 - a. One complete set of packing or mechanical seals, as applicable.
 - b. One complete set of gaskets, seals, as applicable.
 - c. One complete set of pump and motor bearings.
- B. Wrenches, Tools, and Accessories:
 - 1. One set of special tools required for assembly and disassembly of pumping unit and other appurtenances and accessories required to make unit complete and ready for operation.
 - a. If motor or pump have special handling requirements, provide the lifting mechanism required.
 - b. Special tools are considered those tools, which because of their limited use, are not normally available but which are necessary for the particular equipment.

2. Tools of high-grade, forged alloy, tool steel.
3. Industrial grade container for storage of the special tools and spare parts. Include in container list of wrenches, tools, and accessories being furnished.

1.06 PERFORMANCE REQUIREMENTS

- A. Design the pump system in accordance with Part 2 – Products and to meet design flow criteria listed in Table 01 81 05A - WTP Treated Water Flow Requirements.
- B. Provide pumping units to meet Phase 1 Maximum Day Demand, as defined by Table 01 81 05A - WTP Treated Water Flow Requirements. Additionally, furnish and install spare pumping units as needed to meet the redundancy requirements of Section 01 89 46 - Water Treatment Performance Requirements.
- C. Furnish and install four identical pumping units operating in parallel for Treated Water pumps. Size four Treated Water pumps operating in parallel for the Phase 2 Maximum Day Demand, as defined by Table 01 81 05A - WTP Treated Water Flow Requirements. Provide each Treated Water pumping unit with and rated for a variable frequency drive.

1.07 QUALIFICATIONS

- A. Welding Procedures, Welders, and Welding Operators:
 1. At Contractor's option, conform to either:
 - a. ASME BPVC-IX.
 - b. Standard qualification procedure of AWS D1.1.
- B. Pumping Unit (pump and motor) Manufacturer's Installation Representative(s). Five years of experience installing pumping units.

PART 2 PRODUCTS

2.01 PUMPING UNITS

- A. Treated Water pumps:
 1. Type VS1 or VS6 as defined in ANSI/HI 2.1-2.2.
 2. NSF 61 and NSF 372 certified.
- B. Materials in contact with water shall have less than 0.25 percent lead concentration by weight.
- C. Select pumps to operate within the POR in accordance with ANSI/HI 9.6.3 over the range of operation of the pumps.
- D. Replaceable casing and impeller wear rings and bowls with replaceable wear rings or bowl liners.

- E. Sole plates or pumping unit base frames supplied by the pump manufacturer. Grout after installation.
- F. Dynamically balance rotating parts to the pump manufacturer's Quality Control Standards provided the residual imbalance does not exceed the field vibration limits established by HI 9.6.4 and ISO 21940-11 minimum balance quality grade G6.3.
- G. Select pumps with a head-capacity curve that has a continuously falling head versus increasing capacity from shutoff head to minimum expected head.
- H. Pipe pump packing or mechanical seal leakage to a drain.
- I. Do not use tin bronze, red brass, or silicon brass for pump components in contact with water.
- J. Do not use silicon bronze for pump components in service with free chlorine above 0.5 mg/L.
- K. Do not use aluminum bronze for pump components in service with free chlorine above 3 mg/L.
- L. Design and construct pump and pump system in accordance with these specifications, ANSI/HI 1.1-1.2, 1.3, 2.1 - 2.2, 2.3, 5.1-5.6, 9.1-9.5, 9.6.1, 9.6.2, 9.6.3, 9.6.5, 9.6.6, 9.6.7, 9.6.8, 9.8, and 12.1-12.6.
- M. Motors in accordance with Section 01 86 28 - Induction Motor Performance Requirements except as modified herein.
- N. Furnish premium efficiency motors.
- O. Horsepower rating shall be sufficient to carry continuously the maximum possible pump load developed under specified conditions without benefit of the service factor. Horsepower rating to be value listed in NEMA MG 1.
- P. Motor enclosure rated for environment installed in. Open Enclosures shall be weather protected type 1, WPI, or weather protected type 2, WPII. Do not use open drip proof, ODP, or drip proof guarded, ODPG.
- Q. Motors conform to NEMA MG 1 and MG 10.
- R. Furnish 2 winding resistance temperature detectors for each phase and bearing resistance temperature detectors on motors over 200 horsepower.
- S. Resistance temperature detectors for pump ball or roller type bearing on pumps with motors over 200 horsepower.
- T. Anti-friction type having a capacity meeting ABMA 9 or ABMA 11 calculated rating life (L10) of no less than 50,000 hours at pump best efficiency point.

- U. Shop test:
1. Notify Government 30 days prior to domestic pumping unit shop testing and 45 days prior to international pumping unit shop testing.
 2. Pump shop hydraulic performance acceptance test:
 - a. Government will witness pump shop performance test.
 - b. Perform tests for each pump.
 - c. Do not test more than 1 pump at a time.
 - d. Perform test at pump rated speed.
 - 1) If job motor is used, perform test at motor rated voltage and frequency.
 - e. Test each pump in accordance with ANSI/HI 14.6 and ANSI/HI 11.6 for submersible pumps.
 - f. Select guarantee condition ensure pump capacity is no less than what is required to meet flows specified in Table 01 81 05A - WTP Treated Water Flow Requirements.
 - g. Test using grade and tolerance 1U in accordance with ANSI /HI 14.6 and ANSI/HI 11.6.
 - h. Use pump test arrangement in accordance with ANSI/HI 14.6, Appendix A.
 - i. Select measurement equipment as recommended in ANSI/HI 14.6, Appendix I. Calibrate measurement equipment as recommended in ANSI/HI 14.6, Appendix J.
 - j. Provide Government witness test equipment certified calibration records, dimensioned test arrangement drawing, and measurement device uncertainty calculations with test equipment data sheets used to determine uncertainty prior to start of witnessed pump shop test.
 3. Perform a hydrostatic test in accordance with ANSI/HI 14.6, Appendix B.
 - a. Use a minimum K_1 value of 1.5.
 - b. Government may witness hydrostatic test.
- V. Lifting eyes or hooks on the pump and motor.

2.02 ACCESSORIES

- A. Valve and Air/Vacuum Valve Assemblies: In accordance with Section 01 89 36 - Valves, Gates, and Accessories Performance Requirements.
- B. Piping: In accordance with Section 01 81 10 - General Pipe Performance Requirements.
- C. Coatings and passivation in accordance with Section 01 89 09 - Coating Performance Requirements.

- D. Grout between pump sole plates or base frames and concrete with epoxy grout.

PART 3 EXECUTION

3.01 CONTRACTOR FIELD QUALITY CONTROL

A. Pumping unit field test:

1. Supply testing equipment with certified calibration record showing calibration within the time period recommended in ANSI/HI 14.6 Appendix J or 6 months for equipment not listed in Table J.1 - instrument recalibration intervals.
2. Government will witness pump test.
 - a. Perform tests for each pump.
 - b. Do not test more than 1 pump at a time.
3. Observe and record during pumping unit operation:
 - a. Pumping unit operation and record noise level as recommended by ANSI/HI 9.2.
 - b. Suction pressures or sump elevations and discharge pressures.
 - c. Pump discharge flow rate.
 - d. Vibration analysis:
 - 1) Vibration analysis to be full spectrum analysis using a monitor that records and prints analysis results.
 - 2) Vibration levels not to exceed the acceptable field vibration limits established by ANSI/HI 9.6.4.
 - e. Shaft alignment and run-out measurements before and after operational testing.
 - f. Pump and motor bearing temperatures.
 - g. Motor stator temperature.
 - h. Ambient air temperature.
 - i. Motor voltage and amperage.
 - j. Leakage from the pump as observed at the following:
 - 1) Pump pressure-containment components.
 - 2) Pump gaskets.
 - 3) Mechanical seal piping (if selected).
 - 4) Mechanical seal(s) or packing as in accordance with the limits by the seal or packing manufacturer.
 - 5) Bearing housing(s).

- k. Take readings for as long as the system allows, up to 8 hours of operation per pump, as accepted by the COR:
 - 1) Hours 1-2: Every 15 minutes;
 - 2) Hours 2-7: Every hour;
 - 3) Hour 8, or last hour: Every 15 minutes.
 - 4. Without additional cost to Government, make changes and correct errors for which Contractor is responsible and perform pumping unit testing again if changes are made to the pumping unit after testing is performed.
- B. Government Witness: Notify Government 14 days prior to Pumping Unit Field Test.

3.02 TRAINING

- A. Pumping Unit Operation and Maintenance: Manufacturer's recommended training for the operation, maintenance, and repair of pumping units.

END OF SECTION

PART 1 GENERAL

A. In accordance with Section 01 81 05 - General Performance Requirements.

A. Commissioning:

1. Systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs.
2. Encompasses and coordinates separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning Agent (CA):

1. An independent authority, hired by the Contractor, not otherwise associated with the design build team members or the Contractor.
2. Included in design process no later than 60% design.
3. Onsite at all times during construction and directs and coordinates the day-to-day commissioning activities.
4. Does not take an oversight role.

A. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):

- ## 1. ASHRAE Guideline The Commissioning Process

- A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 12 16 - Work Sequence.
- B. Design and 100 Percent Construction Submittals: Refer to Section 01 81 05 - General Performance Requirements.
- C. RSN 01 91 13-1, Operation Phase:
 1. Occupancy and Operations Phase Commissioning Documentation.

1.05 QUALIFICATIONS

- A. CA currently certified as ASHRAE BCxP, AABC CxA, or NEBB CxPP.
- B. Performed commissioning services of at least three other buildings of comparable square footage in the past three years.

1.06 SCOPE

- A. Main Process Area.
- B. Secondary buildings with conditioned spaces.

1.07 COMMISSIONING PROCESS DOCUMENTATION

- A. The CA shall generate the following documentation in accordance with ASHRAE Guideline 0:
 - 1. Pre-Design Phase:
 - a. Owner's Project Requirements.
 - b. Initial Commissioning Plan.
 - c. Systems Manual Outline.
 - 2. Design Phase:
 - a. Updated Owner's Project Requirements.
 - b. Basis of Design.
 - c. Design Review Comments.
 - d. Issues and Resolution Log.
 - 3. Pre-Construction Phase:
 - a. Updated Owner's Project Requirements.
 - b. Updated Basis of Design.
 - c. Updated Commissioning Plan.
 - 4. Post-Construction Phase:
 - a. Systems Manual.
 - b. Issues Report.
 - c. Final Construction Commissioning Report.
 - d. Operation and Maintenance Manuals.
 - 5. Occupancy and Operations Phase:
 - a. Updated Owner's Project Requirements.
 - b. Updated Basis of Design.

- c. Test Procedures.
- d. Test Data Reports.
- e. Final Commissioning Report.

1.08 COORDINATION

- A. Commissioning process requires active participation of Government and the Contractor and its mechanical and electrical engineers, mechanical subcontractor, HVAC subcontractor, HVAC controls subcontractor, testing adjusting and balancing subcontractor, electrical subcontractor, equipment manufacturers' representatives, and other specific subcontractors as deemed appropriate. The CA shall witness the final functional performance commissioning process.
- B. Complete start-up and checkout procedures and ensure the complete readiness of equipment and systems prior to the start of the functional performance testing phase. The CA shall request written confirmation of system readiness for performance testing from the Contractor or its appropriate subcontractor. Once the CA is provided with confirmation of all related systems completion, the actual date and times for the functional performance testing process shall be confirmed. Provide sufficient time and qualified representatives to complete this process.d
- C. Perform testing in accordance with requirements in 01 86 30 - Information System Security Performance Requirements, as well as other applicable Sections.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 COMMISSIONING PROCESS

- A. Performed in accordance with ASHRAE Guideline 0 for the following phases of the project:
 - 1. Pre-design.
 - 2. Design.
 - 3. Construction.
 - 4. Occupancy and operations.
- B. Building Envelope Commissioning
 - 1. Blower door test for conditioned buildings to ensure air sealing is intact.
 - 2. Re-seal envelope where air leakage detected.

END OF SECTION

SECTION 01 91 16

FACILITY COMMISSIONING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. In accordance with Section 01 81 05 - General Performance Requirements.

1.02 DEFINITIONS

- A. DT: Demonstration Test. The DT shall start in July 2024 or as authorized by the COR.
- B. EDT: Extended Demonstration Test.
- C. Final Acceptance: Includes successful completion of the EDT.
- D. Final Acceptance Testing: DT and EDT.
- E. MT: Monitored Test.
- F. Startup Testing: Refer to 1.07 Commissioning Process item A.2.
- G. Substantial Completion: Includes successful completion of the MT.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 - Submittals, Section 01 33 26 - Electrical and Control Drawings and Data, and Section 01 12 16 - Work Sequence.
- B. RSN 01 91 16-1, Qualifications.
- C. RSN 01 91 16-2, Test Plan.
- D. RSN 01 91 16-3, Test Procedures.
- E. RSN 01 91 16-4, System Turnover Books:
 - 1. Submit at completion of startup activities for each system.
 - 2. Submit prior to start of Final Acceptance Testing.
- F. RSN 01 91 16-5, Discrepancy List.
- G. RSN 01 91 16-6, Preliminary SOPs:
 - 1. Ready to support system operation.

- H. RSN 01 91 16-7, Final SOPs:
 - 1. Include modifications made during Final Acceptance Testing.
- I. RSN 01 91 16-8, Outline of Operations Plan.
- J. RSN 01 91 16-9, Operations Plan.
- K. RSN 01 91 16-10, Operation Documentation:
 - 1. Monthly operation status reports.
 - 2. Reporting documents to regulatory agencies.
- L. RSN 01 91 16-11, Issues and Resolution Log.
- M. RSN 01 91 16-12, Maintenance Log.
- N. RSN 01 91 16-13, Monitored Test Report.
- O. RSN 01 91 16-14, Demonstration Test Report.
- P. RSN 01 91 16-15, Extended Demonstration Test Report.
- Q. RSN 01 91 16-16, Operation and Maintenance Manual:
 - 1. Include updates made during the Demonstration and Extended Demonstration Tests.

1.04 PROJECT CONDITIONS

- A. Complete Building Commissioning prior to Facility Commissioning.
- B. Coordinate MT, DT, and EDT with San Juan Lateral repairs and operation as detailed in Section 01 81 07 – San Juan Lateral Performance Requirements.

1.05 SCOPE

- A. Demonstrate successful operation of components and systems, including interfaces between Contractor installed components or systems and those installed by Others. System shall perform as described in Specifications as well as equipment manufacturer's requirements.
- B. Where system interfaces to future equipment for WTP, perform commissioning on components that support future expansion.
- C. Demonstrate hardware and software functionality, performance, and stability.
 - 1. Field-verify component rating curves or operational setpoints and adjustment of control loops or settings.

2. Demonstrate component meets the system performance requirements, including but not limited to:
 - a. Flow.
 - b. Pressure.
 - c. WTP recovery.
 - d. Control signals.
 - e. Individual equipment specific design criteria.
- D. Implement software, settings, or graphic display modifications required for reliable equipment and facility operation and to correct deficiencies identified as a result of these activities.
- E. Operate WTP:
 1. Duration:
 - a. Includes MT, DT, and EDT test periods through government acceptance of WTP.
 - b. During DT and EDT test periods, staff and operate WTP 7 days per week for a minimum of one eight hour shift each day.
 2. Contractor shall be Public Water System certified operator of record during the Final Acceptance Testing.
 3. Provide staff and resources needed to operate the WTP.
 4. Operate the WTP with the level of operator(s) required by NNEPA.
 5. Optimize treatment system.
 6. Specified testing.
 7. Produce treated water that meets regulatory requirements.
 8. Produce water to sufficiently meet demands and distribution system storage.
 9. Sample and analyze water for regulatory compliance.
 10. Required to support water production during the specified periods.
- F. At the completion of the commissioning activities replace spare components and maintenance equipment or materials that were consumed to provide Government with a complete, new set of spare parts and maintenance tools and materials.
- G. Technical personnel shall be onsite to consult with Government personnel for questions or problems.
- H. Coordinate with the requirements in Section 01 79 20 - Training.
- I. Provide:

1. Instrumentation, test equipment, and personnel necessary for performing tests at the WTP.
2. Chemicals, lubricants, gases, fuel, electricity, filters, and other consumables unless explicitly specified otherwise.
3. Chemicals: In water treatment process meet the requirements of NSF/ANSI 60.
4. Maintenance and documentation of permanent equipment and systems.

1.06 EQUIPMENT SPECIFIC TESTING REQUIREMENTS

- A. These requirements in addition to those listed elsewhere in Specifications and Contractor developed testing and commissioning requirements.
- B. Meet equipment manufacturer performance requirements.
- C. Inspect equipment and components for dirt, foreign material and damage to the component or coatings.
- D. Process system or piping system components intended to contain potable water shall be tested with potable water.
- E. Flush and replace lubricants, where required by manufacturer or by the condition of the lubricating material.
- F. Check shaft and coupling alignments, adjusting where necessary.
- G. Check and correct leveling plates, bearing plates, anchorage devices, fasteners and alignment of components.
- H. Operate valves, motors and any other devices.
- I. WTP SCADA, Control and Monitoring Systems:
 1. Demonstrate operation of graphic displays and operator interfaces to the graphic displays and HMIs.
 2. System and component interlock.
 - a. Ensure interlocks intended to prevent or trigger automatic operation act as intended.
 - b. Where simulation of feedback signal is required to verify system interlock the simulation shall be performed at the device unless the device is inaccessible.
 - c. Where possible device feedback shall be provided by operating or forcing feedback from the device, as long as it doesn't damage the device or present a safety hazard.
 3. Check equipment and process startup and shutdown sequences.
 4. Check system setpoints and alarms.

5. Check process timing sequences and make adjustments where necessary to improve system operation.
6. Adjust and tune of control loops, logic, settings and HMIs and graphic displays.
7. Simulate equipment failures.
8. Verify logic and operation of the system.
9. Demonstrate operation under each control mode.
10. Demonstrate operation of alarm call out system.
11. Information Technology and Cyber Security Related Testing:
 - a. Perform capture of netflow data between components for network and protocol analysis at the time of system commissioning.
 - b. Verify account based access control.
 - c. Validate network architecture including port address lists and device address lists.
 - d. Validate and document communication restrictions, filtering and monitoring rules through firewalls and other network components.
 - e. Perform additional Contractor and manufacturer recommended testing.
 - f. The Government may perform additional cyber security related testing and verification of the system with cooperation from the Contractor.
12. Communications Links:
 - a. Test telecommunications cable to ensure that it is free of defects and meets design and manufacturer's guidelines.
 - b. Fiber Optic Cable:
 - 1) Test after installation.
 - 2) Test terminated fiber of each cable using an Optical Time Domain Reflectometer (OTDR).
 - c. Verify communication links between devices. Verify cable is free of defects and determine attenuation and splice/connector loss.

1.07 COMMISSIONING PROCESS

- A. Phases of Testing and Commissioning Work:
 1. Construction Testing:
 - a. Perform in accordance with the requirements in these Specifications.
 - b. Includes inspections and tests at the component and device level.
 2. Startup Testing:
 - a. Install system components prior to beginning startup wet/hot testing activities on system or components within the system.

- b. Do not put a system or subsystem into operation until components system or subsystem, including instrumentation and control components, have been tested to the extent practical and have proven to are operational.
 - c. Includes dry commissioning and wet commissioning activities as well as inspections of complete installation.
 - d. Perform loop checks per ISA 62382, perform verification for each loop and each input or output.
 - e. Perform site acceptance and site integration testing in accordance with ISA 62381.
 - f. Demonstrate operation and performance of each system component. Simulate faults and failure of components as well as varying setpoint conditions.
 - g. When testing requires auxiliary systems such as electrical power, flushing or cooling water, or control air not yet in service, provide substitute sources capable of meeting the requirements acceptable to the COR.
3. Monitored Test (MT):
- a. Follows successful completion of Construction Testing and Startup activities.
 - b. Demonstrate ability of WTP to operate and produce water as specified.
 - c. Duration:
 - 1) Operate WTP in recycle mode for 7 days.
 - 2) Operate WTP in automatic flow-through mode for 24 hours.
 - d. Perform MT:
 - 1) Monitor the operating conditions and performance.
 - 2) Continuously operate system without failures lasting more than 1 hour.
 - 3) Meet performance requirements.
 - 4) Monitor continuously as detailed in Section 01 84 46 - Water Treatment Performance Requirements.
 - 5) Sample and verify water quality at least once during flow through test.
 - 6) COR may collect samples to confirm measurements and analyses.
 - 7) Test facility startup, fault, shutdown and restart operation.
 - 8) Vary flows and setpoints during operation over WTP design range.
 - 9) Demonstrate automatic operation of the SCADA, control and monitoring systems and perform setpoint changes from the control room workstations.

- e. If MT is not successful:
 - 1) Prepare plan for modifying system to meet test requirements.
 - 2) Submit plan within 7 days after the second MT ends.
 - 3) Repeat MT.
 - 4) Government may require Contractor to remove and install an alternative water treatment system to meet the performance requirements at cost to the Contractor.
- 4. Final Acceptance Testing:
 - a. Successfully complete Startup Testing and MT, as determined by Government. Documentation submitted and accepted prior to the start of Final Acceptance Testing activities.
 - b. Obtain authorization from NNEPA to commence WTP operations and produce water for public consumption.
 - c. Each phase of the Final Acceptance Testing shall be successfully completed, by the determination of the Government, with all documentation associated with that test phase submitted prior to the start of the next test phase.
 - d. Demonstration Test (DT):
 - 1) Follows the MT.
 - 2) Demonstrate ability of WTP to operate and produce water throughout DT.
 - 3) Coordinate water production with the Government. WTP shall be produce water every day.
 - 4) Begin after MT Report approved and accepted by the COR.
 - 5) DT duration: 90 calendar days.
 - 6) Continuous monitoring of chlorine (free, total, and combined), turbidity, and pH.
 - 7) Sample and verify water quality performance on a weekly basis. Refer to Section 01 86 46 - Water Treatment Performance Requirements.
 - 8) TOC compliance:, at a minimum
 - a) Sample 2 times per week.
 - b) Demonstrate compliance on a 3-week running average.
 - 9) Operate SCADA, control and monitoring systems in automatic mode throughout testing period unless specific situations require manual control or operation. Document instances of manual control/operation in DT Report.

- 10) Continuously operate system without failures for more than 4 hours.
- 11) Meet performance requirements.
- 12) Repeat 3-month test if DT is not successful at Contractor's expense.
- e. Extended Demonstration Test (EDT):
 - 1) Follows the DT.
 - 2) Demonstrate ability of the WTP to operate and produce water throughout the EDT.
 - 3) Coordinate production during the EDT with the Government. WTP shall be operated to produce water every day.
 - 4) EDT duration: 90 calendar days.
 - 5) Water Quality Requirements:
 - a) Continue DT test for compliance with TOC requirements in Section 01 86 46 - Water Treatment Performance Requirements.
 - b) Measure TOC on a weekly basis and demonstrate TOC compliance on a 3-week running average.
- f. DT and EDT Total Duration: 6 months (7 days per week), minimum. This period may be extended if the DT and EDT testing exceeds 6 months.

1.08 COMMISSIONING PROCESS DOCUMENTATION

- A. Inspection and test documentation:
1. Name and signature of person performing the test.
 2. Date on which the test was performed.
 3. Identification of component, equipment, or system tested.
 4. Identification of tests performed.
 5. Summary results of test or inspection activity, including whether system or component passed or failed.
 6. Data or readings taken to verify component, equipment, or system acceptance.
 7. Test Plan specific for commissioning activities. Includes:
 - a. For all phases of the commissioning process.
 - b. Individual planned test and inspection activities.
 - c. Proposed operating conditions and operational parameters to test.
 8. Test and Inspection Procedures.
 - a. Detailed procedures for commissioning activities.

- b. Methodology, sequence, monitoring and acceptance criteria for test and inspection activities. Include individual steps as well as setpoint variations and component operation.
 - c. If applicable, include method for system pressurization, method of water/air discharge, and water/air source.
 - d. If using references, include a copy of reference in testing procedures.
- 9. System Turnover Books:
 - a. Maintained at jobsite.
 - b. Document commissioning activities performed through start of Final Acceptance Testing.
 - c. Organized by individual component and system.
 - d. Records of inspection and testing activities, including specific test data and reports.
 - e. Updated as commissioning activity is performed.
 - f. Do not remove from site without written approval from the COR.
- 10. MT Report:
 - a. Contains system conditions, operating parameters and performance results.
 - b. SCADA printouts indicating alarms that occurred during MT period.
 - c. Approved prior to start of Demonstration Testing.
- 11. DT Report:
 - a. Contains operating parameters and performance results.
 - b. SCADA printouts indicating alarms that occurred during DT period and system setpoint changes.
- 12. EDT Report: Amend the DT Report with results of the EDT.
- 13. Discrepancy List: Document discrepancies found during commissioning.
- 14. As-built Drawings: Marked field drawing sets with drawing modifications in accordance with Section 01 78 30 - Project Record Documents and Section 01 33 26 - Electrical and Control Drawings and Data.
- 15. Issues and Resolution Log:
 - a. Ongoing log of problems or concerns.
 - b. Maintain throughout WTP operation, include MT, DT, and EDT phases.
- 16. Maintenance Log:
 - a. Maintained at jobsite.
 - b. Organized by individual component and system.

- c. Maintain an ongoing log documenting maintenance activities, including associated testing and inspection reports.
 - d. Do not remove the Maintenance Log from site without written approval from COR.
- 17. Operation and Maintenance (O&M) Manuals:
 - a. In accordance with Section 01 78 30 – Project Record Documents.
 - b. For individual equipment and systems as well as facility operation and maintenance.
- 18. Standard Operating Procedures (SOPs):
 - a. Specific to this facility's components and requirements.
 - b. For all Contractor installed process systems and WTP areas.
 - c. Detailed step by step instructions for maintenance, startup, shutdown, and operating the process systems and equipment.
 - d. Each procedure includes:
 - 1) Scope, descriptions, safety requirements.
 - 2) Processes and equipment impacted by procedure.
 - 3) Operating parameters and standards to be used.
 - 4) Tasks to be carried out.
 - e. Integrated with the Operation and Maintenance Manuals.
 - f. Prepare in accordance with Guidance for Preparing Standard Operating Procedures.
 - g. Example SOPs include process control system use and maintenance, water quality testing, laboratory procedures, chemical delivery and handling, and access such as confined space entry.
 - h. Operations Plan:
 - 1) Provide an Operations Plan for operation of the WTP documenting the Contractor's plan for operating the WTP during the commissioning activities.
 - 2) Include information on the interface with other San Juan Lateral components, including communications systems.
 - i. Operation Documentation:
 - 1) Prepare and submit NNEPA compliance documentation.
 - 2) Provide monthly status reports to the Government.

1.09 COORDINATION

- A. The commissioning process requires active participation of the Contractor’s team, including designers, installation personnel, manufacturers’ representatives, and other specific subcontractors as necessary.
- B. Complete each phase of commissioning and request written confirmation of completion from the Government prior to continuing to the next phase.
- C. The Government may witness commissioning activities.
 - 1. Inform the COR in writing of scheduled activities a minimum of 14 days prior to performing the activity to allow the Government the opportunity to witness.
 - 2. Notify the COR in writing a minimum of 60 days prior to any activities requiring pre-treated water or discharging finished water to the NGWSP San Juan Lateral.
- D. Final Acceptance Testing:
 - 1. Requires communication with the operators of other facilities along the NGWSP San Juan Lateral.
 - 2. Communicate desired changes to setpoints or other operating parameters for facilities not operated by the Contractor to the point of contact identified by the Government.
 - 3. Communicate a timetable for when other facilities along the NGWSP San Juan Lateral need to be operated to support Contractor activities a minimum of 7 days in advance. The Government will consider other requests on a case by case basis and may not be able to be accommodated.
 - 4. Changes to operating parameters for the WTP may be required during this period. For example, the Government may request changes to chlorine concentration based on the chlorine residuals observed in the downstream system.
 - 5. Government will coordinate with Contractor to determine schedule for water production from the WTP during the Final Acceptance Testing phases.
- E. Operations Meeting:
 - 1. Weekly meeting during the Final Acceptance Testing presided by the Contractor, includes Government representatives and Contractor’s staff operating the WTP.
 - 2. Discuss planned operation of the WTP with the Government and operators of other facilities along the NGWSP San Juan Lateral.
 - 3. Discuss time periods when the WTP shall be operated and requirements for staffing/operating impacted facilities.
 - 4. Discuss operational issues, maintenance, and operator training.
 - 5. Discuss any operational challenges or changes needed in the operation of other facilities along the NGWSP San Juan Lateral.
 - 6. Provide meeting minutes after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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 30 10
SPACE UTILIZATION REQUIREMENTS

PART 1 GENERAL



IN REPLY REFER TO:

84-27841
PRM 1.10

June 30, 2011

United States Department of the Interior

BUREAU OF RECLAMATION
PO Box 25007
Denver, CO 80225-0007

MEMORANDUM

To: Reclamation Leadership Team (See List)

From: Elizabeth Cordova-Harrison /s/ Elizabeth Cordova-Harrison
Director, Management Services Office

Subject: Property Management Memorandum 11-01, Space Management Utilization Requirements

To comply with recent Presidential and Office of Management and Budget Directives to reduce the Federal real property footprint, the Department of the Interior is reducing the space utilization standard of 200 usable square feet per person to 180 usable square feet. The attachment provides guidelines and instructions on how Bureau of Reclamation space utilization will be calculated.

Space should be assigned based on statutes and regulations, mission requirements and principles of professional space management. Space requirements based on grade or maximum area per person are no longer mandated by Federal regulations or stipulated by General Services Administration (GSA).

The guidance in this memorandum applies to all existing and new facilities, including Reclamation owned and leased space, to carry out Reclamation's mission. At present, transferred works are excluded.

If you have any questions, please contact Mike O'Neill at 303-445-2404 or Jim Keiffer at 303-445-2044.

Attachment

Reclamation Leadership Team

Commissioner, Attn: 91-10000, 92-00000, 94-00000, 94-30000, 96-00000, 96-40000
Directors, Attn: 84-21000, 84-27000, 84-40000, 84-50000, 86-60000, 86-61000, 86-62000, 86-68000
Regional Directors, Attn: PN-1000, MP-100, LC-1000, UC-100, GP-1000

Area Managers

Regional Director, Attn: CCA-1000, SRA-1000, GCP-1000
Regional Director, Attn: SCC-100, NC-100, CVO-100, KO-100, CC-100, LO-100, MPC-100
Regional Director, Attn: PXAO-1000, YAO-1000, LCD-1000, SCAO-1000
Regional Director, Attn: ALB-100, PRO-100, WCG-CDeAngelis, UC-600, FCCD-100
Regional Director, Attn: MT-100, NK-100, TX-Trevino, DK-100, WY-1000, EC-1000

Continued on next page.

Continued from previous page.

cc: 94-00010

Reclamation Leadership Team Executive Assistants
Commissioner, Attn: 91-00001 (Sterling), 92-00000 (Brown), 94-00000 (Oates),
94-30000 (Quarles), 96-40000 (Coleman)
Directors, Attn: 84-21000 (Green), 84-27000 (Vacant), 84-40000 (Kanatzar),
84-50000 (Reese), 86-60000 (Moon), 86-62000 (Vacant), 86-68000 (Snodgrass)
Regional Directors, Attn: PN-1001 (Kaley), MP-101 (Schlueter), LC-1001 (McLeod),
UC-101 (Hutchinson), GP-1000 (Buchholz)

84-27800 (Smiley), 84-27841 (O'Neill, Reyes)
(w/att to each)

WBR:JKeiffer:dmench:6/13/2011:303-445-2044
H:\Acquisition Share\Correspondence-All\FY11\84-27840 - Property\84-27841\Space Mgmt
D&S\Space Management Memo 6-9-2011.docx

Attachment

Bureau of Reclamation Space Utilization

REQUIREMENTS: The space utilization rate shall meet the calculated rate of 180 usable square feet per person average to the maximum extent possible, in accordance with the following inclusions and exclusions. This utilization rate shall be implemented during office renovations and reconfigurations, new space acquisitions and when practicable to modify existing space.

Inclusions:

1. Individual and shared space, i.e., private offices, systems furniture workstations and any required circulation around the systems furniture
2. Office space located in warehouses, maintenance garages, libraries, laboratories (labs), Emergency Operations Centers (EOC)/Situation room or hangars
3. Conference rooms, if not shared with other agencies or Bureaus
4. Break rooms, kitchens and/or galleys
5. Mailrooms
6. Copy centers/Copy rooms
7. Supply rooms

Exclusions:

1. Computer/telephone rooms (finished)
2. Warehouses
3. Libraries
4. Centralized file rooms
5. Secured file rooms
6. Laboratories
7. Evidence rooms
8. Audio/visual production rooms
9. Dedicated EOC/Situation rooms
10. Airplane Hangars
11. Maintenance Garages
12. Additional excluded areas:
 - a. Elevators
 - b. Stairwells
 - c. Lobbies
 - d. Building corridors

Attachment

- e. Service areas, i.e., restrooms, custodial closets, telephone/electrical closets
- f. Mechanical/machine rooms

UTILIZATION MEASUREMENT:

Calculation of Useable Space: Calculation of useable space shall be measured utilizing Building Owners and Managers Association (BOMA) standards to the maximum extent practicable. The usable area of an office is calculated by measuring to the finished surface side of the office side of corridor and other permanent walls, to the center of the partitions that separate the office from adjoining usable areas, and to the inside finished surface of the main portions of the permanent outer building walls. No deduction shall be made for columns and projections necessary to the building. Usable area is the area where a tenant normally houses personnel and/or furniture, for which a measurement is to be computed.

Utilization Rate: The Utilization Rate (UR) will be based on the total number of employees, regardless of type, in each office location, excluding employees housed in Dam/Power structures. The total number of employees includes, but is not limited to, the following classifications: Full-time permanent, part time, intern, volunteer (if office space is provided), contractor, cooperative partners and any vacancy. The UR is computed using the following formula: total usable square feet divided by the total number of employees.

DEFINITIONS:

Break Room: A room at a business which is set aside for coffee breaks, snacks, lunches, etc.

Centralized File Room: A room that contains either digital or paper files of several departments or organizational units stored at one location under a filing plan or system. Free-standing shelving or a high density mobile shelving system can be utilized in a file room.

Circulation: The space that is required to have passage between workstations and partitioned areas in order to provide safe ingress and egress.

Common Areas: Usually includes a share of building support/common areas such as elevator lobbies, building corridors and floor service areas. Floor service areas typically include restrooms, janitor rooms, telephone closets, electrical closets and mechanical rooms. Common area space generally does not include vertical building penetrations and their enclosing walls, such as stairs, elevator shafts and vertical ducts.

Computer/Telephone Room: A room or space within a building for the housing and operation of computer network servers, telephone switching systems or other similar equipment. The room may be secured to limit access to authorized Information Technology staff and may utilize a Computer Room Air Conditioning unit for proper cooling of the equipment.

Conference Room: A room in a building, such as an office building, set aside for the use of people to hold meetings.

Copy Center or Copy Room: A space in the building set aside for duplicating machines that support large offices.

Corridor: A narrow hallway or passageway, often with rooms opening onto it.

Attachment

Emergency Operation Center/Situation Room (EOC) : A central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management functions at a strategic level in an emergency situation and ensuring the continuity of operation of an organization.

Evidence Room: A room utilized to house material in a safe, secure and controlled manner that is collected to support law enforcement civil and criminal proceedings.

General Services Administration (GSA)-provided Space: Space under the custody or control of GSA and provided to a Department of the Interior Bureau or office. This includes both GSA commercially leased space and GSA-owned space (Federal buildings).

Hangar: A large building with extensive floor area, typically for housing aircraft.

Hotel Work Station: An available workspace that can be used to house visiting, telecommuting or temporary employees.

Joint Use Space: Joint use facilities are “public good” facilities to which the applicable Federal community must contribute, just as residential communities pay for local fire departments and ambulance services. Joint use charges are rents and operating costs for specific amenities, including Government-run cafeterias, Randolph-Sheppard Act vending stands, daycare centers, fitness centers, Public Health Service wellness units, shared conference rooms and visitor parking spaces. The costs for these amenities are summed and distributed among all Federal users on any one of three basis – building, lease or facility – directly in proportion to each user’s percentage of Federal occupancy. Joint use charges apply whether or not employees of the customer agencies elect to use joint use facilities.

Kitchen/Galley: A room or area where food is prepared and cooked. May have small seating areas for employees.

Laboratory (Lab) : A room or building equipped for scientific experiments, research or teaching. Can also be a classroom where practical learning and demonstration take place in science, language and other subjects.

Lease: A contract which sets forth certain rights and responsibilities of the parties through which an owner of a commercial asset (the Lessor) conveys the right to use its asset to another party (the Lessee) for a specified period of time (the lease term) for specified periodic payments.

Library: A building or room containing collections of books, periodicals and recorded material for employees to read, borrow or refer to.

Mailroom: A room or office, as in a business or organization, in which incoming and outgoing mail is processed, sorted, etc.

Measurement of Space: The BOMA International Standard, *Office Buildings: Standard Methods of Measurement* (ANSI/BOMA Z65.1 2010), for office area, defined as the area where a tenant normally houses personnel and/or furniture. This measurement is computed as the usable square footage.

Mechanical/Machine Room: A room or space in a building dedicated to mechanical equipment, such as air handlers, boilers, chillers, water heaters, elevator machinery and any associated electrical equipment.

Attachment

Secured File Room: A room housing sensitive information (For Official Use Only, Law Enforcement Sensitive or Classified) that must be secured utilizing measures such as high security locks, cipher locks or combination locks.

Space: An area, usually defined by some form of constructed boundary, structure or building. Parking areas, wareyards, warehouses, storage and office or general use buildings are typically regarded as “space” within their boundaries. Open, unimproved land or lawns is *not* space.

Space Management: The efficient and economical use of defined space to properly support the mission of the entity on whose behalf it is owned or leased.

Supply Room: A designated space that will house general office supplies, copy paper, printer toner, ink jet cartridges and other similar consumable items required to support the mission of the office.

Usable Square Feet: The actual area of space deemed usable contained within the premises. If the entire building is occupied by a single user, the rentable and usable square foot calculations may be the same.

Utilization: The manner and the degree of efficiency with which GSA-provided, Government-owned, and direct leased facilities are occupied.

Utilization Rate: The average amount of space per person housed in a space assignment, not including special use space. It includes employee workstations, circulation (including reception), file space, consultation rooms and all private offices.

Warehouse: A structure or room for the storage of merchandise or commodities.

REFERENCES:

Code of Federal Regulations (CFR), 41 CFR 101-17 through 20 and 41 CFR 102

Executive Order 13101, Greening the Government through Waste Prevention, Recycling and Federal Acquisition

Executive Order 13327, Federal Real Property Asset Management

Departmental Manual 425 Space Management, Policies and Procedures

Department of the Interior Space Management Handbook, dated July 31, 2007

Space Management Utilization Guidance Memorandum, dated May 12, 2011

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 52 00 00

DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

- A. Inform the CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction. Promptly inform the CO of discrepancies discovered on the drawings. The CO will make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense.

1.02 PROJECT CONDITIONS

- A. Where there are differences as determined by the 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 INFORMATION DRAWINGS

- A. Drawings marked “For Information Only” in the 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 the 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.

1.04 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.

1.05 COPIES OF DRAWINGS

- A. One set of full-size (22 inches by 34 inches) drawings, except standard drawings, will be furnished to the Contractor.
- B. Upon request, additional half-size (11 inches by 17 inches) copies of standard drawings will be furnished to the Contractor.

1.06 LIST OF DRAWINGS

- A. Drawings listed in Table 52 00 00A - List of Drawings, are made a part of Section C - Description/Specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	1695-529-60181	General Map
2	1695-529-60182	Location Map
3	1695-529-60236	Project USGS Topographic Map
4	1695-529-60241	Project Aerial Map
5	1695-529-60242	Project Topographic Map
6		Process Diagram
Information Drawings:		
		Reach 12A As-builts (Available Upon Request after issuance of RFP)
		Reach 12B As-builts (Available Upon Request after issuance of RFP)
		Tohlokai Pumping Plant As-builts (Available Upon Request after issuance of RFP)
		Block 9-11 As-builts (Available Upon Request after issuance of RFP)
		Reach 4c-8 Construction Drawings (Available Upon Request after RFP)
		Pumping Plants 4-7 Construction Drawings (Available Upon Request after RFP)
		Reach 4A-4B Construction Drawings (Available Upon Request after RFP)
		Pumping Plants 2-3 Construction Drawings (Available Upon Request after RFP)

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
		Reach 2-3 60 Percent Design Drawings (Available Upon Request after RFP)
		Pumping Plant 1 Concept Drawings (Available Upon Request after RFP)
		Reach 1, River Intake and Pumping Plant (Available Upon Request after RFP)
9	1695-D-355	Cathodic Protection – Test Station and Junction Box
10	1695-D-356	Cathodic Protection – Bonding and Cable I.D.
11		Process Instrumentation and Sampling Plan Schematic Example
Standard Drawings:		
12	40-D-6234	Standard Nameplates
13	40-D-6032	Induction Motors – Design and Nameplate Data to be Furnished by Contractor
14	Figure 4	Design Activities Performed by Others – Reclamation Information Management Handbook Volume 3 Part 2 Drafting Standards

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 conditions at the San Juan Lateral Water Treatment Plant (WTP) project area. Other sections of these specifications contain geological and geotechnical information important for understanding the significance of geologic conditions to construction operations.
- B. Geologic descriptions, drawings, logs of subsurface explorations, water level data, and test data in these specifications include information and records of geologic investigations for the work and are geologic data upon which the design of this work is based. These data supersede previous versions which may be available for examination by Offerors. These data are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations.
- C. Unconsolidated soil materials recorded in geologic exploration logs included in these Specifications were classified under current Unified Soil Classification System procedures as described in USBR 5000 (laboratory classification) and USBR 5005 (visual classification). These two procedures are similar to ASTM D2487 and ASTM D2488, respectively.
- D. Reclamation has established standard descriptors and descriptive criteria for rock and standard descriptors and descriptive criteria for discontinuities. These standards are detailed on Geology Drawings 40-D-7022 and 40-D-7023 included in Section 53 20 00 - Records of Geologic and Subsurface Investigations. The standards provide the basis for classification and description of rock and discontinuities logged after September 1984.
- E. The geologic logs of drill holes, test pits, water-level data, and other available geologic information indicate the conditions encountered during the investigations. 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 drought, precipitation, changes in the surface elevation of nearby reservoirs, irrigation, or flooding.
- F. The geologic drawings portray generalized geologic conditions. Consult the geologic logs of explorations for specific details. For General Geologic Legend, Explanation, and Notes, refer to Geology Drawing 1695-529-60234.
- G. Surface geology and location of explorations, cross sections, and note drawings for the work are included in these specifications on Geology Drawings 1695-529-60234, 1695-529-60208, and 1695-529-60231 through 1695-529-60233.

- H. Selected samples recovered during investigations were tested by Reclamation's Four Corners Construction Office (FCCO) laboratories in Farmington, New Mexico. Summaries of Physical Properties Test Results from laboratory tests performed on these samples are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations. Offerors are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties which the Offeror believes to be significant. Samples are available for examination at Reclamation's FCCO in Farmington, New Mexico. Offerors wishing to inspect the samples, visit the site, or take samples at the site shall make arrangements with FCCO at telephone number 505-324-5035.
- I. Additional laboratory testing was conducted by Reclamation's Technical Service Center (TSC) Concrete Geotechnical and Structural Laboratory (CGSL) in Denver, Colorado. Offerors are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties which the Offeror believes to be significant. Results of laboratory testing is available by contacting the CGSL at telephone number 303-445-2373.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM)
1. ASTM D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification)
 2. ASTM D2488 Description and Identification of Soils (Visual-Manual Procedure)
- B. Bureau of Reclamation (Reclamation)
1. Earth Manual, Part 2, Third Edition (1990), available from:
<https://www.usbr.gov/tsc/techreferences/mands/manuals.html>
 2. Procedure No. and Title:
 - a. USBR 5000-86 Determining Unified Soil Classification (Laboratory Method)
 - b. USBR 5005-86 Determining Unified Soil Classification (Visual Method)
 - c. USBR 7205 Determining Unit Weight of Soils In-place by the Sand-Cone Method
 - d. Engineering Geology Field Manual, Second Edition (1998)
 - e. Copies of the above Reclamation procedures are available for review at Bureau of Reclamation, FCCO, 1235 La Plata Highway, Farmington, New Mexico 87401; or at the Technical Service Center, 6th and Kipling, Building 67, Room 1068, Denver, Colorado 80225. Offerors wishing to inspect the reports and memoranda shall make arrangements through the FCCO at 505-325-1794.

1.03 REFERENCE REPORTS

- A. Copies of the following reports and memoranda are available for review at Bureau of Reclamation, FCCO, 1235 La Plata Highway, Farmington, New Mexico, 87401; or at the Technical Service Center, 6th and Kipling, Building 67, Room 1068, Denver, Colorado, 80225. Offerors wishing to inspect the reports and memoranda shall make arrangements through the FCCO at 505-325-1794.
1. Preliminary Geologic Investigation, Navajo Gallup Water Supply Project, San Juan Lateral Water Treatment Plant, Bureau of Reclamation, Upper Colorado Region, Four Corners Construction Office, Farmington, New Mexico, August 2017.
 2. Geologic Design Data Report, San Juan Lateral Water Treatment Plant, Navajo Gallup Water Supply Project, Bureau of Reclamation, Upper Colorado Region, Four Corners Construction Office, Farmington, New Mexico, July 2018.
 3. Geotechnical Laboratory Testing to Characterize San Juan Lateral Water Treatment Plant Foundation Materials, Concrete, Geotechnical, & Structural laboratory (CGSL), Technical Memorandum Number: 8530-18-35, Upper Colorado Region, Navajo Gallup Water Supply Project, San Juan Lateral, Water Treatment Plant, New Mexico, Bureau of Reclamation Technical Service Center Denver, Colorado, June 2018.

1.04 GEOLOGIC INVESTIGATIONS

- A. Geologic investigations conducted at the San Juan Lateral WTP are listed below; and available logs of investigations are contained in Section 53 20 00 - Records of Geologic and Subsurface Investigations.
1. Drill holes were conducted by Reclamation Upper Colorado and Great Plains Region Drill Crews. Drilling was achieved using a CME 85 truck mounted drill rig and a CME 850 track mounted drill rig. Continuous core sampling in soils was conducted using a 4.25-inch diameter by 5-foot-long hollow stem auger sampler. Core drilling in rock was conducted using an HQ3 wireline rock coring system with a 2.5-inch diameter split tube sampler. Drill hole testing utilized the Standard Penetration Test (SPT) and the Modified California Barrel Sampler (California Sampler) method.
 - a. Standard Penetration Testing (SPT) was conducted using a 4.25-inch diameter by 5-foot-long hollow stem auger with a split tube type sampler and a 1.5 inch inside diameter by 2.5 foot-long SPT sampler. A 140-pound auto hammer was used to drive the sampler. The SPT sampler was advanced 1.5 feet with blow counts reported per 0.5 foot of advancement.
 - b. The California Sampler had a 2.5 inch outside, 2-inch inside diameter, with three to four, 4-inch by 1.94-inch brass liners. The central barrel was 16 inches in length. A 140-pound auto hammer was used to drive the sampler. The sampler was seated with two to three blows, where the

seated depth was recorded. After seating, blow counts were recorded for every 0.5 foot of advancement. The sampler was advanced 1.0 foot for each test and the bottom two brass liners (A and B) were capped, sealed with tape and labeled for laboratory testing. A third brass liner (C) was occasionally recovered and sent for testing.

2. Test pits were conducted by FCCO geologists, backhoe operator and laboratory personnel. Test pits were excavated using a Case 580N backhoe with a 24-inch-wide bucket. Test pits were excavated to the limits of reach of the equipment or to refusal to advance.
3. The following are the geologic investigations that were performed at the San Juan Lateral WTP site. Geologic surface mapping at a scale of 1 inch to 100 feet was performed in 2014. Subsurface investigations began in June, 2017 and consists of 15 drill holes (DHWTP3-17-1, DHWTP-17-2, DHWTP-17-3, DHWTP-17-4, DHWTP-17-5, DHWTP-17-6, DHWTP-17-7, DHWTP-17-8, DHWTP-18-9, DHWTP-18-10, DH-18-1, DH-18-2, DH-18-3, DH-18-4 and DH-18-5), 5 test pits (TPWTP3-18-1, TPWTP3-18-2, TPWTP3-18-3, TPWTP3-18-4 and TP-18-5), and electrical resistivity imaging (ERI) surveys.
4. Groundwater was not encountered in any of the drill holes or test pits.
5. In-place densities were taken in test pits TPWTP3-18-2 at 0.5 feet, TPWTP3-18-4 at 1.5 feet and TPWTP3-18-5 at 4.0 feet of depth. Results from the in-place densities are shown on test pit logs in Section 53 20 00 - Records of Geologic and Subsurface Investigations.
6. Corrosion samples from the San Juan Lateral WTP site were collected at 6 feet below ground surface and sent to the TSC Concrete Geotechnical and Structural Laboratory (CGSL) for soil chemistry/corrosivity testing. Results from the soil chemistry/corrosivity testing are documented in technical memorandum 8530-18-35 from the TSC CGSL referenced above.
7. Several samples from the San Juan Lateral WTP site were collected and sent to the TSC CGSL for one-dimensional (1-D) swell-consolidation testing. Results from the one-dimensional (1-D) swell-consolidation testing are documented in technical memorandum 8530-18-35 from the TSC CGSL referenced above.

1.05 REGIONAL GEOLOGY

- A. The San Juan Lateral WTP is located on western slope of the folding features associated with the Hogback Monocline within the San Juan Basin. The San Juan Basin is a broad basin that is surrounded by many mountain ranges with distinct geologies including the Chuska Mountains, the La Plata Mountains, the San Juan Mountains, the San Pedro Mountains, the Zuni Mountains, and Mount Taylor. Characterized by plateaus, mesas and dry-wash canyons presently being eroded in an arid climate, the San Juan Basin is a structural depression that contains Quaternary and Tertiary alluvium, resting on rocks of Tertiary and Cretaceous age which crop out around the margins of the basin.

1.06 SITE GEOLOGY

- A. The San Juan Lateral WTP project area is located on a plain with surface drainage sloping to the west and includes a remnant fluvial terrace of the San Juan River to the north. The terrace is flat on top, flanked by risers on the north and south, and a road cut (Indian Service Road 36) to the east. Geologic features surrounding the site include the Hogback Monocline and oil field to the east and the Table Mesa Anticline and oil field to the south. The geologic units encountered at the San Juan Lateral WTP footprint consists of alluvium, terrace gravels, claystone, and shale bedrock.
- B. The Quaternary Alluvium (Qal) varies in thickness but is generally found to be 1 to 10 feet thick at the site. Alluvial soils are generally fine grained with variable amounts of plastic to non-plastic fines and occasionally contain sand and gravel. Alluvial soils range from Silty Sand (SM), Lean Clay (CL), Lean Clay with Sand (CL)s and Sandy Lean Clay s(CL). The alluvium is derived from a variety of sources including slope wash, eolian and alluvial deposition as well as weathering and decomposition of in-place bedrock. Quaternary Alluvium is used to describe surficial deposits regardless of origin, with the exception of Quaternary age Terrace Gravels.
- C. The Quaternary Terrace Gravels (Qtg) are found on the terrace located at the northern end of the project area, north of Indian Service Road 36. The terrace gravels range in thickness from 8 to 20 feet thick and overly bedrock. Quaternary terrace gravel is comprised of unconsolidated deposits of gravel, cobbles, and boulders in a predominantly sandy matrix with lesser amounts of silt and clay. The terrace gravels originate from the San Juan River alluvium and glacial outwash deposits forming terraces and exhibit weak to moderate cementation. Terrace gravels range from Lean Clay (CL), Silty Sand (SM), Silty Sand with Gravel (SM)g to Poorly Graded Gravel with Sand and Cobble (GP)sc and were noted to contain lenses and pockets of clean sand and gravel. Sand, gravel, and cobble are generally hard to very hard, rounded to sub rounded with occasional flat and elongated particles. Boulders are encountered on the surface surrounding the site but were not noted in sub-surface explorations.
- D. Bedrock at the treatment plant site is the Cretaceous age Mancos Shale. The Mancos Shale is an offshore marine deposit comprised predominantly of shale with interbedded claystone and sandstone. The shale is a light to dark gray, marine deposit that is laminated to thinly bedded and fissile. The shale is generally moderately soft (H5) to moderately hard (H4). The shale can be intensely weathered (W7) to slightly weathered (W3) and has a no to strong reaction with HCl. The claystone is light to dark brown, laminated to thinly bedded, very soft (H7) and decomposed (W9) to intensely weathered (W7). The claystone has a strong reaction with HCl. Generally, the shale and claystone contain calcium carbonate as nodules, stringers and in bedding planes. Iron and manganese oxide staining and carbon blebs are also present.

1.07 WATER 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. Groundwater was not encountered in any of the geologic explorations at the San Juan Lateral WTP site. However; perched water tables could be encountered along the claystone and shale bedrock surfaces. Expect additional ground and surface water after extensive rainfall and snowmelt.
- C. Sand washes and tributary streams in the project area may have intermittent surface water flow particularly after rainfall. Surface flow would have an adverse effect on excavation and construction activities. Surface flow is likely to increase groundwater elevation in the surrounding areas and would likely increase groundwater elevations in areas that are dry when streams do not have flowing surface water.

1.08 ENGINEERING GEOLOGY AND GEOTECHNICAL CONSIDERATIONS

- A. Excavation:
 - 1. Excavation at the WTP in unconsolidated soils and intensely weathered bedrock can be accomplished using common methods. The claystone of the Mancos Shale is often weathered and very soft and can be excavated using common methods. The shale units of the Mancos Shale formation are generally less weathered and range from moderately soft to moderately hard and will likely require excavation by ripper-equipped dozers or large excavators with adequate pullout force and appropriate teeth.
 - 2. Excavation on of the terrace gravels (Qtg) can be accomplished using common methods. Terrace gravel that contain oversize material greater than 3 inches may not be suitable as engineered backfill. Test pit TP-18-5 encountered some sloughing within the Poorly Graded Gravel with Sand and Cobbles (GP)sc.
- B. Slope Stability:
 - 1. The stability of surficial deposits in the foundation area is dependent primarily on material composition. Natural slopes in unconsolidated alluvium are generally stable at approximately 1.5:1 or flatter in sandy materials. Bedrock exposures in the area are typically stable at about 1.5:1 or steeper in claystone and shale, and 1:1 to vertical in sandstone.
 - 2. Recommendations for cut slopes in surficial deposits are based on material type and texture. All cut slopes shall be constructed in accordance with the Reclamation Safety and Health Standards and OSHA standards. Recommendations are for dry or adequately dewatered materials. Materials with excessive moisture will require further flattening for stability. Recommended cut slopes Poorly Graded Sand (SP), Poorly Graded Sand with Silt (SP-SM), Silty Sand (SM), and granular soils with gravel, cobbles, and boulders are 1.5:1.

Recommended cut slopes for Silty Clayey Sand (SC-SM) and Clayey Sand (SC) are 1:1 or flatter.

3. Cut slopes in bedrock will be dependent upon the rock type and degree of weathering. All decomposed to intensely weathered, very soft to soft bedrock will be classified as a type B or type C soils depending upon the composition of the rock. Moderately weathered to fresh, moderately soft to hard bedrock can be classified as Stable Rock if all requirements of the Reclamation Safety and Health Standards are met. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

C. Expansive and Collapsible Materials Laboratory Testing:

1. Results of physical properties testing indicated that the Cretaceous Mancos Shale Formation claystone unit primarily classified as CL–Lean Clay. Due to high disturbance in some of the CA brass liner samples, only eight samples were tested for swell potential. Of the eight samples tested, only one exhibited swell potential; all other samples collapsed upon wetting. Results from the one-dimensional (1-D) swell-consolidation testing are documented in the technical memorandum 8530-18-35 from the TSC CGSL referenced above.
2. The expansive material (Samples 72F-258) was obtained from a depth of 7.0 to 8.0 feet in DHWTP3-17-5. Two specimens were tested from this sample, exhibiting a swell potential of 5.7 and 6.2 percent with swell pressures of 17,443 and 29,377 pounds per square foot (psf) – respectively. Based on the results, this material is considered to have “high” swell potential and has “slight compressibility” in virgin compression.
3. Samples which collapsed upon wetting generally exhibited large collapse strains. This is likely due to sample disturbance and not due to actual collapse potential. Due to the depositional environment, the geologic characteristics and physical properties of the claystone unit, it is unlikely that the material would exhibit significant collapse behavior in the field. Weakly bonded, and friable, bedding planes within the claystone unit which had relatively low water contents were likely disturbed (fractured) as a result of the CA sampling method, extrusion from the CA sampler, or both. The samples that collapsed had higher initial void ratios with e_o values ranging from 0.542 to 0.842, again, likely due to sampling disturbance. These materials also exhibited C_c values ranging from 0.12 to 0.19, indicating that they are “slightly” to “moderately compressible” in virgin compression.

D. Corrosivity:

1. Based on developed corrosivity categories and ion concentration ranges, the foundation materials tested exhibited “Very Severe” resistivity values, “Severe” to “Very Severe” Sulfate concentrations, “Moderate” Chloride concentrations, and neutral pH values. Compare these results to in-situ soil resistivity measurements for the test area, if available, to develop potential corrosion mitigation measures. The presence of very severe resistivity values and severe to

very severe Sulfate concentrations indicate that special considerations pertaining to corrosion of metals and concrete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 53 20 00
RECORDS OF GEOLOGIC AND SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.01 GEOLOGY DRAWINGS

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
G4	1695-529-60234	General Geologic Legend, Explanation and Notes
G5	1695-529-60208	Surface Geology/Location of Exploration & Geologic Sections
G6	1695-529-60231	Geologic Sections A-A' and B-B'
G7	1695-529-60232	Geologic Sections C-C' and D-D'
G8	1695-529-60233	Geologic Sections E-E', F-F' and G-G'

1.02 GEOLOGIC LOGS

Geologic Logs

Sheet No.	Title
Drill Holes	
G9	Geologic Log of Drill Hole No. DHWTP3-17-1
G10	Geologic Log of Drill Hole No. DHWTP3-17-2
G11	Geologic Log of Drill Hole No. DHWTP3-17-3
G12	Geologic Log of Drill Hole No. DHWTP3-17-4
G13	Geologic Log of Drill Hole No. DHWTP3-17-5

Geologic Logs

Sheet No.	Title
G14	Geologic Log of Drill Hole No. DHWTP3-17-6
G15	Geologic Log of Drill Hole No. DHWTP3-17-7
G16	Geologic Log of Drill Hole No. DHWTP3-17-8
G17	Geologic Log of Drill Hole No. DHWTP3-17-9
G18	Geologic Log of Drill Hole No. DHWTP3-17-10
G19	Geologic Log of Drill Hole No. DH-18-1
G20	Geologic Log of Drill Hole No. DH-18-2
G21	Geologic Log of Drill Hole No. DH-18-3
G22	Geologic Log of Drill Hole No. DH-18-4
G23	Geologic Log of Drill Hole No. DH-18-5
Test Pits	
G24	Log of Test Pit No. TPWTP3-18-1
G25	Log of Test Pit No. TPWTP3-18-2
G26	Log of Test Pit No. TPWTP3-18-3
G27	Log of Test Pit No. TPWTP3-18-4
G28	Log of Test Pit No. TPWTP3-18-5

1.03 LABORATORY TEST DATA

Laboratory Test Data

Sheet No.	Title
Laboratory Test Data for Drill Holes	
G29	Summary of Physical Properties Test Results (Maximum Density by Proctor), DHWTP3-17-1: SPT-1, SPT-2, SPT-3, SPT-4, SPT-5, SPT-6 and SPT-7
G30	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-17-2: SPT-1, SPT-2, SPT-3, SPT-4, SPT-5, SPT-6, SPT-7 and SPT-8
G31	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-17-3: SPT-1, SPT-2, SPT-3, SPT-4, SPT-5 and SPT-6

Laboratory Test Data

Sheet No.	Title
G32	Summary of Physical Properties Test Results, DHWTP3-17-4: SPT-1, SPT-2 and SPT-3
G33	Summary of Physical Properties Test Results, DHWTP3-17-5: SPT-1, SPT-2, SPT-3 and SPT-4
G34	Summary of Physical Properties Test Results, DHWTP3-17-6: SPT-1, SPT-2 and SPT-3
G35	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-17-7: SPT-1, SPT-2 and SPT-3
G36	Summary of Physical Properties Test Results, DHWTP3-17-7: Bag Sample
G37	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-17-8: SPT-1, SPT-2 and SPT-3
G38	Summary of Physical Properties Test Results, DHWTP3-17-8: 10.0 to 20.0 feet
G39	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-18-9: SPT-1, SPT-2 and SPT-3
G40	Summary of Physical Properties Test Results (Maximum Density by Proctor) DHWTP3-18-10: SPT-1, SPT-2 and SPT-3
Laboratory Test Data for Test Pits	
G41	Summary of Physical Properties Test Results, TPWTP3-18-2, TPWTP3-18-4 and TP-18-5

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 53 30 00
PRELIMINARY GEOLOGIC DESIGN DATA REPORT

PART 1 GENERAL

RECLAMATION
Managing Water in the West

GEOLOGIC DESIGN DATA REPORT
SAN JUAN LATERAL WATER TREATMENT
PLANT



NAVAJO GALLUP WATER SUPPLY PROJECT



Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Four Corners Construction Office
Farmington, New Mexico



July 2018

Preliminary

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APPENDIX 1

LOGS OF EXPLORATION

Drill Holes:

DHWTP3-17-1, DHWTP3-17-2, DHWTP3-17-3, DHWTP3-17-4, DHWTP3-17-5, DHWTP3-17-6, DHWTP3-17-7, DHWTP3-17-8, DHWTP3-18-9, DHWTP3-18-10, DH-18-1, DH-18-2, DH-18-3, DH-18-4, DH-18-5

Test Pits:

TPWTP3-18-1, TPWTP3-18-2, TPWTP3-18-3, TPWTP3-18-4, TP-18-5

APPENDIX 2

LABORATORY DATA

APPENDIX 3

PHOTOGRAPHS

APPENDIX 4

DRAWINGS

Dwg No. 1695-529-60181 General Map

Dwg No. 1695-529-60182 Location Map

Dwg No. 1695-529-60234 General Geologic Legend, Explanation and Notes

Dwg No. 1695-529-60208 Surface Geology, Location of Exploration and Geologic Sections

Dwg No. 1695-529-60231 Geologic Sections A-A' and B-B'

Dwg No. 1695-529-60232 Geologic Sections C-C' and D-D'

Dwg No. 1695-529-60233 Geologic Sections E-E', F-F' and G-G'

1.0 INTRODUCTION

The Navajo-Gallup Water Supply Project (NGWSP) is a major infrastructure project that once constructed, will convey a reliable municipal and industrial water supply from the San Juan River to the eastern section of the Navajo Nation, southwestern portion of the Jicarilla Apache Nation and the city of Gallup, New Mexico. Approximately 280 miles of pipeline, several pumping plants and two water treatment plants are under construction or being designed. The NGWSP is divided into two segments, the Eastern phase (Cutter Lateral) and a Western phase (San Juan Lateral).

The San Juan Lateral is divided into several reaches and includes the San Juan Lateral Water Treatment Plant (SJWTP) the subject of this report. The SJWTP is to be located between Reach 3, Reach 4A and the Shiprock Connection, approximately 22 miles west of Farmington, NM. Refer to location map in Appendix 4. The SJWTP will treat municipal water for the city of Gallup and surrounding Navajo Nation Chapters.

For the purposes of this report, the SJWTP location has been divided into the “SJWTP” area located south of Indian Service Road 35 and the “terrace” area located north of the Indian Service Road 36. Refer to drawing 1605-529-6-108 in Appendix 4.

1.1 PURPOSE

The purpose of this report is to summarize geologic investigations for the SJWTP. Investigations were performed to collect site specific design data for potential buildings, line pipe and water storage facility foundations. The geologic investigations were requested by Reclamations Technical Service Center (TSC) to characterize foundation conditions with emphasis on identifying, sampling and testing potentially expansive foundation material. The design and construction of the SJWTP will be done by others as a design/build contract. This report presents the data collected from February 2017 through June of 2018 from subsurface investigations and geologic mapping performed in 2014. Some laboratory tests are currently in progress and are not included in this report.

1.2 TOPOGRAPHICAL DATA BASE

An aerial topographic survey was flown in April 6th 2010 by Woolpert Inc. from approximately 3,600 feet above the ground surface. Ground panel points for the aerial topographic survey were located by Reclamation survey crews using GPS survey equipment. The topography provided by Woolpert Inc. consists of 2-foot contours using NAD-83/NAVD-88 datum. Test pits and drill holes from investigations were located and additional topography was collected by the Four Corners Construction Office (FCCO) survey crew utilizing survey quality GPS instruments. The coordinates are expressed in 1983 State Plane, New Mexico, West Zone.



Photo taken from the terrace to the north of the proposed SJWTP site looking south across Indian Service Route 36.

Image for reference only.

Photo taken on 6/8/2017 by P. Gardner.

2.0 GEOLOGIC INVESTIGATIONS

Geologic investigations of the proposed SJWTP site include geologic mapping, test pits, drill holes, field and laboratory testing. Geologic surface mapping at a scale of 1 inch to 100 feet was performed in 2014. Subsurface investigations began in 2017 and consisted of five test pits (TPWTP3-18-1 through TPWTP3-18-4 and TP-18-5) and fifteen drill holes (DHWTP3-17-1 through DHWTP3-17-8, DHWTP3-18-9, DHWTP3-18-10 and DH-18-1 through DH-18-5). Refer to drawing 1695-529-60208 in Appendix 4 for surface geology and locations of test pits and drill holes.

Test pits were conducted by FCCO geologists, backhoe operator and laboratory personnel. Test pits were excavated using a Case 580N backhoe with a 24 inch bucket. Excavation was advanced to the limit of the equipment or to refusal.

Drill holes were conducted by the FCCO geology group and the Reclamation Upper Colorado Region Drill Crew. Drilling was achieved using a CME 850 track mounted drill rig and a CME 85 truck mounted drill rig. Drill holes were advanced using flight auger dry core, Standard Penetration Testing (SPT) and Modified California Barrel Sampler (California Sampler) testing. Diamond core drilling methods were employed for auger refusal.

All soils recovered from test pits and drill holes were logged and visually classified using methods described in USBR 5005 [Earth Manual, Part 2, 1991 Edition, and the Unified Soil Classification System (USCS)]. All rock core recovered from the drill holes were visually classified using methods described in the USBR, Engineering Geology, Field Manual, Second addition, Volume 1.

Refer to Appendix 1 for geologic logs, Appendix 2 for lab results, Appendix 3 for photos, Appendix 4 for drawings and investigation data summary tables included in this report.

2.1 TESTING AND SAMPLING

Testing conducted by the FCCO Materials Laboratory included in-place density, Proctor, Atterberg Limits, specific gravity, gradation analysis and laboratory soil classification. Testing conducted by the TSC Concrete Geotechnical Structural Laboratory (CGSL) included soil

physical properties, one-dimensional (1-D) swell-consolidation, soil chemistry/corrosivity, uniaxial compressive strength and unconfined compressive strength.

In-place density tests were performed in test pits TPWTP3-18-2, TPWTP3-18-4 and TPWTP3-18-5 in alluvial material. In-place densities were not performed in all test pits when bedrock or oversized material was encountered. Results from the in-place density tests are shown on Table 2, test pit logs in Appendix 1 and on the summary of test results in Appendix 2.

Samples from test pits at the terrace and SJWTP areas were collected around 6 feet below ground surface for soil chemistry/corrosivity testing for concrete, steel pipe and cathodic protection design. The results of this testing is documented in a separate report from the CGSL.



Excavation of terrace gravel and cobbles in test pit TP-18-5.
Image for reference only.

Photo taken 2/22/2018 by P. Gardner.

Bulk samples of flight auger cuttings were collected from 10 to 20 feet of depth in drill hole DHWTP3-17-8 and from ground level to 10 feet of depth in drill holes DHWTP3-18-9 and DHWTP3-18-10. The bulk sample from DHWTP-17-8 was sent to the FCCO for compaction testing and laboratory classification and results are shown on Table 2 and on the summary of test results in Appendix 2. Information regarding testing performed on bulk samples from DHWTP3-18-9 and DHWTP3-18-10 are available in a separate report from the CGSL.

Standard Penetration Tests were conducted using a 4.25 inch inside diameter by 5 foot-long hollow stem auger with a split tube sampler and a 1.5 inch inside diameter by 2.5 foot-long SPT sampler. A 140 pound auto hammer was used to drive the sampler. The SPT sampler was advanced 1.5 feet with blow counts reported per 0.5 foot of advancement. Representative samples were sent to the FCCO Materials Laboratory for laboratory soil classification. Results from the SPTs are shown on drill logs in Appendix 1 and are included on the summary of test results in Appendix 2 and Table 1.

California Samplers were conducted using a 2.5 inch outside, 2 inch inside diameter central barrel, with three to four, 4 inch x 1.94 inch brass liners. The central barrel was 16 inches in length. Samples were extracted at depths specified in the Field Exploration Request for the purpose of 1-D swell-consolidation testing. A 140 pound auto hammer was used to drive the sampler. The sampler was seated and blow counts were recorded for every 0.5 foot of advancement. The sampler was advanced 1.0 foot for each test and the bottom two brass liners (A and B) were capped, sealed with tape and labeled for laboratory testing. The third brass liner (C) was occasionally sent for testing or logged and visually classified using methods described in USBR 5005. The results of this testing is documented in a separate report from the CGSL.

Diamond core drilling methods used the HQ3 diamond core drilling system with a 5-foot-long split tube sample barrel and wireline extraction system. Select samples were sealed with plastic, foil and wax to preserve the in-situ condition for laboratory strength testing. The results of this testing is documented in a separate report from the CGSL.



Core box of the Mancos Shale recovered from drill hole DHWTP3-17-7.
Image for reference only. Photo taken on 12/16/2017 by P. Gardner.

3.0 REGIONAL GEOLOGY

The SJWTP is located on western slope of the folding features associated with the Hogback Monocline within the San Juan Basin near Shiprock, New Mexico. The San Juan Basin is a broad basin that is surrounded by many mountain ranges with distinct geologies including the Chuska Mountains, the La Plata Mtns, the San Juan Mtns, the San Pedro Mtn, the Zuni Mtns, and Mt. Taylor. Characterized by plateaus, mesas and dry-wash canyons presently being eroded in an arid climate, the San Juan Basin is a structural depression that contains Quaternary and Tertiary alluvium, resting on rocks of Tertiary and Cretaceous age which crop out around the margins of the basin.

4.0 SITE GEOLOGY

The SJWTP is located on a plain near the crest of an anticline (O’Sullivan, R. B. and Beikman, H. M., 1963) with surface drainage sloping to the west toward the Dead Mans Wash. The plain is bound to the north by a remnant fluvial terrace of the San Juan River. The terrace is flat on top, flanked by risers on the north and south, and a road cut to the east. Bedrock at the terrace and SJWTP areas is comprised of the Mancos Shale. Geologic features surrounding the site include the Hogback Monocline and oil field to the east and the Table Mesa Anticline and oil field to the south. Between the SJWTP area and the terrace area is the Indian Service Route 36 that is anticipated to require trenchless methods for the road crossing of the line pipe.



Illustration of the terrace investigation site looking west across Indian Service Route 36.

Image for reference only.

Photo taken on 3/9/2018 by P. Gardner.

4.1 STRATIGRAPHY

The geologic units encountered at the San Juan Lateral Water Treatment Plant footprint consists of alluvium, claystone and shale bedrock. The Quaternary Alluvium varies in depth but is generally found within 1 to 10 feet below ground surface at the treatment plant site. Bedrock at the treatment plant site is an offshore marine deposit called the Cretaceous Mancos Shale and is predominantly shale with interbedded claystone. The terrace to the north consists of approximately 8 to 20 feet in depth of Terrace Gravel overlying the Mancos Shale. The Terrace Gravel is coarse-grained overburden of clay and silt, sand, gravel and cobble with a trace of boulders.

4.1.1 SURFICIAL DEPOSITS

Embankment (Embk)

The embankment materials are comprised of fine to coarse, miscellaneous engineered compacted earth material used for road grade above the existing ground surface. Embankment may contain foundation or subgrade material ranging from well to poorly graded material and oversized particles.

Quaternary Alluvium (Qal)

Quaternary alluvium is comprised of unconsolidated soils that overlie bedrock across the investigation site. Alluvial soils are generally fine grained with variable amounts of plastic to non-plastic fines and occasionally contain sand and gravel. Alluvial soils range from Silty Sand (SM), Lean Clay (CL), Lean Clay with Sand (CL)s and Sandy Lean Clay (CL). The alluvium is derived from a variety of sources including slope wash, eolian and alluvial deposition as well as weathering and decomposition of in-place bedrock. Quaternary Alluvium is used to describe surficial deposits at the SJWTP regardless of origin.

Quaternary Terrace Gravel (Qtg)

Quaternary terrace gravel is comprised of unconsolidated deposits of gravel, cobbles and boulders in a predominantly sandy matrix with lesser amounts of silt and clay. The terrace gravels originate from the San Juan River alluvium and glacial outwash deposits forming

terraces and exhibit weak to moderate cementation. Terrace Gravels range from Lean Clay (CL), Silty Sand (SM), Silty Sand with Gravel (SM)g to Poorly Graded Gravel with Sand and Cobble (GP)sc and were noted to contain lenses and pockets of clean sand and gravel. Sand, gravel and cobble are generally hard to very hard, rounded to sub rounded with occasional flat and elongated particles. Boulders are encountered on the surface surrounding the site but were not noted in sub-surface explorations.

4.1.2 BEDROCK

Cretaceous Mancos Shale (Km)

The Cretaceous Mancos shale formation is predominantly shale with interbedded claystone. The shale is a light to dark gray, marine deposit that is laminated to thinly bedded and fissile. The shale is generally moderately soft (H5) to hard (H3). The shale ranges from intensely weathered (W7) to slightly weathered (W3) and has a strong to no reaction with HCl. The claystone is light to dark brown, laminated to thinly bedded, very soft (H7) to moderately soft (H5) and decomposed (W9) to slightly weathered (W3). The claystone has a strong reaction with HCl. Generally, the shale and claystone contains calcium carbonate as nodules, stringers and in bedding planes. Gypsum, iron and manganese oxide staining, Trona and carbon blebs are also present.

5.0 GEOLOGIC CONSIDERATIONS

Concerns about the safety surrounding the geologic environment come from the stability of slopes in excavations, excavation methods and overhead and buried utilities. Specific situations are addressed below.

5.1 STABILITY OF EARTH MATERIALS

This section includes information on natural slope stability and recommends temporary and permanent cut slopes for both surficial deposits and bedrock. The stability of cut slopes is dependent upon the composition of materials and moisture conditions. The following descriptions use OSHA soil types to aid in the stability determinations (OSHA Safety and Health Regulations for Construction).

5.1.1 NATURAL SLOPE STABILITY

The stability of surficial deposits in the foundation area is dependent primarily on material composition. Natural slopes in unconsolidated alluvium are generally stable at approximately 1.5:1 or flatter in sandy materials. Bedrock exposures in the area are typically stable at about 1.5:1 or steeper in claystone and shale, and 1:1 to vertical in sandstone.

5.1.2 TEMPORARY AND PERMANENT CUT SLOPES

Recommendations for cut slopes in surficial deposits are based on material type and texture. All cut slopes shall be constructed in accordance with the Reclamation Safety and Health Standards and OSHA standards. Recommendations are for dry or adequately dewatered materials.

Materials with excessive moisture will require further flattening for stability. Recommended cut slopes for type C soils, including Poorly Graded Sand (SP), Poorly Graded Sand with Silt (SP-SM), Silty Sand (SM), and granular soils with gravel, cobbles and boulders are 1.5:1.

Recommended cut slopes for type B soils, including Silty Clayey Sand (SC-SM) and Clayey Sand (SC) are 1:1 or flatter.

Cut slopes in bedrock will be dependent upon the rock type and degree of weathering. All decomposed to intensely weathered, very soft to soft bedrock will be classified as a type B or type C soils depending upon the composition of the rock. Moderately weathered to fresh, moderately soft to hard bedrock can be classified as Stable Rock if all requirements of the Reclamation Safety and Health Standards are met. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

5.2 EXCAVATION CONSIDERATIONS

Excavation at the water treatment plant in unconsolidated soils and intensely weathered bedrock can be accomplished using common methods. The claystone of the Mancos Shale is often weathered and very soft and can be excavated using common methods. The shale units of the Mancos Shale formation are generally less weathered and range from moderately soft to moderately hard and will likely require excavation by ripper-equipped dozers or large excavators with adequate pullout force and appropriate teeth.

Excavation of the terrace gravels can be accomplished using common methods. Terrace gravel that contain oversize material greater than 3 inches may not be suitable as engineered backfill. Test pit TP-18-5 encountered sloughing within the Poorly Graded Gravel with Sand and Cobbles (GP)sc.

5.2.1 UTILITIES

There are overhead utilities and an NTUA water line located between the SJWTP and terrace area. An abandoned water line was also identified on the surface geology map near the road crossing. Equipment ingress and egress to the site should observe the overhead utility wire height along with the buried pipe depth and pipe dimensions of the water line.

TABLE 1: SUMMARY OF DRILL HOLE INVESTIGATIONS

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL, AND DEPTH (feet)	LAB TEST DATA								BLOWS @ 0.5 (feet)
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE	
DHIWTP3-17-1 Site Investigation	0.0-1.8: CL (Qal)	3.0-4.5	CL	87.8	12.2	0.0	32.0	16.2	4.9	14/40/50
		5.0-6.5	(CL)s	76.0	24.0	0.0	29.5	13.2	3.3	50/NA/NA
	1.8-7.9: CLSTN (Km)	7.5-9.0	CL	90.8	9.2	0.0	34.3	19.6	5.7	21/45/50
	7.9-13.9: SHALE (Km)	10.0-11.5	CL	92.3	7.7	0.0	33.8	18.5	5.2	17/50/NA
		12.5-14.0	CL	89.0	11.0	0.0	35.7	21.1	7.0	31/42/50
	13.9-16.2: CLSTN (Km)	15.0-16.5	CL	86.0	14.0	0.0	33.6	17.3	4.1	50/NA/NA
		20.0-21.5	CL	94.4	5.6	0.0	33.8	17.4	2.6	50/NA/NA
	16.2-45.0: SHALE (Km)	25.0-26.5		No Recovery						50/NA/NA
		2.5-4.0	CL	93.2	4.8	0.0	35.0	21.0	5.9	16/25/24
		5.0-6.5	CL	93.1	6.9	0.0	35.2	19.6	7.6	8/18/17
DHIWTP3-17-2 Site Investigation	0.0-3.8: CL (Qal)	7.5-9.0	CL	98.6	1.4	0.0	37.2	20.8	7.5	18/33/41
		10.0-11.5	CL	91.0	9.0	0.0	33.2	15.6	6.3	31/50/NA
	3.8-10.0: CL (Qal)	12.5-14.0	CL	99.0	1.0	0.0	38.7	21.6	7.0	18/50/NA
	10.0-17.0: CLSTN (Km)	15.0-16.5	CL	96.0	4.0	0.0	34.1	16.6	6.9	9/32/34
		20.0-21.5	CL	94.1	5.9	0.0	35.6	18.3	7.0	20/30/32
	17.0-45.0: SHALE (Km)	25.0-26.5	CL	94.9	5.1	0.0	35.2	17.9	6.3	7/33/50
		29.0-31.5		No Recovery						50/NA/NA
		31.5-36.5		No Recovery						50/NA/NA
	0.0-1.7: CL (Qal)	5.0-6.5	CL	95.3	4.5	0.0	40.7	21.6	7.8	23/37/50
		7.5-9.0		No Recovery						50/NA/NA
DHIWTP3-17-3 Site Investigation	1.7-7.2: CLSTN (Km)	10.0-11.5	CL	87.4	11.4	1.2	34.0	16.9	6.3	17/33/26
	7.2-10.2: SHALE (Km)	12.5-14.0	CL	84.4	15.6	0.0	33.3	16.7	5.9	26/39/33
	10.2-19.3: CLSTN (Km)	15.0-16.5	CLs	76.9	21.7	1.4	31.2	13.5	5.2	21/41/44
		19.3-45.0: SHALE (Km)	CL	88.1	11.9	0.0	33.6	16.4	6.0	20/50/NA
		25.0-26.5	CL	55.1	18.2	26.7	30.4	15.4	5.0	50/NA/NA

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL, AND DEPTH (feet)	LAB TEST DATA								BLOWS/s (feet)
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE	
DHWTP3-17-4 Site Investigation	0.0-1.5: CL (Qal) 1.5-23.5: CLSTN (Km) 23.5-50.5: SHALE (Km)	3.5-5.0	CL	94.5	5.5	0.0	36.1	19.1	6.5	24/38/32
		6.0-7.0	California Sample							
		8.5-10.0	(CL)s	70.3	29.7	0.0	31.6	13.8	5.2	21/39/50
		11.0-12.0	California Sample							
		13.5-15.0	(CL)s	75.3	24.7	0.0	30.6	14.2	5.1	10/27/39
		18.5-19.5	California Sample							
		23.5-25.0	No Recovery							
		28.5-29.5	No Recovery							
		38.5-39.6	Core Sample							
		40.0-40.5	Core Sample							
		40.5-41.5	Core Sample							
		42.6-43.3	Core Sample							
		44.5-45.2	Core Sample							
		46.5-47.5	Core Sample							
		47.7-48.7	Core Sample							
DHWTP3-17-5 Site Investigation	0.0-4.0: CL (Qal) 4.0-4.8: SHALE (Km) 4.8-25.4: CLSTN (Km) 25.4-50.0: SHALE (Km)	4.5-6.0	CL	96.0	4.0	0.0	33.5	20.0	8.1	16/27/26
		7.0-8.0	California Sample							
		9.5-11.0	CL	98.0	2.0	0.0	36.9	20.5	9.0	13/20/23
		13.0-13.0	California Sample							
		14.5-16.0	CL	97.8	2.2	0.0	36.6	18.8	8.3	21/36/42
		16.0-16.5	California Sample							
		16.5-26.0	CL	96.8	3.2	0.0	37.4	20.4	7.4	20/50/NA
		26.0-29.5	Core Sample							
		31.0-31.7	Core Sample							
		32.8-40.0	Core Sample							
		48.0-48.0	Core Sample							
		49.1-49.9	Core Sample							

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL AND DEPTH (feet)	LAB TEST DATA								BLOWS/0.5 (feet)
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE	
DHIWTPA-17-6 Site Investigation	0.0-0.9: CL (Qal)	4.0-5.5	CL	96.1	3.9	0.0	40.3	25.3	7.4	13/25/34
		6.5-7.5	California Sample							
		9.0-10.5	CL	98.4	1.6	0.0	38.7	19.5	8.0	8/33/39
		11.5-12.5	California Sample							
	0.9-17.6: CLSTN (Km)	14.0-13.5	CL	93.4	6.6	0.0	37.2	18.9	6.9	27/33/28
		24.7-23.2	Core Sample							
	17.6-51.5: SHALE (Km)	27.0-27.7	Core Sample							
		28.3-29.2	Core Sample							
		31.7-32.7	Core Sample							
		34.9-33.5	Core Sample							
		38.3-39.0	Core Sample							
DHIWTPA-17-7 Site Investigation	0.0-1.2: CL (Q)	4.0-5.5	CL	97.4	2.6	0.0	39.0	21.2	7.0	17/24/22
		6.5-7.5	California Sample							
	1.2-22.9: CLSTN (Km)	9.0-10.5	CL	96.1	3.9	0.0	38.9	23.8	7.2	28/43/48
		11.5-12.5	California Sample							
	22.9-25.1: CLSTN (Km)	14.0-13.5	CL	89.5	10.5	0.0	34.9	17.3	6.3	20/34/38
		19.0-20.0	California Sample							
	25.1-37.0: SHALE (Km)	1-20.7	Core Sample							
		37.0-40.3	s(CL)	67.0	33.0	0.0	27.3	12.0	4.2	Bag Sample
	40.3-51.5: SHALE (Km)	37.0-40.3	Core Sample							
DHIWTPA-17-8 Site Investigation	0.0-1.3: CL (Qal)	5.6-6.0	CL	90.2	9.8	0.0	33.4	18.6	6.8	16/45/50
		7.5-7.9	California Sample							
	1.3-19.0: CLSTN (Km)	9.5-11.0	CL	86.4	13.6	0.0	32.6	17.6	6.1	50/50
		16.0-20.0	Bulk Sample							
	19.8-49.5: SHALE (Km)	12.0-13.0	California Sample							
		14.5-16.0		86.1	13.9	0.0	32.6	16.9	5.9	44/50/NA
		19.5-20.0	No Recovery							

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL AND DEPTH (feet)	LAB TEST DATA							BLOWS/0.5 (feet)	
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX		% MOISTURE
DHWTP3-18-9 Road Crossing	0.0-2.1: s(CL) (Qal) 2.1-8.7: CLSTN (Km) 8.7-10.5: SHALE (Km) 10.5-22.8: CLSTN (Km) 22.8-39.0: SHALE (Km)	0.0-10.0	Bulk Sample							NA
		0.0-1.0	California Sample							4/4
		4.0-5.5	CL	93.8	6.2	0.0	37.7	20.7	13.5	19/45/50
		6.5-7.5	California Sample							48/50
		11.5-13.0	CL	84.4	12.8	2.8	34.4	18.1	6.3	7/25/25
		14.0-15.0	California Sample							50/38
		16.5-18.0	(CL)s	72.9	27.1	0.0	30.2	15.1	5.6	39/50/NA
		19.0-20.0	No Recovery							35/NA
		24.0-25.5	No Recovery							40/NA/NA
		29.0-30.0	No Recovery							35/NA
		0.0-10.0	Bulk Sample							NA
		0.0-1.0	California Sample							3/3
DHWTP3-18-10 Road Crossing	0.0-0.3: s(CL) (Qal) 0.3-1.6: CL (CL) 1.6-11.0: CLSTN (Km) 11.0-12.0: SHALE (Km) 12.0-16.3: CLSTN (Km) 16.3-40.0: SHALE (Km)	0.0-10.0	Bulk Sample							NA
		0.0-1.0	California Sample							3/3
		4.0-5.5	CL	94.3	5.7	0.0	38.9	21.8	7.1	24/48/50
		6.5-7.5	California Sample							33/50
		9.0-10.5	CL	98.5	1.5	0.0	44.1	27.8	7.5	21/32/42
		14.0-15.0	California Sample							19/21
		16.5-18.0	(CL)s	77.3	21.9	0.8	31.8	14.7	4.8	37/44/50
		19.0-20.0	California Sample							50/NA
		21.5-23.0	No Sample							18/NA/NA
		0.0-14.5: Silt, sand and gravel (Qg)	California Sample							49/50
		14.5-29.6: CLSTN (Km)	California Sample							35/49
		29.6-49.0: SHALE (Km)	California Sample							29/47
DH-18-1 Terrace Investigation	0.0-14.5: Silt, sand and gravel (Qg) 14.5-29.6: CLSTN (Km) 29.6-49.0: SHALE (Km)	0.0-1.0	California Sample							45/50
		1.0-2.0	California Sample							41/50
		2.0-3.0	California Sample							31/50
		3.0-4.0	California Sample							50/NA

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL, AND DEPTH (feet)	LAB TEST DATA								BLOWS/0.5 (feet)
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE	
DH-18-2 Terrace Investigation	0.0-18.0: Silt, sand,	19.0-20.0								50/NA
	gravel and	21.5-22.5								50/NA
	cobbles (Qtz)	24.0-25.0								50/29
	18.0-34.3: CLSTN (Km)	26.5-27.5								50/NA
	34.3-50.0: Silt, sand,	35.6-36.3								NA
	gravel and	36.5-37.0								NA
	cobbles (Qtz)	37.3-37.9								NA
	34.3-50.0: Silt, sand,	49.0-49.7								NA
DH-18-3 Terrace Investigation	0.0-8.0: Silt, sand,	9.0-10.0								39/50
	gravel and	11.5-12.5								42/50
	cobbles (Qtz)	14.0-15.0								38/50
	8.4-50.5: CLSTN (Km)	16.5-17.5								50/NA
DH-18-4 Terrace Investigation	0.0-8.0: Silt, sand,	10.5-11.5								50/NA
	gravel and	13.0-14.0								50/NA
	cobbles (Qtz)	16.5-17.5								50/NA
	8.0-11.5: SM (Qtz)	19.0-20.0								50/NA
	11.5-13.8: Silt, sand,	24.0-25.0								50/NA
	gravel and	26.5-27.5								50/NA
	cobbles (Qtz)	34.0-35.0								50/NA
	13.8-44.8: SHALE (Km)	39.0-40.0								50/NA

DRILL HOLES										
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL AND DEPTH (feet)	LAB TEST DATA							BLOWS 0.5 (feet)	
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX		% MOISTURE
DH-18-5 Terrace Investigation	0.0-19.0: Silt, sand, gravel and cobbles (Qtg) 19.0-50.5: SHALE (Km)	20.9-21.6	Core Sample							NA
		23.7-24.3	Core Sample							NA
		24.6-25.3	Core Sample							NA
		26.2-26.8	Core Sample							NA
		32.7-33.2	Core Sample							NA
		33.2-33.7	Core Sample							NA
		33.7-34.4	Core Sample							NA
		34.4-35.0	Core Sample							NA
		35.9-36.5	Core Sample							NA
		37.5-38.0	Core Sample							NA
		45.2-45.6	Core Sample							NA
		45.6-46.3	Core Sample							NA
		47.9-48.4	Core Sample							NA

TABLE 2: SUMMARY OF TEST PIT INVESTIGATIONS

TEST PITs											
EXPLORATION AND LOCATION	VISUAL CLASSIFICATION, GEOLOGIC SYMBOL AND DEPTH (feet)	LAB TEST DATA								COMPACTION TEST	
		DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE	IN-PLACE DRY DENSITY	D-VALUE AND MAXIMUM DRY DENSITY
TPWTP3-18-1 Site Investigation	0.0-1.5: CL (Qal) 1.5-2.8: CLSTN (Km) 2.8-6.0: SHALE (Km)	-	-	-	-	-	-	-	-	-	-
TPWTP3-18-2 Site Investigation	0.0-2.5: CL (Qal) 2.5-6.4: CLSTN (Km) 6.4-7.3: SHALE (Km)	0.5	s(CL)	65.6	33.3	1.1	20.2	8.3	3.8	94.3 lb/ft ³	D= 78.2 % 120.6 lb/ft ³ Opt= 12.2 %
TPWTP3-18-3 Site Investigation	0.0-1.0: CL (Qal) 1.0-3.0: CLSTN (Km) 3.0-6.8: SHALE (Km)	-	-	-	-	-	-	-	-	-	-
TPWTP3-18-4 Site Investigation	0.0-0.9: CL (Qal) 0.9-5.5: CLSTN (Km) 5.5-6.6: SHALE (Km)	1.5	CL	97.6	2.4	0.0	36.9	19.9	9.2	102.3 lb/ft ³	D= 88.8 % 115.2 lb/ft ³ Opt= 15.4 %
TP-18-5 Terrace Investigation	0.0-1.1: CL (Qal) 1.1-5.5: (SM)g (Qg) 5.5-10.9: (GP)c (Qg)	4.0	(SM)g	34.8	46.6	18.6	NA	NP	6.7	91.7 lb/ft ³	D= 78.7 % 116.1 lb/ft ³ Opt= 15.5 %
DHWTP3-18-8 Site Investigation	0.0-1.3: CL (Qal) 1.3-19.0: CLSTN (Km) 19.0-51.5: SHALE (km)	10.0-20	CL	89.7	10.3	0.0	33.4	17.7	2.5	Bulk Sample	D= NA 115.3 lb/ft ³ Opt= 15.3 %

6.0 REFERENCES

OSHA Safety and Health Regulations for Construction. 29 CFR 1926 Subpart P-Excavations
Appendix A, Soil Classification and 29 CFR 1926 Subpart P-Excavations,
Appendix B, Sloping and Benching

O’Sullivan, R. B. and Beikman, H. M., 1963. Geology, Structure, and Uranium Deposits of
the Shiprock Quadrangle, New Mexico and Arizona. U. S. Geological Survey Miscellaneous
Geological Investigations Map I-345.

USBR 5005 [Earth Manual, Part 2, Third Edition, and the Unified Soil Classification System
(USCS)].

USBR, Engineering Geology Field Manual, Second Edition, volume 1.

Preliminary

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APPENDIX 1

Preliminary


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GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-17-1															SHEET 1 OF 1		
FEATURE: San Juan Lateral Water Treatment Plant			PROJECT: Navajo Gallup Water Supply Project			STATE: New Mexico											
LOCATION: Site Investigation			COORDINATES: N 2,075,067.9 E 2,497,016.8 N.M. State Plane			GROUND ELEVATION: 5175.1 ft NAD 83											
BEGUN: 6/14/17 FINISHED: 6/15/17			TOTAL DEPTH: 45.0 ft			ANGLE FROM HORIZONTAL: -90°											
DEPTH AND ELEVATION OF WATER LEVEL: NE			DEPTH TO BEDROCK: 1.8 ft			HOLE LOGGED BY: P. Gardner											
DATE MEASURED: 6/15/2017						REVIEWED BY: C. Beyer											
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION	
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION				
<p>All measurements are from ground level and are the same as those used by drillers.</p> <p>DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: M. Butler</p> <p>PURPOSE: Preconstruction soil and bedrock foundation investigations.</p> <p>DRILL EQUIPMENT: CME Model 850 track mounted rotary drill rig.</p> <p>DRILL METHOD: 0.0 to 3.0 ft. 4.25 inch HSA with 1/2" bit. 3.0 to 26.5 ft. 4.25 inch HSA with dry core system and SPT. 26.5 to 45.0 ft. 4.25 inch HSA with dry core system.</p> <p>CASING RECORD: None used.</p> <p>DRILLING MEDIUM: 0.0 to 45.0 ft. None.</p> <p>HOLE COMPLETION: Backfilled with bentonite and cuttings.</p> <p>SAMPLING: 3.0 to 4.5 ft. SPT 5.0 to 6.5 ft. SPT 7.5 to 9.0 ft. SPT 10.0 to 11.5 ft. SPT 12.5 to 14.0 ft. SPT 15.0 to 16.5 ft. SPT 20.0 to 21.5 ft. SPT 25.0 to 26.5 ft. SPT (NR)</p>	0.0	Qal	NR											CL	5173.3	0.0 to 1.8 ft QUATERNARY ALLUVIUM (Qal)	
	5		25	0		9	87.8	12.2	0.0	32.0	16.2	4.9	CL	14/40/50		0.0 to 1.8 ft LEAN CLAY (CL): About 90% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 10% fine to coarse, hard, angular sand; maximum size, coarse sand; brown and dry; strong reaction with HCl.	
	10		60	0		7	78.0	24.0	0.0	29.5	13.2	3.3	(CL)s	50/NA/NA		1.8 to 45.0 ft CRETACEOUS MANCOS SHALE (Km)	
	15		48	0		7	90.8	9.2	0.0	34.3	19.6	5.7	CL	21/45/50		1.8 to 7.9 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded. Very soft (H7) and decomposed (W9) to 4.5 ft. Intensely weathered (W7) below 4.5 ft. CaCO ₃ in laminations. Strong reaction with HCl.	
	20		68	0		7	92.3	7.7	0.0	33.8	18.5	5.2	CL	17/50/NA	SHALE	7.9 to 13.9 ft SHALE: Light to dark gray color, laminated to very thinly bedded and fissile. Very soft (H7) and intensely weathered (W7). Gypsum present below 10.4 ft. FeOx and MnOx staining below 13.3 ft. Easily breaks on bedding planes. Strong reaction with HCl.	
	25			0			89.0	11.0	0.0	35.7	21.1	7.0	CL	31/42/50		13.9 to 16.2 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded. Very soft (H7) and intensely weathered (W7). CaCO ₃ in laminations. MnOx and FeOx staining present. Strong reaction with HCl.	
	30			0			86.0	14.0	0.0	33.6	17.3	4.1	CL	50/NA/NA		16.2 to 45.0 ft SHALE: Light to dark gray color, laminated to very thinly bedded and fissile. Moderately soft (H5) and moderately weathered (W5). FeOx, MnOx staining and gypsum present. Easily breaks on bedding planes. Hard pan, moderately hard (H4) and moderately weathered (W5), encountered between 26.2 to 27.4 ft. Weak reaction with HCl.	
	35			0			4	5.6	0.0	33.8	17.4	2.6	CL	50/NA/NA		STRATIGRAPHY: 0.0 to 1.8 ft QUATERNARY ALLUVIUM (Qal) 1.8 to 45.0 ft CRETACEOUS MANCOS SHALE (Km)	
	40		100	0			NA	NA	NA	NA	NA	NA	50/NA/NA				
	45		18	0		4											
			32	0		5									SHALE		
			32	0		5											
			26	0													
		45													5130.1		
	BOTTOM OF HOLE																

COMMENTS:
HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

All angles measured from core axis at zero degrees unless otherwise noted.

The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Geology Field Manual and Drawing
Titled Geology for Designs and Specification as follows "Drawing No. 40-D-6493 Standard Descriptions and Descriptive Criteria for rock. Drawing No.
40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities.



SHEET 1 OF 1

DRILL HOLE DHWTP3-17-1

Preliminary Geologic Design Data Report
53 30 00 - 28


Preliminary Geologic Design Data Report
53 30 00 - 29

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-17-4															SHEET 1 OF 1				
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Site Investigation BEGUN: 12/4/17 FINISHED: 12/5/17 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 12/5/2017			PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,076,975.9 E 2,497,567.6 N.M. State Plane TOTAL DEPTH: 50.5 ft DEPTH TO BEDROCK: 1.5 ft			STATE: New Mexico GROUND ELEVATION: 5169.4 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer													
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION		
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT							
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. Reynolds, D. Hunter PURPOSE: Preconstruction soil and bedrock foundation investigations. DRILL EQUIPMENT: CME Model 850 track mounted rotary drill rig DRILL METHOD: 0.0 to 3.5: 4.25 inch HSA with pilot bit. 3.5 to 26.0: 4.25 inch HSA and dry core system with SPT and California Sampling. 26.0 to 28.5: 4.25 inch HSA with pilot bit. 28.5 to 38.5: 4.25 inch HSA with dry core system and California Sampling. 38.5 to 50.5: HQ3 diamond core drilling system with 5-foot-long split tube sample barrel. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 38.5: None. 38.5 to 50.5: Water. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 3.5 to 5.0: SPT 6.0 to 7.0: California (A,B,C) 8.5 to 10.0: SPT 11.0 to 12.0: California (A,B) 13.5 to 15.0: SPT 18.5 to 19.5: California (A,B,C) 23.5 to 25.0: SPT (NR) 28.5 to 29.5: California (NR) 38.8 to 39.6: HQ3 Core (A) 40.0 to 40.5: HQ3 Core (B) 40.5 to 41.5: HQ3 Core (C) 42.6 to 43.3: HQ3 Core (D) 44.8 to 45.2: HQ3 Core (E) 46.5 to 47.5: HQ3 Core (F) 47.7 to 48.7: HQ3 Core (G)	5	Qal	NR												CL	5167.9	0.0 to 1.5 ft QUATERNARY ALLUVIUM (Qal)		
																		0.0 to 1.5 ft LEAN CLAY (CL): About 90% fines with medium plasticity, medium toughness, medium dry strength and no dilatancy; about 10% fine to medium sand; maximum size, medium sand; brown and dry; strong reaction with HCl.	
																		1.5 to 50.5 ft CRETACEOUS MANCOS SHALE (Km)	
																		1.5 to 23.5 ft CLAYSTONE: Light to dark brown color and sandy. Laminated to very thinly bedded and friable. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blebs and FeOx staining present. CaCOx nodules, stringers and in laminations. Grades to shale. Strong reaction with HCl.	
																		CLSTN	23.5 to 25.4 ft SHALE: Light to dark gray color and dry. Laminated to very thinly bedded and fissile. Moderately hard (H4) and slightly weathered (W3). FeOx staining present. CaCOx nodules, stringers and in laminations. Bedding planes near horizontal. Weak reaction with HCl.
																			25.4 to 50.5 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). FeOx staining present. CaCOx nodules, stringers and in laminations. Bedding planes near horizontal. Claystone interbeds. Weak reaction with HCl.
																			JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 37.6 88° 6 3 6 CaCOx FeOx 50.0 90° 6 3 6 CaCOx FeOx
																			STRATIGRAPHY: 0.0 to 1.5 ft QUATERNARY ALLUVIUM (Qal) 1.5 to 50.5 ft CRETACEOUS MANCOS SHALE (Km)
		15																	
	20																		
	25																		
	30																		
	35																		
	40																		
	45																		
	50																		
BOTTOM OF HOLE																			

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCOx= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

 All angles measured from core axis at zero degrees unless otherwise noted.

 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock."
 Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."




SHEET 1 OF 1
DRILL HOLE DHWTP3-17-4

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-17-5														SHEET 1 OF 1			
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Site Investigation BEGUN: 12/13/17 FINISHED: 12/14/17 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 12/14/2017				PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,076,059.4 E 2,497,390.5 N.M. State Plane TOTAL DEPTH: 50.0 ft DEPTH TO BEDROCK: 4.0 ft				STATE: New Mexico GROUND ELEVATION: 5166.0 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer									
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION	
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION				
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. Reynolds, D. Hunter PURPOSE: Preconstruction soil and bedrock foundation investigations. DRILL EQUIPMENT: CME Model 850 track mounted rotary drill rig. DRILL METHOD: 0.0 to 4.5: 4.25 inch HSA with pilot bit. 4.5 to 27.8: 4.25 inch HSA and core system with SPT and California Sampling. 27.8 to 28.0: 4.25 inch HSA with pilot bit. 28.0 to 50.0: HQ3 diamond core drilling system with 5-foot-long split tube sample barrel. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 28.0: None. 28.0 to 50.0: Water. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute. HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 4.5 to 6.0: SPT 7.0 to 8.0: California (A,B) 9.5 to 11.0: SPT 12.0 to 13.0: California (A,B) 14.5 to 16.0: SPT 19.5 to 20.5: California (A,B) 24.5 to 26.0: SPT 28.8 to 29.5: HQ3 Core (A) 31.0 to 31.7: HQ3 Core (B) 42.8 to 43.9: HQ3 Core (C) 44.0 to 44.8: HQ3 Core (D) 49.1 to 49.9: HQ3 Core (E)	5	Qal	NR		5										CL	0.0 to 4.0 ft QUATERNARY ALLUVIUM (Qal)	
																	0.0 to 4.0 ft LEAN CLAY (CL): About 90% fines with low plasticity, low toughness, high dry strength and no dilatancy; about 10% fine sand; maximum size, fine sand; light brown and dry; strong reaction with HCl.
																	4.0 to 50.0 ft CRETACEOUS MANCOS SHALE (Km)
																	4.0 to 4.8 ft SHALE: Light to dark gray color, sandy, fissile and dry. Bedding is laminated and bedding planes near horizontal. Moderately soft (H5) and moderately to slightly weathered (W4). Carbon blebs present. CaCO ₃ nodules, stringers and in laminations. Friable and easily breaks on bedding planes. Stakes rapidly in water. Strong reaction with HCl.
																	4.8 to 25.4 ft CLAYSTONE: Light to dark brown color, sandy and dry. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and moderately to slightly weathered (W4). Carbon blebs present. CaCO ₃ nodules, stringers and in laminations. Friable and easily breaks on bedding planes. Stakes rapidly in water. Strong reaction with HCl.
																	25.4 to 27.8 ft SHALE: Light to dark gray color, sandy and dry. Laminated to very thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Bedding planes near horizontal. Weak reaction with HCl.
																	27.8 to 34.2 ft SHALE: Light to dark gray color, sandy and dry. Laminated to very thinly bedded and fissile. Hard (H3) and slightly weathered (W3). FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Bedding planes near horizontal. Weak reaction with HCl.
																	JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 28.5 0° 4 1 1 CaCO ₃
																	34.2 to 50.0 ft SHALE: Light to dark gray color, sandy and dry. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Bedding planes near horizontal. Weak reaction with HCl.
																	JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 42.8 87° 4 2 3 CaCO ₃
																	STRATIGRAPHY: 0.0 to 1.7 ft QUATERNARY ALLUVIUM (Qal) 1.7 to 50.0 ft CRETACEOUS MANCOS SHALE (Km)
		15				5-7	4	96.0	4.0	0.0	33.5	20.0	8.1	CL	16/27/26		CLSTN
	36						98.0	2.0	0.0	36.9	20.5	9.0	CL	13/20/23			
	40													25/46			
	52						97.8	2.2	0.0	36.6	18.8	8.3	CL	21/36/42			
	60													30/33			
	25						96.0	3.2	0.0	37.4	20.4	7.4	CL	20/50/NA	5140.6		
	30	Km	NR		5												
	35																
	40																
	45																
	50																

BOTTOM OF HOLE

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone
 All angles measured from core axis at zero degrees unless otherwise noted.
 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock." Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."


 SHEET 1 OF 1 DRILL HOLE DHWTP3-17-5


Preliminary Geologic Design Data Report
53 30 00 - 32

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-17-7															SHEET 1 OF 1			
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Site Investigation BEGUN: 12/16/17 FINISHED: 12/17/17 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 12/17/2017				PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,075,532.3 E 2,499,260.6 N.M. State Plane TOTAL DEPTH: 51.5 ft DEPTH TO BEDROCK: 1.2 ft				STATE: New Mexico GROUND ELEVATION: 5179.2 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer										
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION	
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT						
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. Reynolds, D. Hunter PURPOSE: Preconstruction soil and bedrock foundation investigations. DRILL EQUIPMENT: CME Model 850 track mounted rotary drill rig DRILL METHOD: 0.0 to 4.0: 4.25 inch HSA with pilot bit. 4.0 to 20.0: 4.25 inch HSA and core system with SPT and California Sampling. 20.0 to 51.5: HQ3 diamond core drilling system with 5-foot-long split tube sample barrel. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 20.0: None. 20.0 to 51.5: Water. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute. HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 4.0 to 5.5: SPT 6.5 to 7.5: California (A,B) 9.0 to 10.5: SPT 11.5 to 12.5: California (A,B) 14.0 to 15.5: SPT 19.0 to 20.0: California (A,B) 20.1 to 20.7: HQ3 Core (A) 37.0 to 40.3: Bag 47.5 to 48.5: HQ3 Core (B)	0.0	Qal													CL	5179.0	0.0 to 1.2 ft QUATERNARY ALLUVIUM (Qal)	
	5		NR															0.0 to 1.2 ft LEAN CLAY (CL): About 90% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 10% fine sand; maximum size, fine sand; brown and dry, strong reaction with HCl.
	20						97.4	2.6	0.0	39.0	21.2	7.0	CL	17/24/22			1.2 to 51.5 ft CRETACEOUS MANCOS SHALE (Km)	
	100													25/40			1.2 to 19.8 ft CLAYSTONE: Light to dark brown color and dry. Laminated to thinly bedded. Bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blebs present. CaCO ₃ in laminations. Friable and easily breaks on bedding planes. Stakes rapidly in water. Strong reaction with HCl.	
	32				5-7	7	96.1	3.9	0.0	38.9	23.8	7.2	CL	28/43/48	CLSTN			JOINT MEASUREMENTS: DEPTH INCL. R T HL INFILLING 10.9 90° 5 3 1 CaCO ₃ , gypsum 11.0 90° 5 3 1 CaCO ₃ , gypsum 11.5 0° 4 1 1 CaCO ₃ , FeOx, gypsum
	68																	19.8 to 21.6 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately hard (H4) and moderately to slightly weathered (W4). CaCO ₃ in laminations. Bedding planes near horizontal. Weak reaction with HCl.
	15						89.5	10.5	0.0	34.9	17.3	6.5	CL	20/34/38			21.6 to 22.9 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Bedding planes near horizontal. Weak reaction with HCl.	
	20														19/50	5199.4	22.9 to 25.1 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded. Bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and slightly weathered (W3). Carbon blebs present. CaCO ₃ in laminations. Friable and easily breaks on bedding planes. Grades to shale. Strong reaction with HCl.	
	25																	25.1 to 37.0 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). Carbon blebs present. CaCO ₃ in laminations. Bedding planes near horizontal. Claystone interbeds. Sandstone interbeds between 35.0 to 37.1 ft. No to weak reaction with HCl.
	30																	37.0 to 40.3 ft CLAYSTONE: Light to dark brown color and sandy. Laminated to thinly bedded. Bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and slightly weathered (W3). Carbon blebs present. CaCO ₃ in laminations. Friable and easily breaks on bedding planes. Grades to shale. Shale and sandstone interbeds. Strong reaction with HCl.
35																	40.3 to 51.5 ft SHALE: Light to dark gray color and sandy. Laminated to thinly bedded and fissile. Very soft (H7) to moderately soft (H5) and slightly weathered (W3). Carbon blebs present. CaCO ₃ in laminations. Bedding planes near horizontal. Claystone interbed intervals from 45.4 to 46.6 and 48.9 to 50.8 feet. No to weak reaction with HCl.	
40																	STRATIGRAPHY: 0.0 to 1.2 ft QUATERNARY ALLUVIUM (Qal) 1.2 to 51.5 ft CRETACEOUS MANCOS SHALE (Km)	
45																		
50																		
BOTTOM OF HOLE																		

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

 All angles measured from core axis at zero degrees unless otherwise noted.

 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock."
 Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."




SHEET 1 OF 1
DRILL HOLE DHWTP3-17-7

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-17-8														SHEET 1 OF 1				
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Site Investigation BEGUN: 12/18/17 FINISHED: 12/18/17 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 12/18/2017				PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,074,515.0 E 2,498,924.4 N.M. State Plane TOTAL DEPTH: 49.5 ft DEPTH TO BEDROCK: 1.3 ft				STATE: New Mexico GROUND ELEVATION: 5192.7 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer										
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION		
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION					
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. Reynolds, D. Hunter PURPOSE: Preconstruction soil and bedrock foundation investigations. DRILL EQUIPMENT: CME Model 850 track mounted rotary drill rig. DRILL METHOD: 0.0 to 4.5: 4.25 inch HSA with pilot bit. 4.5 to 29.9: 4.25 inch HSA and dry core system with SPT and California Sampling. 29.9 to 44.5: 4.25 inch HSA with pilot bit. 44.5 to 49.5: 4.25 inch HSA with dry core system. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 49.5: None. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute. HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 4.5 to 6.0: SPT 7.0 to 8.0: California (B) 9.5 to 11.0: SPT 10.0 to 20.0: Bulk 12.0 to 13.0: California (A) 14.5 to 16.0: SPT 19.5 to 20.5: California (NR)	5	Qal	NR												CL	0.0 to 1.3 ft QUATERNARY ALLUVIUM (Qal)		
	32																0.0 to 1.3 ft LEAN CLAY (CL): About 90% fines with medium plasticity, medium toughness, medium dry strength and no dilatancy; about 10% fine sand; maximum size, fine sand; brown and dry, strong reaction with HCl.	
	76																1.3 to 49.5 ft CRETACEOUS MANCOS SHALE (Km)	
	72																1.3 to 19.0 ft CLAYSTONE: Light to dark brown color and dry. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blebs present. CaCO ₃ nodules, stringers and in laminations. Friable and easily breaks on bedding planes. Grades to shale. No to strong reaction with HCl.	
	60																	19.0 to 21.9 ft SHALE: Light to dark gray color and dry. Laminated to thinly bedded and fissile. Moderately hard (H4) and slightly weathered (W3). FeOx staining present. Bedding planes near horizontal. No to weak reaction with HCl.
	15																	21.9 to 49.5 ft SHALE: Light to dark gray color and dry. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). CaCO ₃ in laminations. Bedding planes near horizontal. Easily separates on bedding planes. Claystone interbeds. No to weak reaction with HCl.
	68																	JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 22.3 75° 4 2 3 CaCO ₃ 23.0 88° 4 2 3 CaCO ₃ 23.3 89° 4 2 3 CaCO ₃ 23.9 90° 4 2 3 CaCO ₃
	20																	STRATIGRAPHY: 0.0 to 1.3 ft QUATERNARY ALLUVIUM (Qal) 0.9 to 49.5 ft CRETACEOUS MANCOS SHALE (Km)
	100																	
	25	Km																
100																		
30																		
NR																		
35																		
NR																		
40																		
NR																		
45																		
100																		
BOTTOM OF HOLE																		

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

 All angles measured from core axis at zero degrees unless otherwise noted.

 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock."
 Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."




SHEET 1 OF 1
DRILL HOLE DHWTP3-17-8

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-18-9															SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Road Crossing BEGUN: 5/2/18 FINISHED: 5/3/18 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 5/3/2018			PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,076,983.5 E 2,498,846.1 N.M. State Plane TOTAL DEPTH: 39.0 ft DEPTH TO BEDROCK: 2.1 ft					STATE: New Mexico GROUND ELEVATION: 5185.7 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer								
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION			
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: B. Kenyon, B. Samuels PURPOSE: Preconstruction soil and bedrock investigations for trenchless construction methods. DRILL EQUIPMENT: CME Model 85 truck mounted rotary drill rig DRILL METHOD: 0.0 to 4.0: 4.25 inch HSA with pilot bit. 4.0 to 8.7: 4.25 inch HSA and dry core system with SPT and California Sampling. 8.7 to 11.5: 4.25 inch HSA with pilot bit. 11.5 to 30.0: 4.25 inch HSA and dry core system with SPT and California Sampling. 30.0 to 39.0: 4.25 inch HSA with dry core system. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 39.0. None. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute. HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 0.0 to 10.0: Bulk 0.0 to 1.0: California (A,B) 4.0 to 5.5: SPT 6.5 to 7.5: California (A,B) 11.5 to 13.0: SPT 14.0 to 15.0: California (A,B) 16.5 to 18.0: SPT 19.0 to 20.0: California (NR) 24.0 to 25.5: SPT (NR) 29.0 to 30.0: California (NR)	0.0	Qal	NR										4/4	s(CL)	0.0 to 2.1 ft QUATERNARY ALLUVIUM (Qal)	
	5		93		5-7	7	93.8	6.2	0.0	37.7	20.7	13.5	CL	19/45/50	5183.6	0.0 to 2.1 ft SANDY LEAN CLAY s(CL). About 60% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 40% fine to coarse, hard, subrounded sand; maximum size, coarse sand; brown and dry; CaCO ₃ stringers present, strong reaction with HCl.
	10		100		5									48/50	CLSTN	2.1 to 39.0 ft CRETACEOUS MANCOS SHALE (Km)
	15		100		5		84.4	12.8	2.8	34.4	18.1	6.3	CL	7/25/25	5177.0	2.1 to 8.7 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blebs present. CaCO ₃ nodules, stringers and in laminations. Friable and easily breaks on bedding planes. Grades to shale. Strong reaction with HCl.
	20		100		5		72.9	12.1	0.0	30.2	15.1	5.6	(CL)s	39/50/NA	5175.2	8.7 to 10.5 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). Bedding planes near horizontal. No to weak reaction with HCl.
	25		100		5									50/38	CLSTN	10.5 to 22.8 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blebs present. CaCO ₃ nodules, stringers and in laminations. FeOx present. Friable and easily breaks on bedding planes. Shale interbeds. Strong reaction with HCl.
	30		100		5									35/NA		JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 17.0 60° 4 2 6 CaCO ₃ 18.0 72° 4 3 6 CaCO ₃ 18.1 83° 4 3 6 CaCO ₃ 20.2 58° 4 0 6 CaCO ₃ 20.3 78° 4 0 6 CaCO ₃ 20.5 90° 4 2 6 CaCO ₃ 20.9 90° 4 2 6 CaCO ₃ 21.2 58° 4 3 6 CaCO ₃ 21.8 78° 4 3 6 CaCO ₃ 22.2 90° 4 2 6 CaCO ₃
	35		66		5		NA	NA	NA	NA	NA	NA	NA	40/NA/NA	5162.9	22.8 to 29.0 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). Bedding planes near horizontal. FeOx staining. No to weak reaction with HCl.
																STRATIGRAPHY: 0.0 to 2.1 ft QUATERNARY ALLUVIUM (Qal) 2.1 to 39.0 ft CRETACEOUS MANCOS SHALE (Km)

BOTTOM OF HOLE

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone
 All angles measured from core axis at zero degrees unless otherwise noted.
 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock."
 Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."



 SHEET 1 OF 1 DRILL HOLE DHWTP3-18-9

GEOLOGIC LOG OF DRILL HOLE NO. DHWTP3-18-10														SHEET 1 OF 1		
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Road Crossing BEGUN: 5/4/18 FINISHED: 5/9/18 DEPTH AND ELEVATION OF WATER LEVEL: NE DATE MEASURED: 5/9/2018				PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,077,383.1 E 2,499,092.9 N.M. State Plane TOTAL DEPTH: 40.0 ft DEPTH TO BEDROCK: 1.6 ft				STATE: New Mexico GROUND ELEVATION: 5195.9 ft NAVD 88 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: P. Gardner REVIEWED BY: C. Beyer								
NOTES	DEPTH	GEOLOGIC SYMBOL	% CORE RECOVERY	% ROD	HARDNESS	WEATHERING	LABORATORY DATA							BLOWS / 0.5 FT	VISUAL CLASSIFICATION	CLASSIFICATION AND PHYSICAL CONDITION
							% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION			
All measurements are from ground level and reported in feet unless otherwise noted. DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: B. Kenyon, B. Samuels PURPOSE: Preconstruction soil and bedrock investigations for trenchless construction methods. DRILL EQUIPMENT: CME Model 85 truck mounted rotary drill rig DRILL METHOD: 0.0 to 4.0: 4.25 inch HSA with pilot bit. 4.0 to 11.2: 4.25 inch HSA and dry core system with SPT and California Sampling. 11.2 to 14.0: 4.25 inch HSA with pilot bit. 14.0 to 21.9: 4.25 inch HSA and dry core system with SPT and California Sampling. 21.9 to 33.5: 4.25 inch HSA with dry core system. 33.5 to 36.5: 4.25 inch HSA with pilot bit. 36.5 to 40.0: 4.25 inch HSA with dry core system. CASING RECORD: None used. DRILLING MEDIUM: 0.0 to 40.0: None. DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute. HOLE COMPLETION: Backfilled with bentonite. SAMPLING: 0.0 to 10.0: Bulk Sample 0.0 to 1.0: California (A,B) 4.0 to 5.5: SPT 6.5 to 7.5: California (A,B) 9.0 to 10.5: SPT 14.0 to 15.0: California (A,B) 16.5 to 18.0: SPT 19.0 to 20.0: California (A) 21.5 to 23.0: SPT (shale)	0.0	Qal	NR										3/3	SM	0.0 to 1.6 ft QUATERNARY ALLUVIUM (Qal)	
	0.0 to 0.3 ft													CL 5194.3	0.0 to 0.3 ft SILTY SAND (SM): About 65% fine to coarse, hard, subrounded sand; about 35% fines with no plasticity, low dry strength and rapid dilatancy; trace of fine, hard, subangular gravel; maximum size, 10mm; brown and dry; strong reaction with HCl.	
	0.3 to 1.6 ft													CLSTN	0.3 to 1.6 ft LEAN CLAY (CL): About 90% fines with medium plasticity, medium toughness, high dry strength and no dilatancy; about 10% fine sand; trace of fine to coarse, hard, subangular to subrounded gravel; maximum size, 60mm; dark brown, dry, CaCO ₃ stringers and nodules present; strong reaction with HCl.	
	1.6 to 40.0 ft													CL 5194.9	1.6 to 40.0 ft CRETACEOUS MANCOS SHALE (Km)	
	1.6 to 11.0 ft													SHALE 5193.9	1.6 to 11.0 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). CaCO ₃ laminations. FeOx staining. Friable and easily breaks on bedding planes. Grades to shale. Strong reaction with HCl.	
	11.0 to 12.0 ft													CLSTN 5179.6	11.0 to 12.0 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). Bedding planes near horizontal. No to weak reaction with HCl.	
	12.0 to 16.3 ft														12.0 to 16.3 ft CLAYSTONE: Light to dark brown color. Laminated to thinly bedded and bedding planes near horizontal. Very soft (H7) to moderately soft (H5) and intensely weathered (W7). Carbon blobs present. CaCO ₃ nodules, stringers and in laminations. FeOx present. Friable and easily breaks on bedding planes. Shale interbeds. Strong reaction with HCl.	
	16.3 to 40.0 ft														16.3 to 40.0 ft SHALE: Light to dark gray color. Laminated to thinly bedded and fissile. Moderately soft (H5) and slightly weathered (W3). Bedding planes near horizontal. FeOx staining. Claystone interbeds. No to weak reaction with HCl.	
	40.0														SHALE	STRATIGRAPHY: 0.0 to 1.6 ft QUATERNARY ALLUVIUM (Qal) 1.6 to 40.0 ft CRETACEOUS MANCOS SHALE (Km)
	BOTTOM OF HOLE															

COMMENTS:
 HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide
 CaCO₃= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

 All angles measured from core axis at zero degrees unless otherwise noted.

 The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock."
 Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."



SHEET 1 OF 1
DRILL HOLE DHWTP3-18-10

Preliminary Geologic Design Data Report
53 30 00 - 37

Preliminary Geologic Design Data Report
53 30 00 - 38

Preliminary Geologic Design Data Report
53 30 00 - 39


GEOLOGIC LOG OF DRILL HOLE NO. DH-18-4										SHEET 1 OF 1		
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Terrace Investigation BEGUN: 5/31/2018 FINISHED: 5/31/2018 DEPTH TO WATER & ELEVATION: NE WATER DEPTH MEASURED ON: 5/31/2018			PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,077,830.9 E 2,500,040.5 N.M. State Plane TOTAL DEPTH: 44.8 ft DEPTH TO BEDROCK: 13.8 ft TOP OF CASING ELEVATION: NA			STATE: New Mexico GROUND ELEVATION: 5245.8 ft NAVD 88 ANGLE FROM HORIZONTAL: -90 ° HOLE LOGGED BY: C. Beyer REVIEWED BY: P. Gardner						
NOTES	DEPTH	GEOLOGIC UNIT	CLASSIFICATION	ENGINEERING PROPERTIES				GRAPHIC	% RECOVERY	RQD	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
				Fracture Density	Hardness	Weathering	Blows/0.5 Ft					
<p>All measurements are from ground level and reported in feet unless otherwise noted.</p> <p>DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. McFadden, B. Samuels</p> <p>PURPOSE: Preconstruction soil and bedrock foundation investigations.</p> <p>DRILL EQUIPMENT: CME Model 85 truck mounted rotary drill rig.</p> <p>DRILL METHOD: 0.0 to 9.0: 4.25 inch HSA with pilot bit. 9.0 to 14.0: 4.25 inch HSA with dry core system and California Sampling. 14.0 to 16.5: 4.25 inch HSA with pilot bit. 16.5 to 44.8: 4.25 inch HSA with dry core system and California Sampling.</p> <p>CASING RECORD: None used.</p> <p>DRILLING MEDIUM: 0.0 to 44.8: None.</p> <p>DRILLING NOTES: Auto Hammer set at constant RPM rate of 20-40 blows per minute.</p> <p>HOLE COMPLETION: Backfilled with bentonite.</p> <p>SAMPLING: 16.5 to 17.5: California (A) 19.0 to 20.0: California (A) 21.5 to 22.5: California (A) 24.0 to 25.0: California (A, B) 29.0 to 30.0: California (A) 34.0 to 35.0: California (NR) 39.0 to 40.0: California (NR)</p>	5	Qtg	Silt, Sand, Gravel and Cobble						0			0.0 to 13.8 ft Quaternary Terrace Gravel (Qtg)
									0			0.0 to 8.0 ft NO RECOVERY: Silt, sand, gravel, and cobbles; No sample using pilot bit. Gravel and cobbles are hard and subrounded. Dry, strong reaction with HCl. (Depths based on drilling action while pilot bit was in use)
			SM						0			8.0 to 11.5 ft: SILTY SAND (SM): About 85% fine sand; about 15% nonplastic fines with rapid dilatancy, and no dry strength; trace medium to coarse sand; Maximum size, coarse sand; dry, light brown in color; strong reaction with HCl.
									0			11.5 to 13.8 ft NO RECOVERY: Silt, sand, gravel, and cobbles; No sample using pilot bit. Gravel and cobbles are hard and subrounded. Dry, Strong reaction with HCl.
		5232.0		Silt, Sand, Gravel and Cobble					24			13.8 to 44.8 ft Cretaceous Mancos Shale (Km)
		15							0			13.8 to 14.0 ft NO RECOVERY: Hard pan; calcite cemented sand and gravel atop shale bedrock.
		20							32			14.0 to 44.8 ft SHALE: Brownish gray, sandy, fissile, laminated to thinly bedded, moderately soft (H5), moderately to intensely weathered (W6), slakes rapidly. Calcite, gypsum and iron oxide along some bedding planes and fractures. Core often separates along bedding planes. Strong reaction with HCl. Becomes moderately hard (H4) below 31.0 ft. Core ground by auger.
		25							92			STRATIGRAPHY:
									100	NA		0.0 to 13.8 ft QUATERNARY TERRACE GRAVEL (Qtg) 13.8 to 44.8 ft CRETACEOUS MANCOS SHALE (Km)
		30	Km	SHALE	NA				96			
	35							100				
	40							100				
	5201.0							100				
BOTTOM OF HOLE												

COMMENTS:

HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide CaCOx= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

All angles measured from core axis at zero degrees unless otherwise noted.

The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock." Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."



SHEET 1 OF 1

DRILL HOLE DH-18-4

GEOLOGIC LOG OF DRILL HOLE NO. DH-18-5										SHEET 1 OF 1		
FEATURE: San Juan Lateral Water Treatment Plant LOCATION: Terrace Investigation BEGUN: 6/3/2018 FINISHED: 6/3/2018 DEPTH TO WATER & ELEVATION: NE WATER DEPTH MEASURED ON: 6/3/2018			PROJECT: Navajo Gallup Water Supply Project COORDINATES: N 2,078,070.3 E 2,499,866.7 N.M. State Plane TOTAL DEPTH: 50.5 ft DEPTH TO BEDROCK: 19.0 ft TOP OF CASING ELEVATION: NA			STATE: New Mexico GROUND ELEVATION: 5248.1 ft NAVD 88 ANGLE FROM HORIZONTAL: -90 ° HOLE LOGGED BY: C. Beyer REVIEWED BY: P. Gardner						
NOTES	DEPTH	GEOLOGIC UNIT	CLASSIFICATION	ENGINEERING PROPERTIES				GRAPHIC	% RECOVERY	RQD	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
				Fracture Density	Hardness	Weathering	Blows/0.5 Ft					
<p>All measurements are from ground level and reported in feet unless otherwise noted.</p> <p>DRILLED BY: Upper Colorado Drill Crew DRILLER: B. Lane HELPER: C. McFadden, B. Samuels</p> <p>PURPOSE: Preconstruction soil and bedrock foundation investigations.</p> <p>DRILL EQUIPMENT: CME Model 85 truck mounted rotary drill rig.</p> <p>DRILL METHOD: 0.0 to 14.0: 4.25 inch HSA with pilot bit. 14.0 to 50.5: HQ3 diamond core drilling system with 5-foot-long split tube sample barrel.</p> <p>CASING RECORD: None used.</p> <p>DRILLING MEDIUM: 0.0 to 14.0: None. 14.0 to 50.5: Water.</p> <p>DRILLING NOTES: 14.0 to 25.5: Slow drilling due to clay causing bit to plug.</p> <p>HOLE COMPLETION: Backfilled with bentonite.</p> <p>SAMPLING: 20.9 to 21.6: HQ3 Core 23.7 to 24.3: HQ3 Core 24.6 to 25.3: HQ3 Core 26.2 to 26.8: HQ3 Core 32.7 to 33.2: HQ3 Core 33.2 to 33.7: HQ3 Core 33.7 to 34.4: HQ3 Core 34.4 to 35.0: HQ3 Core 35.9 to 36.5: HQ3 Core 37.5 to 38.0: HQ3 Core 45.2 to 45.6: HQ3 Core 45.6 to 46.3: HQ3 Core 47.9 to 48.4: HQ3 Core</p>	5								0			0.0 to 19.0 ft Quaternary Terrace Gravel (Qtg)
									0			0.0 to 19.0 ft NO RECOVERY: Silt, sand, gravel, and cobbles; No sample using pilot bit. Gravel and cobbles are hard and subrounded. Dry, strong reaction with HCl.
									0			19.0 to 50.5 ft Cretaceous Mancos Shale (Km)
									0			19.0 to 50.5 ft SHALE: Brownish gray, sandy, fissile, laminated to thinly bedded, moderately soft (H5), moderately to intensely weathered (W6), slakes rapidly. Calcite, gypsum and iron oxide along some bedding planes and fractures. Core often separates along bedding planes. Strong reaction with HCl. Hard (H3) concretionary bed from 26.0 to 26.3 ft.
									67	0		JOINT MEASUREMENTS: DEPTH INCL R T HL INFILLING 27.4 55° 5 3 3 Gypsum, Calcite. 29.5 90° 5 3 3 Gypsum, Calcite. 43.8 90° 5 3 3 Trona, Calcite, Clay.
									30	0		STRATIGRAPHY: 0.0 to 19.0 ft QUATERNARY TERRACE GRAVEL (Qtg) 19.0 to 50.5 ft CRETACEOUS MANCOS SHALE (Km)
									80	80		
									100	78		
									100	2		
									100	92		
								100	90			
								100	68			
								100	56			
	50	5197.6										


BOTTOM OF HOLE

COMMENTS:

HSA= hollow stem auger NA= not available ft= feet NE= not encountered NP= non plastic NR= no recovery HCl= hydrochloric acid FeOx= iron oxide CaCOx= calcium carbonate MnOx= manganese oxide SPT= standard penetration test HQ3= coring system SS= sandstone CLSTN= claystone

All angles measured from core axis at zero degrees unless otherwise noted.

The data for the center column and "classification and physical condition" column are based on Bureau of Reclamation Engineering Geology Field Manual and drawings titled Geology for Designs and Specifications as follows "Drawing No. 40-D-6493 Standard Descriptors and Descriptive Criteria for Rock. Drawing No. 40-D-6499 Standard Descriptors and Descriptive Criteria for Discontinuities."



SHEET 1 OF 1 DRILL HOLE DH-18-5

7-1336-A (1-86) Bureau of Reclamation		LOG OF TEST PIT NO. TPWTP3-18-1			SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant			PROJECT: Navajo Gallup Water Supply Project			
LOCATION: Site Investigation			GROUND ELEVATION: 5179.70			
COORDINATES: N 2,076,253 E 2,498,891			METHOD OF EXPLORATION: Case 580N Rubber Tire Backhoe			
APPROXIMATE DIMENSIONS: 2x12x6			LOGGED BY: P. Gardner			
DEPTH TO WATER: NE DATE: 2/21/2018			DATE EXCAVATED: 2/21/2018			
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)			
			3 - 5 in	5 - 12 in	PLUS 12 in	
1 1.5 ft (5178.2)	CL	0.0 to 1.5 ft LEAN CLAY : About 90% fines with medium plasticity, medium toughness, medium dry strength and no dilatancy; about 10% predominantly fine sand; maximum size, coarse sand; strong reaction with HCl. 4-PLACE CONDITION: Dark to light brown and dry, homogeneous and hard. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)				
2 2.8 ft (5176.9)	CLSTN	1.5 to 2.8 ft CLAYSTONE: Light to dark brown and laminated to thinly bedded. Moderately soft (H7), intensely weathered (W7) and friable. Grades to shale. Carbon blebs and roots present. CaCO ₃ nodules, stringers and in laminations. Strong reaction with HCl. GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)				
3 <						

7-1336-A (1-86) Bureau of Reclamation		LOG OF TEST PIT NO. TPWTP3-18-2		SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant		PROJECT: Navajo Gallup Water Supply Project			
LOCATION: Site Investigation		GROUND ELEVATION: 5170.59			
COORDINATES: N 2,076,486 E 2,497,931		METHOD OF EXPLORATION: Case 580N Rubber Tire Backhoe			
APPROXIMATE DIMENSIONS: 2x12x7		LOGGED BY: P. Gardner			
DEPTH TO WATER: NE DATE: 2/21/2018		DATE EXCAVATED: 2/21/2018			
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)		
			3 - 5 in	5 - 12 in	PLUS 12 in
1	CL (visual) s(CL) (lab class)	0.0 to 2.5 ft LEAN CLAY : About 90% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 10% fine sand; trace of fine, hard subangular gravel; maximum size, 20 mm; strong reaction with HCl.			
	In-place density taken at 0.5 feet	4-PLACE CONDITION: Brown and dry, homogeneous and hard.			
		5-PLACE UNIT WEIGHT AND MOISTURE FROM 0.5 ft.			
		Total 124.3 lbf/ft ³ , 3.8% (78.2% compaction)			
		LAB TEST DATA: 65.6% fines, 33.3% sand, 1.1% gravel LL= 20.2 PI= 8.3			
		SPG= 1.70			
		Maximum dry density: 120.6 lbf/ft ³ , optimum water content= 12.2 %			
		Laboratory classification is SANDY LEAN CLAY.			
2	2.5 ft (5168.1)				
	CLSTN	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
		2.5 to 6.4 ft CLAYSTONE: Light to dark brown and laminated to thinly bedded. Very soft (H7), intensely weathered (W7) and friable. Grades to shale. Carbon blebs, FeOx staining and roots present. CaCO ₃ nodules, stringers and in laminations. Strong reaction with HCl.			
		GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)			
3					
4					
5					
6	6.4 ft (5164.2)				
	SHALE	6.4 to 7.3 ft SHALE: Light to dark gray and laminated to thinly bedded. Moderately soft (H5), moderately weathered (W5) and fissile. Carbon blebs and claystone laminations. FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Weak reaction with HCl. Recovered as flat, angular, 1 to 8 inch particles.			
7	7.3 ft (5163.3)				
		GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)			
COMMENTS: Surface vegetation consists of grasses and weeds. Discontinued excavation at 7.3 feet due to refusal on bedrock.					

7-1336-A (1-86) Bureau of Reclamation		LOG OF TEST PIT NO. TPWTP3-18-3		SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant		PROJECT: Navajo Gallup Water Supply Project			
LOCATION: Site Investigation		GROUND ELEVATION: 5174.51			
COORDINATES: N 2,075,345 E 2,497,592		METHOD OF EXPLORATION: Case 580N Rubber Tire Backhoe			
APPROXIMATE DIMENSIONS: 2x12x7		LOGGED BY: P. Gardner			
DEPTH TO WATER: NE DATE: 2/22/2018		DATE EXCAVATED: 2/22/2018			
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)		
			3 - 5 in	5 - 12 in	PLUS 12 in
1	CL	0.0 to 2.5 ft LEAN CLAY : About 95% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 5% fine sand; maximum size, fine sand; strong reaction with HCl. IN PLACE CONDITION: Brown and dry, homogeneous and hard.			
2	CLSTN	2.5 to 6.0 ft CLAYSTONE: Light to dark brown and laminated to thinly bedded. Very soft (H7), intensely weathered (W7) and friable. Grades to shale. Carbon blebs, FeOx staining and roots present. CaCOx nodules, stringers and in laminations. Strong reaction with HCl. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3		3.0 ft (5171.5)			
4	SHALE	6.4 to 6.8 ft SHALE: Light to dark gray and laminated to thinly bedded. Moderately soft (H5), moderately weathered (W5) and fissile. Carbon blebs and claystone laminations. FeOx staining present. CaCOx nodules, stringers and in laminations. Weak reaction with HCl. Recovered as flat, angular, 1 to 6 inch particles. Corrosion sample taken at 6.0 ft. GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)			
5		Corrosion sample taken at 6.0 ft.			
6		6.8 ft (5167.7)			
COMMENTS: Surface vegetation consists of grasses and weeds. Discontinued excavation at 6.8 feet due to refusal on bedrock.					

7-1336-A (1-86) Bureau of Reclamation		LOG OF TEST PIT NO. TPWTP3-18-4		SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant		PROJECT: Navajo Gallup Water Supply Project			
LOCATION: Site Investigation		GROUND ELEVATION: 5182.87			
COORDINATES: N 2,075,073 E 2,498,588		METHOD OF EXPLORATION: Case 580N Rubber Tire Backhoe			
APPROXIMATE DIMENSIONS: 2x12x7		LOGGED BY: P. Gardner			
DEPTH TO WATER: NE DATE: 2/21/2018		DATE EXCAVATED: 2/21/2018			
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)		
			3 - 5 in	5 - 12 in	PLUS 12 in
1	CL	0.0 to 0.9 ft LEAN CLAY : About 95% fines with medium plasticity, medium toughness, medium dry strength and no dilatancy; about 5% fine sand; maximum size, fine sand; strong reaction with HCl.			
	0.9 ft (5182.0)	IN-PLACE CONDITION: Light to dark brown and dry, homogeneous and hard.			
2	CLSTN CL (lab class)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
		0.9 to 1.5 ft CLAYSTONE: Light to dark brown and laminated to thinly bedded. Very soft (H7), intensely weathered (W7) and friable. Grades to shale. Carbon blebs and roots present. CaCO ₃ nodules, stringers and in laminations. Strong reaction with HCl.			
3		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 1.5 ft. Total: 101.3 lb./cu. ft. (9.2% (88.8% compaction) LAB TEST DATA: 97.6% fines, 2.4% sand LL= 36.9 PI= 19.9 SPG= 2.80 Maximum dry density: 110.2 lb/ft ³ , optimum water content= 15.4 % Laboratory classification is LEAN CLAY.			
	In-place density taken at 1.5 feet.	GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)			
4					
5					
6	SHALE	5.5 to 6.6 ft SHALE: Light to dark gray and laminated to thinly bedded. Moderately soft (H5), moderately weathered (W5) and friable. Carbon blebs and claystone laminations. FeOx staining present. CaCO ₃ nodules, stringers and in laminations. Weak reaction with HCl. Recovered as flat, angular, 1 to 8 inch particles.			
	Corrosion sample taken at 6.0 ft.	Corrosion sample taken at 6.0 ft.			
	6.6 ft (5176.3)	GEOLOGIC INTERPRETATION: Cretaceous Mancos Shale (Km)			
COMMENTS: Surface vegetation consists of grasses and weeds. Discontinued excavation at 6.6 feet due to refusal on bedrock.					

7-1336-A (1-86) Bureau of Reclamation		LOG OF TEST PIT NO. TP-18-5		SHEET 1 OF 1	
FEATURE: San Juan Lateral Water Treatment Plant		PROJECT: Navajo Gallup Water Supply Project			
LOCATION: Terrace Investigation		GROUND ELEVATION: 5247.73			
COORDINATES: N 2,078,162 E 2,499,849		METHOD OF EXPLORATION: Case 580N Rubber Tire Backhoe			
APPROXIMATE DIMENSIONS: 2x12x11		LOGGED BY: P. Gardner			
DEPTH TO WATER: NE DATE: 2/22/2018		DATE EXCAVATED: 2/22/2018			
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)		
			3 - 5 in	5 - 12 in	PLUS 12 in
1	CL 1.1 ft (5246.6)	0.0 to 1.1 ft LEAN CLAY : About 95% fines with low plasticity, low toughness, medium dry strength and no dilatancy; about 5% fine sand; trace of fine to coarse, hard, round to subrounded gravel; maximum size, 75mm; strong reaction with HCl.			
2	(SM)g (lab class)	IN-PLACE CONDITION: Brown and dry, homogeneous and hard.	tr		
3	In-place density taken at 4.0 ft.	GEOLOGIC INTERPRETATION: Quaternary Terrace Gravel (Qtg) 1.1 to 5.5 ft SILTY SAND WITH GRAVEL: About 45% fine to coarse, hard, subangular to rounded sand; about 35% fines with no plasticity, no toughness, low dry strength and rapid dilatancy; about 20% fine to coarse, hard, rounded to subrounded gravel; trace of very hard, round to subrounded cobbles; maximum size, 150mm; no to weak reaction with HCl.			
4		IN-PLACE CONDITION: Light to dark brown and dry, lenses and pockets of gravel and sand about 3 inches thick and the width of the trench, moderate cementation.			
5	5.5 ft (5242.2)	IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 ft. Total: 91.7 lbf/ft³, 6.7% (8.7% compaction) LAB TEST DATA: 46.8% sand, 34.8% fines, 18.6% gravel LL= NA PI= NP SPG= 2.81 Maximum dry density: 116.5 lbf/ft³ optimum water content= 15.5 % Laboratory classification is SILTY SAND WITH GRAVEL.	5	tr	
6	(GP)sc	GEOLOGIC INTERPRETATION: Quaternary Terrace Gravel (Qtg) 5.5 to 10.9 ft POORLY GRADED GRAVEL WITH SAND AND COBBLE: About 65% hard, rounded to subrounded gravel (about 1/8 of gravel gravel particles are flat and elongated); about 30% fine to coarse, hard, subangular to subrounded sand; about 5% non-plastic fines with rapid dilatancy and no dry strength; no reaction with HCl.			
7	Corrosion sample taken at 6.0 ft.	TOTAL SAMPLE (BY VOLUME): About 5% 3- to 5-inch hard, rounded to subangular cobbles; trace of 5- to 12-inch hard, subrounded cobbles; remainder minus 3 inch; maximum size, 200 mm.			
8		IN-PLACE CONDITION: Gray to tan color and dry, weak cementation, sloughing walls.			
9		Corrosion sample taken at 6.0 ft.			
10		GEOLOGIC INTERPRETATION: Quaternary Terrace Gravel (Qtg)			
	10.9 ft (5236.8)				
COMMENTS: Surface vegetation consists of grasses and weeds. Discontinued excavation at 10.9 feet due to sloughing walls but not refusal.					

APPENDIX 2

Preliminary

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SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Maximum Density by Proctor)

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-17-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS			
TEST PIT NUMBER	DEPTH - feet	CLASSIFICATION SYMBOL	FINES		SAND #200 (0.075mm) to 3" (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY- pcf	FILL MOISTURE CONTENT - %	SPECIFIC GRAVITY PLUS No. 4	SPECIFIC GRAVITY MINUS No. 4	MAXIMUM DRY DENSITY - pcf	OPTIMUM MOISTURE CONTENT - %	PENETRATION RESISTANCE - psi	D-VALUE - %
			SMALLER THAN 0.005mm	0.005 to 0.075mm															
SPT-1	3.0 - 4.5	CL	43.3	44.5	12.2	0	0	0	32.0	16.2	-	--	4.9	-	2.61	--	--	--	--
SPT-2	5.0 - 6.5	(CL) _s	31.6	44.4	24.0	0	0	0	29.5	13.2	-	--	3.3	-	2.67	--	--	--	--
SPT-3	7.5 - 9.0	CL	41.0	49.8	9.2	0	0	0	34.3	19.6	-	--	5.7	-	2.67	--	--	--	--
SPT-4	10.0 - 11.5	CL	42.9	44.4	7.7	0	0	0	33.8	18.5	-	--	5.2	-	2.66	--	--	--	--
SPT-5	12.5 - 14.0	CL	44.9	44.9	11.0	0	0	0	35.7	21.1	-	--	7.0	-	2.64	--	--	--	--
SPT-6	15.0 - 16.5	CL	38.6	47.4	4.0	0	0	0	33.6	17.3	-	--	4.1	-	2.59	--	--	--	--
SPT-7	20.0 - 21.5	CL	39.5	54.9	5.6	0	0	0	33.8	17.4	-	--	2.6	-	-	--	--	--	--

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
*Denotes In-place density and 5-point curve.

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Maximum Density by Proctor)

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-17-2

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS			
TEST PIT NUMBER	DEPTH - feet	CLASSIFICATION SYMBOL	FINES		SAND #200 (0.075mm) to 3" (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY- pcf	FILL MOISTURE CONTENT - %	SPECIFIC GRAVITY PLUS No. 4	SPECIFIC GRAVITY MINUS No. 4	MAXIMUM DRY DENSITY - pcf	OPTIMUM MOISTURE CONTENT - %	PENETRATION RESISTANCE - psi	D-VALUE - %
			SMALLER THAN 0.005mm	0.005 to 0.074mm															
SPT-1	2.5 – 4.0	CL	49.0	46.2	4.8	0	0	0	35.0	21.0	--	--	5.9	--	2.72	--	--	--	--
SPT-2	5.0 – 6.5	CL	48.6	44.5	6.9	0	0	0	35.2	19.6	--	--	7.6	--	2.77	--	--	--	--
SPT-3	7.5 – 9.0	CL	56.2	42.4	1.4	0	0	0	37.2	20.8	--	--	7.5	--	2.71	--	--	--	--
SPT-4	10.0 – 11.5	CL	46.6	44.4	9.0	0	0	0	33.2	15.6	--	--	6.3	--	2.72	--	--	--	--
SPT-5	12.5 – 14.0	CL	56.0	43.0	1.0	0	0	0	38.7	21.6	--	--	7.0	--	2.74	--	--	--	--
SPT-6	15.0 – 16.5	CL	51.0	45.0	4.0	0	0	0	34.1	16.6	--	--	6.9	--	2.73	--	--	--	--
SPT-7	20.0 – 21.5	CL	53.1	41.0	5.9	0	0	0	35.6	18.3	--	--	7.0	--	2.71				
SPT-8	25.0 – 26.5	CL	51.6	43.3	5.1	0	0	0	35.2	17.9	--	--	6.5	--	2.73				

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
*Denotes In-place density and 5-point curve.

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Maximum Density by Proctor)

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-17-3

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT							CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS			
TEST PIT NUMBER	DEPTH - feet	CLASSIFICATION SYMBOL	FINES		SAND #200 (0.075mm) to 3" (76.2mm)	GRAVEL #4 (4.75mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY- pcf	FILL MOISTURE CONTENT - %	SPECIFIC GRAVITY PLUS No. 4	SPECIFIC GRAVITY MINUS No. 4	MAXIMUM DRY DENSITY - pcf	OPTIMUM MOISTURE CONTENT - %	PENETRATION RESISTANCE - psi	D-VALUE - %	
			SMALLER THAN 0.005mm	0.005 to 0.075mm																
SPT-1	5.0 – 6.5	CL	56.6	38.9	4.5	0	0	0	40.7	21.6	14.0	--	7.8	--	2.71	--	--	--	--	
SPT-2	10.0 - 11.5	CL	45.1	42.3	11.4	1.2	0	0	34.0	16.9	14.1	--	6.3	2.91	2.68	--	--	--	--	
SPT-3	12.5 – 14.0	(CL) _s	40.8	43.6	15.6	0	0	0	33.3	16.7	14.0	--	5.9	--	2.67	--	--	--	--	
SPT-4	15.0 – 16.5	(CL) _s	37.1	43.8	21.7	1.4	0	0	31.2	13.8	--	--	5.2	2.46	2.67	--	--	--	--	
SPT-5	20.0 – 21.5	CL	44.1	43.6	11.9	0	0	0	33.6	16.4	14.4	--	6.0	--	2.65	--	--	--	--	
SPT-6	25.0 -26.5	o(CL) _s	22.7	32.4	8.2	26.7	0	0	30.4	15.4	14.0	--	5.0	2.32	2.62	--	--	--	--	

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
*Denotes In-place density and 5-point curve.

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: REACH 1

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Drill Hole Number: DHRWTP3-17-4

[illegible]

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: REACH 1

Page 1 of 1

Drill Hole Number: DHRWTP3-17-5

[illegible] \mathbf{Z}

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: REACH 1

Page 1 of 1

Drill Hole Number: DHRWTP3-17-6

[illegible]

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-17-7

[illegible]

**Denotes In-place density and 5-point curve.*

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: REACH 1

Page 1 of 1

Drill Hole Number: DHRWTP3-17-7

[illegible]

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-17-8

[illegible]

**Denotes In-place density and 5-point curve.*

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: SJWTP

Page 1 of 1

[illegible]

* Denotes In-place density and 5-point curve

PROJECT: Navajo Gallup Water Supply Project

FEATURE: Reach 1 Water Treatment Plant

Page 1 of 1

DHWTP3-18-9

[illegible]

*Denotes In-place density and 5-point curve.

PROJECT: Navajo Gallup Water Supply Project

FEATURE: San Juan Lateral Water Treatment Plant

Page 1 of 1

DHWTP3-18-10

[illegible]

**Denotes In-place density and 5-point curve.*

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT

FEATURE: SJWTP

Page 1 of 1

[illegible]

* Denotes In-place density and 5-point curve

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Preliminary

APPENDIX 3

Preliminary

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**Navajo Gallup Water Supply Project
San Juan Lateral, Water Treatment Plant, Drill Core Photos**



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (3.0-5.0 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (5.0-7.5 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (7.5-10.0 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (10.0-12.5 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (12.5-15.0 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (15.0-20.0 feet). Photo By: P. Gardner



Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (20.0-25.0 feet). Photo By: P. Gardner



Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (25.0-30.0 feet). Photo By: P. Gardner



Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (30.0-35.0 feet). Photo By: P. Gardner



Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (35.0-40.0 feet). Photo By: P. Gardner



Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (40.0-45.0 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (3.0-12.5 feet). Photo By: P. Gardner



Photo Date: 6/14/2017 NGWSP, SJWTP, DHWTP3-17-1 (12.5-30.0 feet). Photo By: P. Gardner

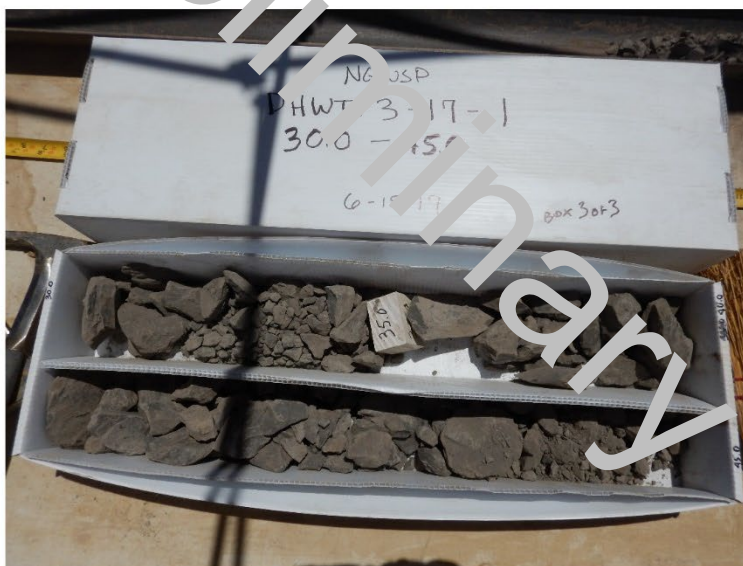


Photo Date: 6/15/2017 NGWSP, SJWTP, DHWTP3-17-1 (30.0-45.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (5.0-7.5 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (7.5-10.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (10.0-12.5 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (12.5-15.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (15.0-20.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (20.0-25.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (25.0-30.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (30.0-35.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-2 (35.0-39.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-2 (39.0-40.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-2 (40.0-41.3 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-2 (41.3-45.0 feet). Photo By: P. Gardner



Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (5.0-15.0 feet). Photo By: P. Gardner

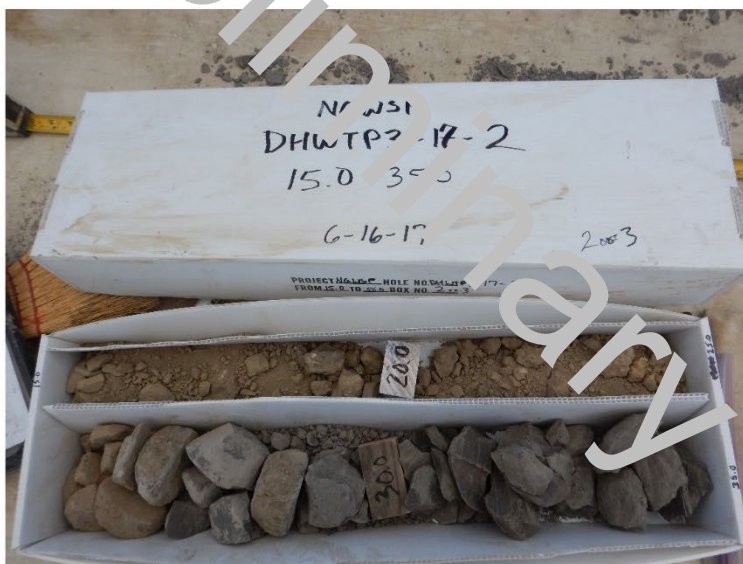


Photo Date: 6/16/2017 NGWSP, SJWTP, DHWTP3-17-2 (15.0-35.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-2 (35.0-45.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (5.0-7.5 feet). Photo By: P. Gardner

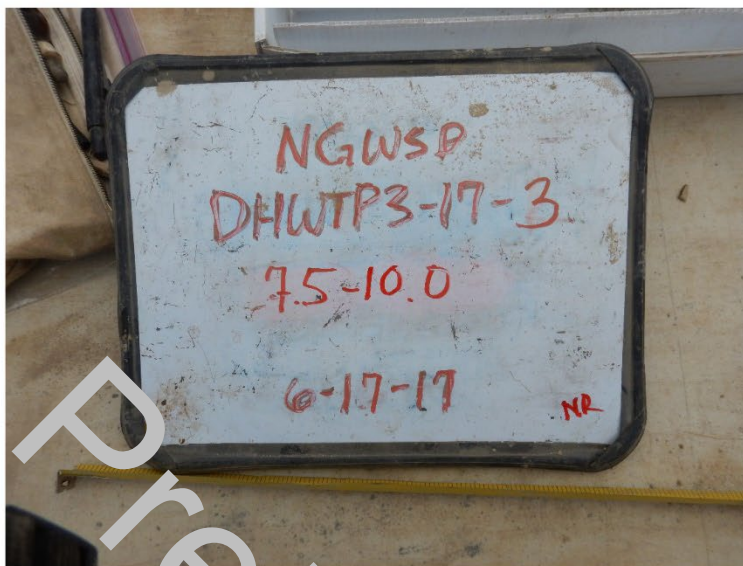


Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (7.5-10.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (10.0-12.5 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (12.5-15.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (15.0-20.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (20.0-25.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (25.0-30.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (30.0-35.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (35.0-37.0 feet). Photo By: P. Gardner

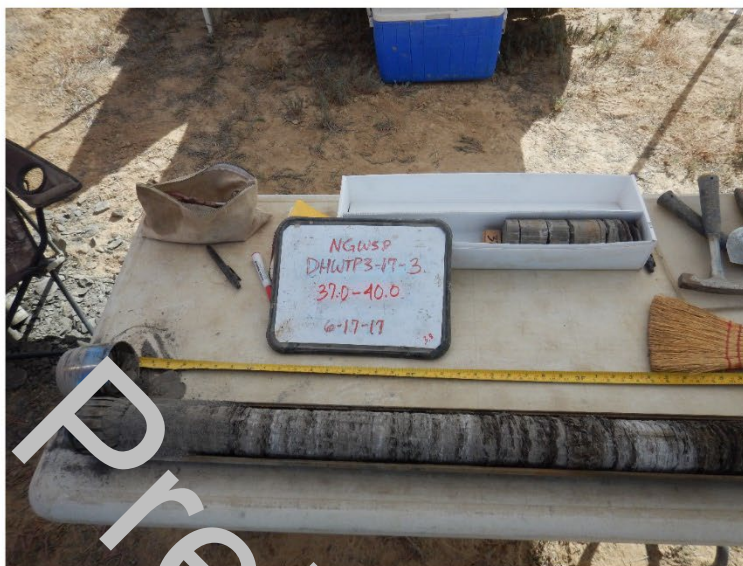


Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (37.0-40.0 feet). Photo By: P. Gardner



Photo Date: 6/18/2017 NGWSP, SJWTP, DHWTP3-17-3 (40.0-41.2 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (41.2-45.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (5.0-20.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (20.0-35.0 feet). Photo By: P. Gardner



Photo Date: 6/17/2017 NGWSP, SJWTP, DHWTP3-17-3 (35.0-45.0 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (3.5-6.0 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (6.0-8.5 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (8.5-11.0 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (11.0-13.5 feet). Photo By: P. Gardner

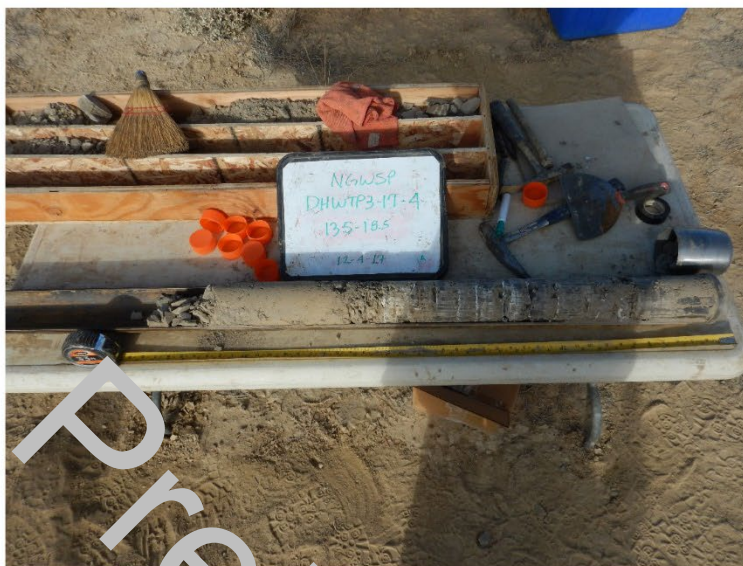


Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (13.5-18.5 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (18.5-23.5 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (23.5-26.0 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (28.5-33.5 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (33.5-38.5 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (38.5-41.5 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (41.5-46.5 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (46.5-50.5 feet). Photo By: P. Gardner



Photo Date: 12/4/2017 NGWSP, SJWTP, DHWTP3-17-4 (3.5-26.0 feet). Photo By: P. Gardner



Photo Date: 12/5/2017 NGWSP, SJWTP, DHWTP3-17-4 (28.5-50.5 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (4.5-7.0 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (7.0-9.5 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (9.5-12.0 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (12.0-14.5 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (14.5-19.5 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (19.5-24.5 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (24.5-27.8 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWTP3-17-5 (28.0-32.0 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWTP3-17-5 (32.0-37.0 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWTP3-17-5 (37.0-42.0 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWT3-17-5 (42.0-47.0 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWT3-17-5 (47.0-50.0 feet). Photo By: P. Gardner



Photo Date: 12/13/2017 NGWSP, SJWTP, DHWTP3-17-5 (4.5-27.8 feet). Photo By: P. Gardner



Photo Date: 12/14/2017 NGWSP, SJWTP, DHWTP3-17-5 (27.8-50.0 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (4.0-6.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (6.5-9.0 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (9.0-11.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (11.5-14.0 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (14.0-18.6 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (19.0-21.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (21.5-26.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (26.5-31.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (31.5-36.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (36.5-41.5 feet). Photo By: P. Gardner

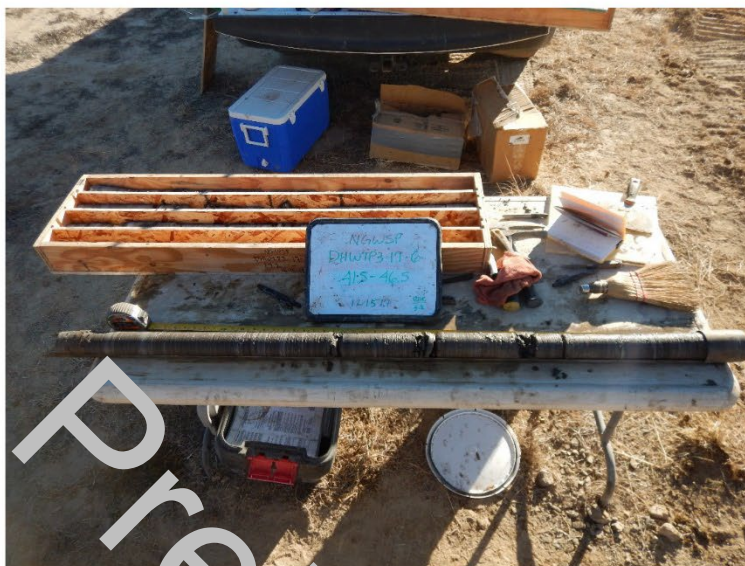


Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (41.5-46.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (46.5-51.5 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (4.0-29.2 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (29.2-45.9 feet). Photo By: P. Gardner



Photo Date: 12/15/2017 NGWSP, SJWTP, DHWTP3-17-6 (45.9-51.5 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (4.0-6.5 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (6.5-9.0 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (9.0-11.5 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (11.5-14.0 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (14.0-19.0 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (19.0-20.0 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (20.0-21.6 feet). Photo By: P. Gardner

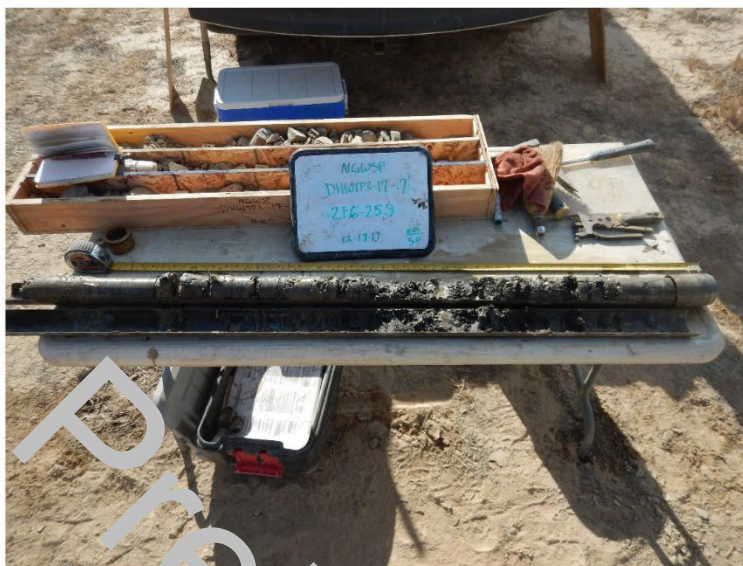


Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (21.6-25.9 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (25.9-26.6 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (26.6-31.6 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (31.6-36.6 feet). Photo By: P. Gardner

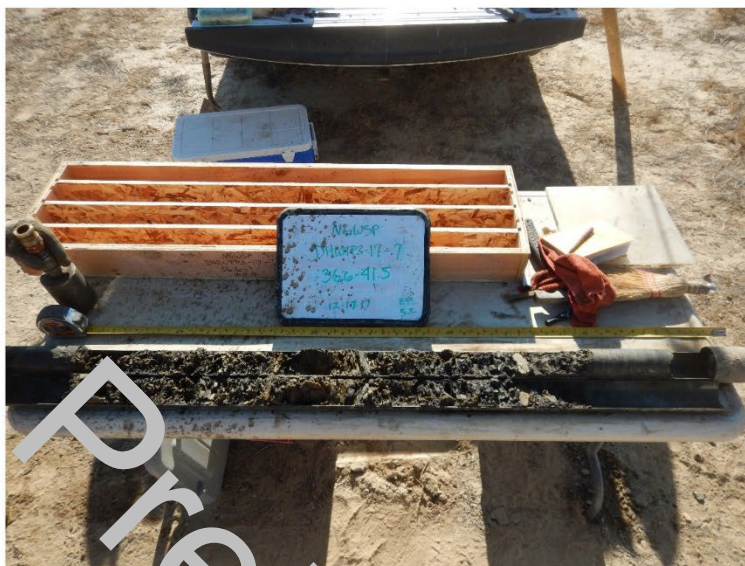


Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (36.6-41.5 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (41.5-46.6 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (46.6-51.5 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (4.0-22.2 feet). Photo By: P. Gardner



Photo Date: 12/16/2017 NGWSP, SJWTP, DHWTP3-17-7 (22.2-36.6 feet). Photo By: P. Gardner



Photo Date: 12/17/2017 NGWSP, SJWTP, DHWTP3-17-7 (36.6-51.5 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (4.5-7.0 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (7.0-9.5 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (9.5-12.0 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (12.0-14.5 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (14.5-19.5 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (19.5-24.5 feet). Photo By: P. Gardner

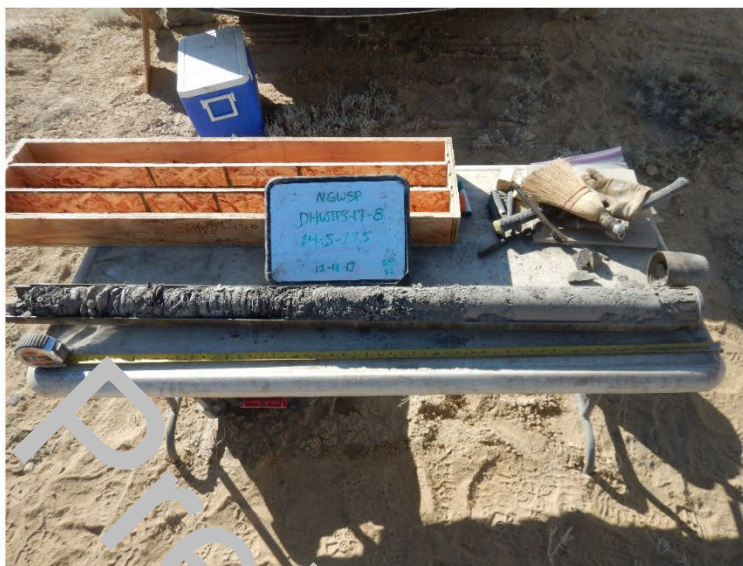


Photo Date: 12/18/2017 NGWSP, SJWTP, DHWT3-17-8 (24.5-29.5 feet). Photo By: P. Gardner



Photo Date: 12/19/2017 NGWSP, SJWTP, DHWT3-17-8 (29.5-29.9 feet). Photo By: P. Gardner



Photo Date: 12/19/2017 NGWSP, SJWTP, DHWTP3-17-8 (44.5-49.5 feet). Photo By: P. Gardner



Photo Date: 12/18/2017 NGWSP, SJWTP, DHWTP3-17-8 (4.5-24.5 feet). Photo By: P. Gardner



Photo Date: 12/19/2017 NGWSP, SJWTP, DHWTP3-17-8 (24.5-49.5 feet). Photo By: P. Gardner



Photo Date: 5/2/2018 NGWSP, SJWTP, DHWTP3-18-9 (4.0-6.5 feet). Photo By: P. Gardner



Photo Date: 5/2/2018 NGWSP, SJWTP, DHWTP3-18-9 (6.5-8.7 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (11.5-14.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (14.0-16.5 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (16.5-19.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (19.0-24.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (24.0-29.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWS, SJWTP, DHWTP3-18-9 (29.0-34.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWS, SJWTP, DHWTP3-18-9 (34.0-39.0 feet). Photo By: P. Gardner



Photo Date: 5/2/2018 NGWSP, SJWTP, DHWTP3-18-9 (4.0-12.0 feet). Photo By: P. Gardner

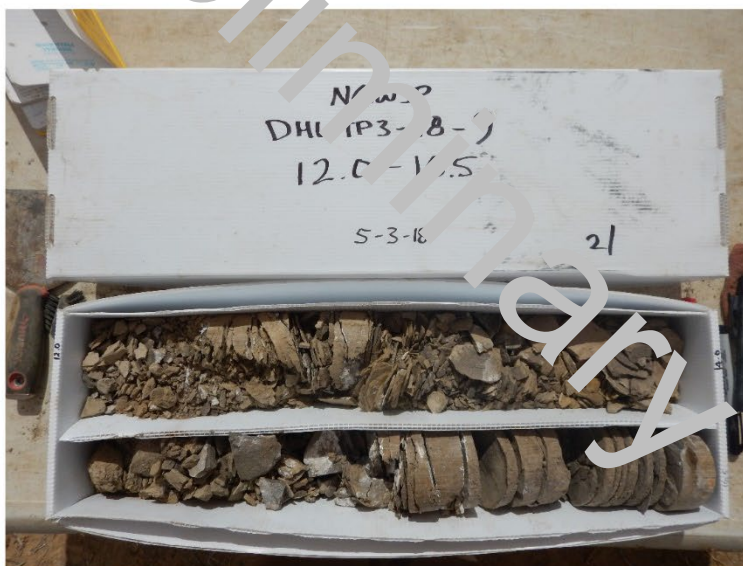


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Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (16.5-21.5 feet). Photo By: P. Gardner

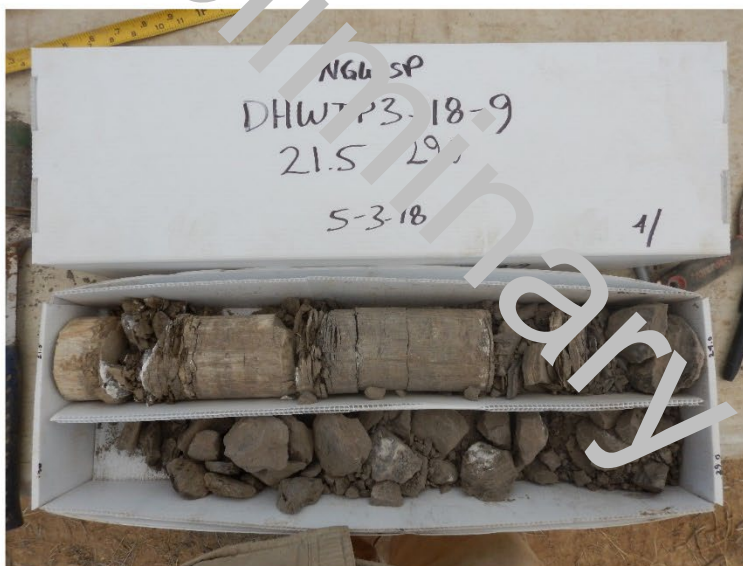


Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (21.5-29.0 feet). Photo By: P. Gardner



Photo Date: 5/3/2018 NGWSP, SJWTP, DHWTP3-18-9 (29.0-39.0 feet). Photo By: P. Gardner

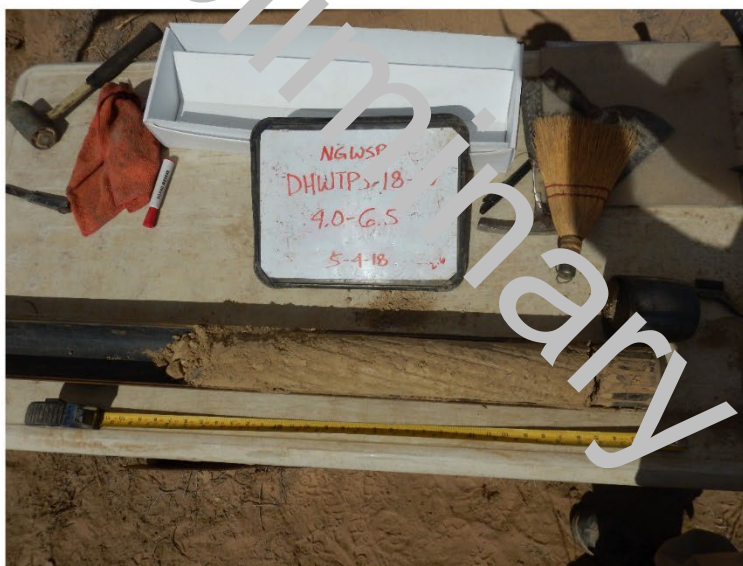


Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (4.0-6.5 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (6.5-9.0 feet). Photo By: P. Gardner

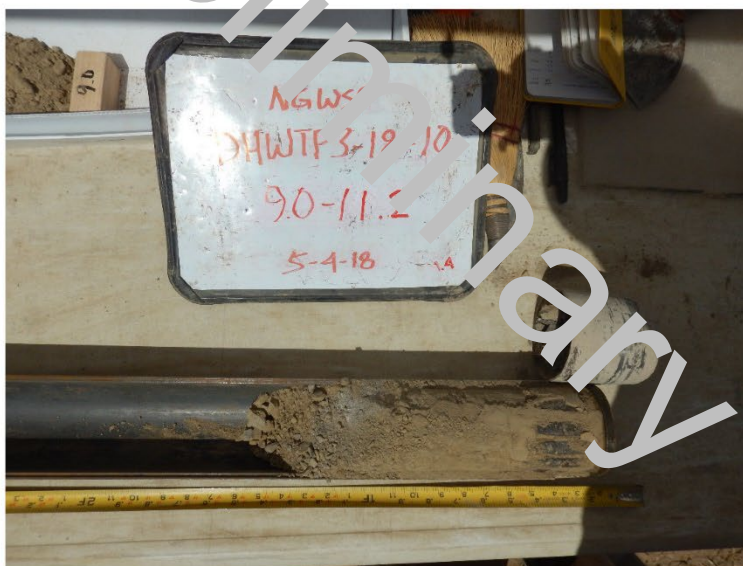


Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (9.0-11.2 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (14.0-16.5 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (16.5-19.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (19.0-21.5 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (21.5-24.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (24.0-29.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (29.0-33.5 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (36.5-40.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (4.0-11.2 feet). Photo By: P. Gardner

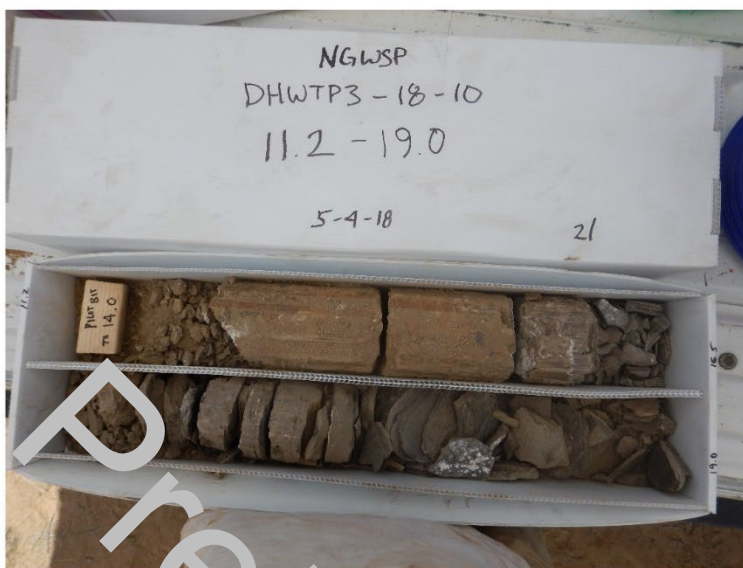


Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (11.2-19.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (19.0-25.0 feet). Photo By: P. Gardner



Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (25.0-33.5 feet). Photo By: P. Gardner

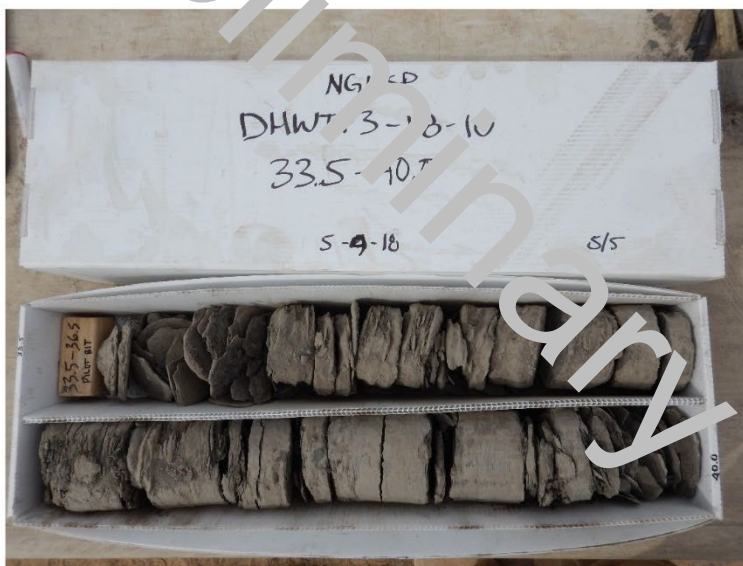


Photo Date: 5/4/2018 NGWSP, SJWTP, DHWTP3-18-10 (33.5-40.0 feet). Photo By: P. Gardner

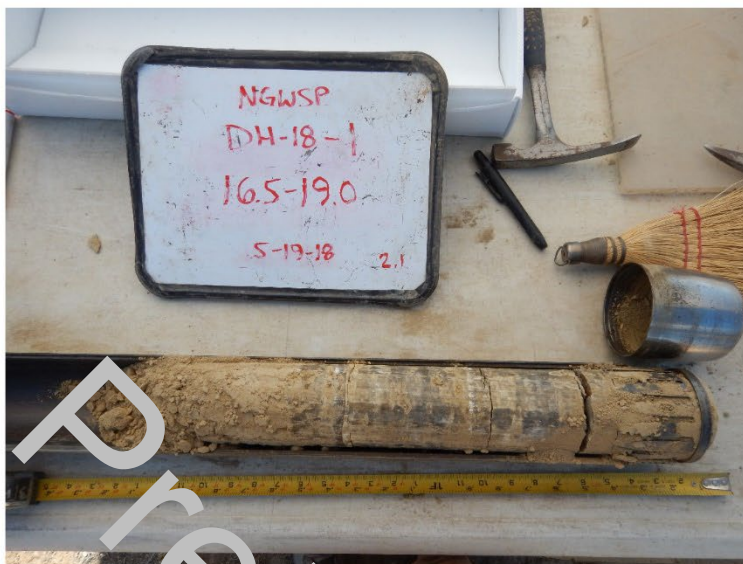


Photo Date: 5/19/2018 NGWSP SJWTP DH-18-1 (16.5-19.0 feet). Photo By: P. Gardner

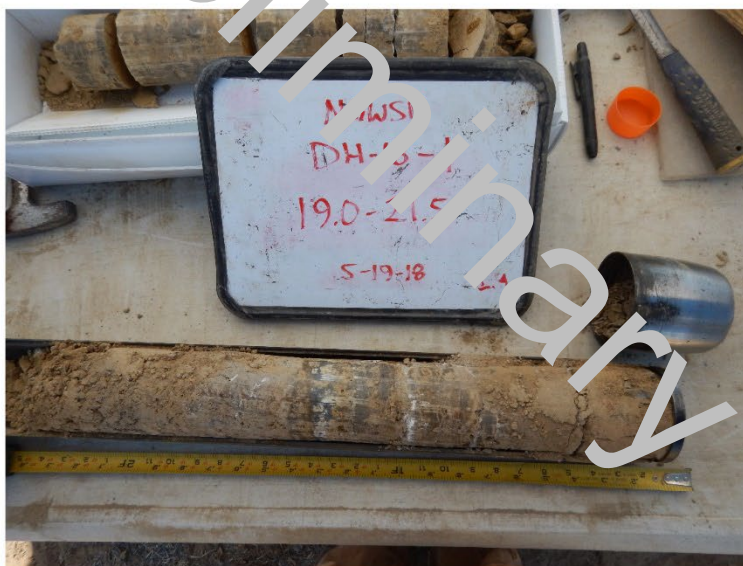


Photo Date: 5/19/2018 NGWSP SJWTP DH-18-1 (19.0-21.5 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (21.5-24.0 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (24.0-26.5 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (26.5-29.0 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (29.0-34.0 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (34.0-39.0 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (39.0-44.0 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (44.0-49.0 feet). Photo By: P. Gardner

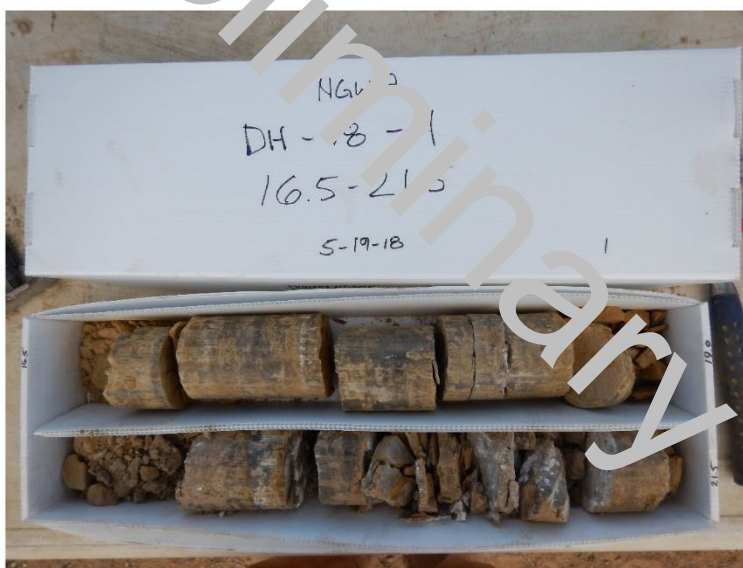


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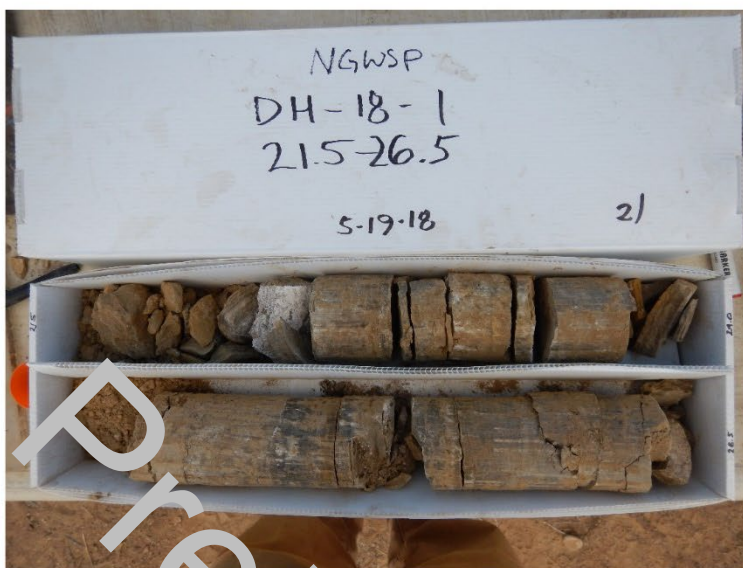


Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (21.5-26.5 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (26.5-31.5 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (31.5-36.5 feet). Photo By: P. Gardner

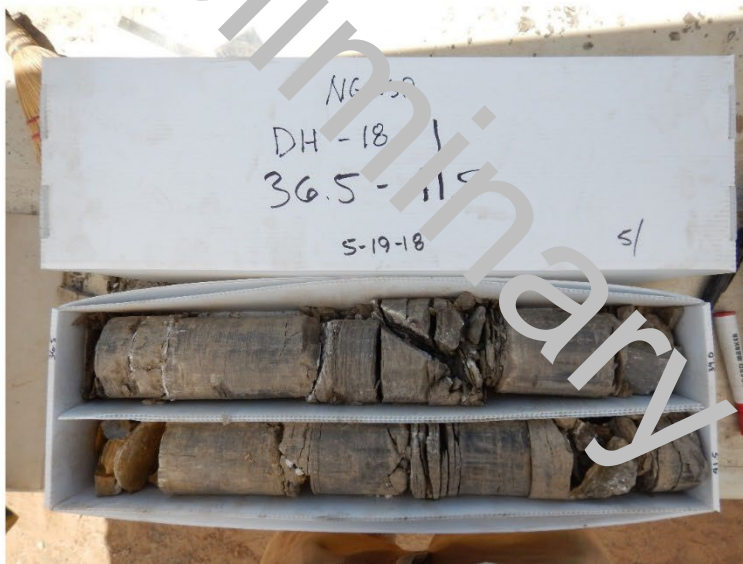


Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (36.5-41.5 feet). Photo By: P. Gardner



Photo Date: 5/19/2018 NGWSP, SJWTP, DH-18-1 (41.5-49.0 feet). Photo By: P. Gardner



Photo Date: 5/20/2018 NGWSP, SJWTP, DH-18-2 (19.0-21.5 feet). Photo By: P. Gardner



Photo Date: 5/20/2018 NGWSP, SJWTP, DH-18-2 (21.5-24.0 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (24.0-26.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (26.5-29.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (29.5-34.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP SJWTP DH-18-2 (34.5-39.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP SJWTP DH-18-2 (39.5-44.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (44.5-49.0 feet). Photo By: P. Gardner

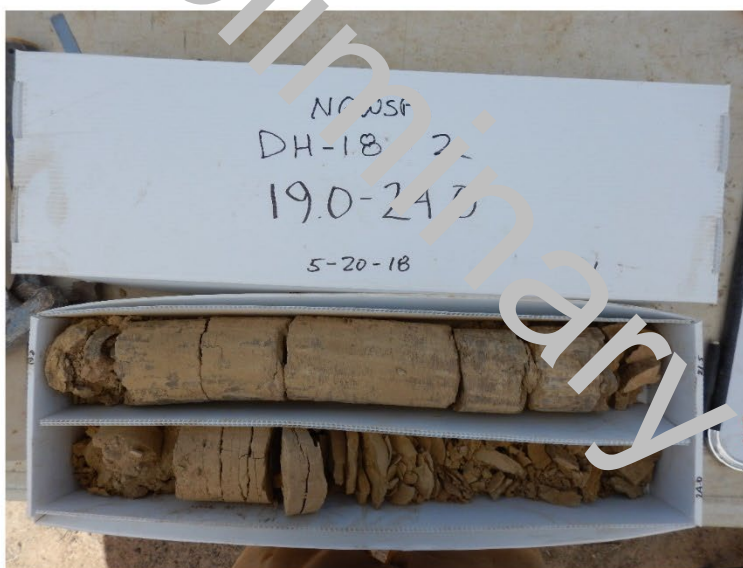


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Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (24.0-26.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-2 (26.5-41.2 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP SJWTP DH-18-2 (41.2-50.0 feet). Photo By: P. Gardner

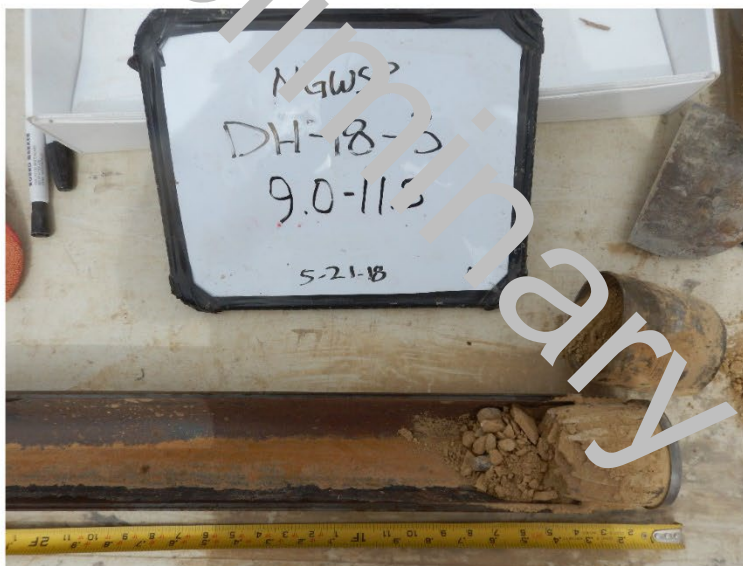


Photo Date: 5/21/2018 NGWSP SJWTP DH-18-3 (9.0-11.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-3 (11.5-14.0 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-3 (14.0-16.5 feet). Photo By: P. Gardner



Photo Date: 5/21/2018 NGWSP, SJWTP, DH-18-3 (16.5-17.0 feet). Photo By: P. Gardner



Photo Date: 5/22/2018 NGWSP, SJWTP, DH-18-3 (17.0-17.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (17.5-20.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (20.5-25.5 feet). Photo By: P. Gardner

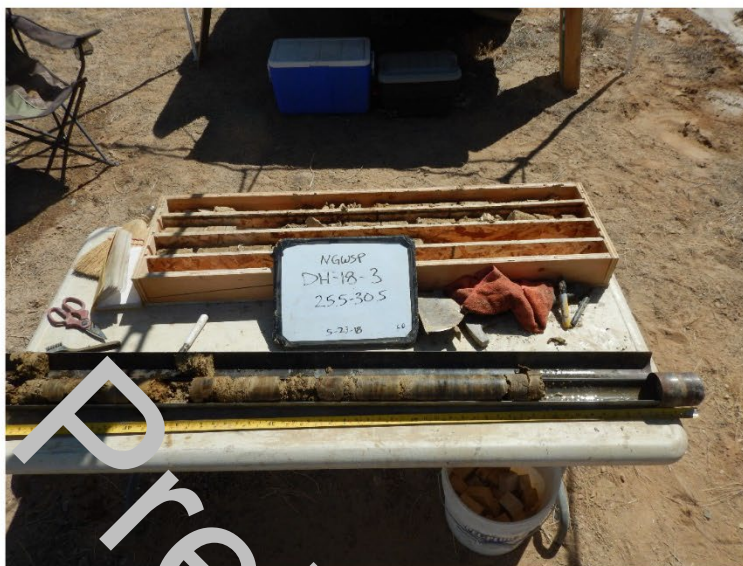


Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (25.5-30.5 feet). Photo By: P. Gardner

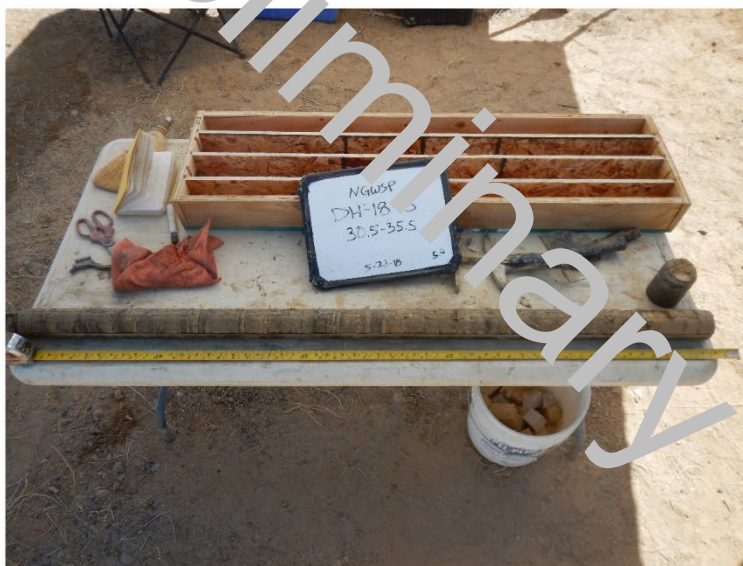


Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (30.5-35.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (35.5-40.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (40.5-45.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP SJWTP DH-18-3 (45.5-50.5 feet). Photo By: P. Gardner



Photo Date: 5/22/2018 NGWSP SJWTP DH-18-3 (9.0-17.0 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (17.5-30.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (30.5-45.5 feet). Photo By: P. Gardner



Photo Date: 5/23/2018 NGWSP, SJWTP, DH-18-3 (45.5-50.5 feet). Photo By: P. Gardner



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (34.0-39.0 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (39.0-44.0 feet). Photo By: C. Beyer

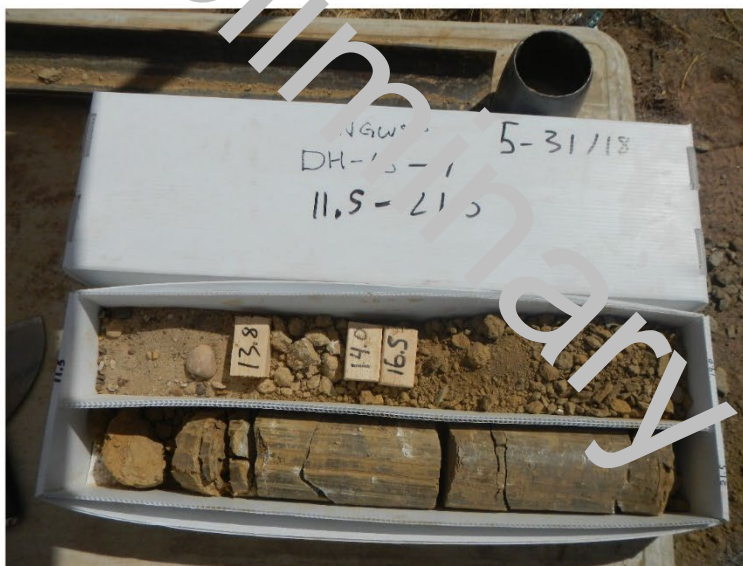


Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (11.5-21.5 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (21.5-26.0 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (26.0-31.0 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (31.0-34.0 feet). Photo By: C. Beyer

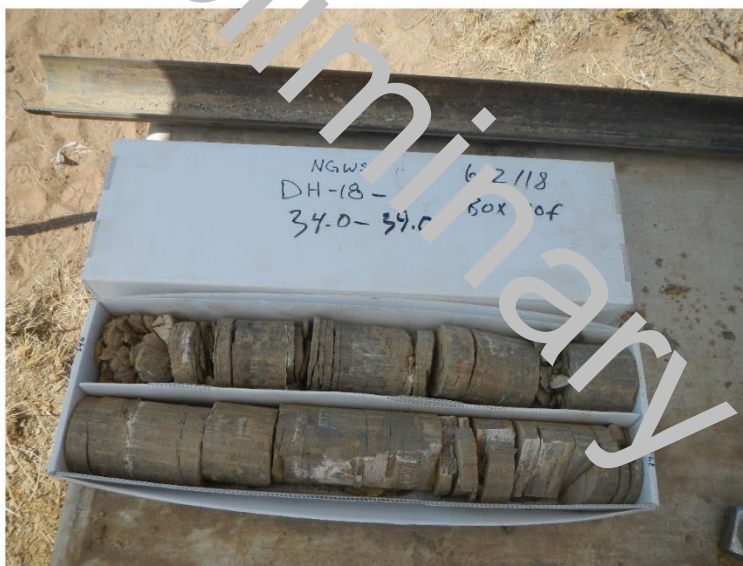


Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (34.0-39.0 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (39.0-43.3 feet). Photo By: C. Beyer



Photo Date: 6/2/2018 NGWSP, SJWTP, DH-18-4 (43.3-44.8 feet). Photo By: C. Beyer



Photo Date: 6/4/2018 NGWSP SSWTP, DH-18-5 (15.5-20.5 feet). Photo By: C. Beyer



Photo Date: 6/4/2018 NGWSP, SJWTP, DH-18-5 (20.5-25.5 feet). Photo By: C. Beyer



Photo Date: 6/4/2018 NGWSP, SSWTP, DH-18-5 (25.5-30.5 feet). Photo By: C. Beyer



Photo Date: 6/4/2018 NGWSP, SJWTP, DH-18-5 (30.5-35.5 feet). Photo By: C. Beyer



Photo Date: 6/4/2018 NGWSP SJWTP, DH-18-5 (35.5-40.5 feet). Photo By: C. Beyer



Photo Date: 6/5/2018 NGWSP, SJWTP, DH-18-5 (40.5-44.5 feet). Photo By: C. Beyer



Photo Date: 6/5/2018 NGWSP SJWTP, DH-18-5 (44.5-49.5 feet). Photo By: C. Beyer



Photo Date: 6/5/2018 NGWSP, SJWTP, DH-18-5 (14.0-29.4 feet). Photo By: C. Beyer



Photo Date: 6/5/2018 NGWSP, SJWTP, DH-18-5 (29.4-40.5 feet). Photo By: C. Beyer



Photo Date: 6/5/2018 NGWSP, SJWTP, DH-18-5 (40.5-50.5 feet). Photo By: C. Beyer

Navajo Gallup Water Supply Project
San Juan Lateral, Water Treatment Plant, Test Pit Photos



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-1 (0.0-6.0 feet). Photo By: P. Gardner



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-1 (0.0-6.0 feet). Photo By: P. Gardner



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-2 (0.0-7.3 feet). Photo By: P. Gardner



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-2 (0.0-7.3 feet). Photo By: P. Gardner

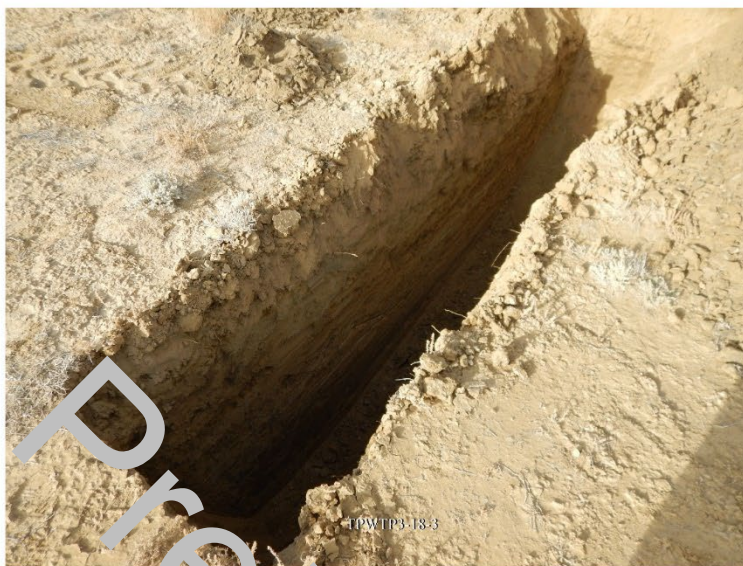


Photo Date: 2/22/2018 NGWSP, SJWTP, TPWTP3-18-3 (0.0-6.8 feet). Photo By: P. Gardner



Photo Date: 2/22/2018 NGWSP, SJWTP, TPWTP3-18-3 (0.0-6.8 feet). Photo By: P. Gardner



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-4 (0.0-6.6 feet). Photo By: P. Gardner



Photo Date: 2/21/2018 NGWSP, SJWTP, TPWTP3-18-4 (0.0-6.6 feet). Photo By: P. Gardner



Photo Date: 2/22/2018 NGWSP, SJWTP, TP-18-5 (0.0-10.9 feet). Photo By: P. Gardner

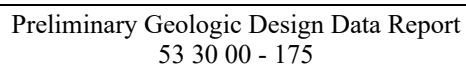


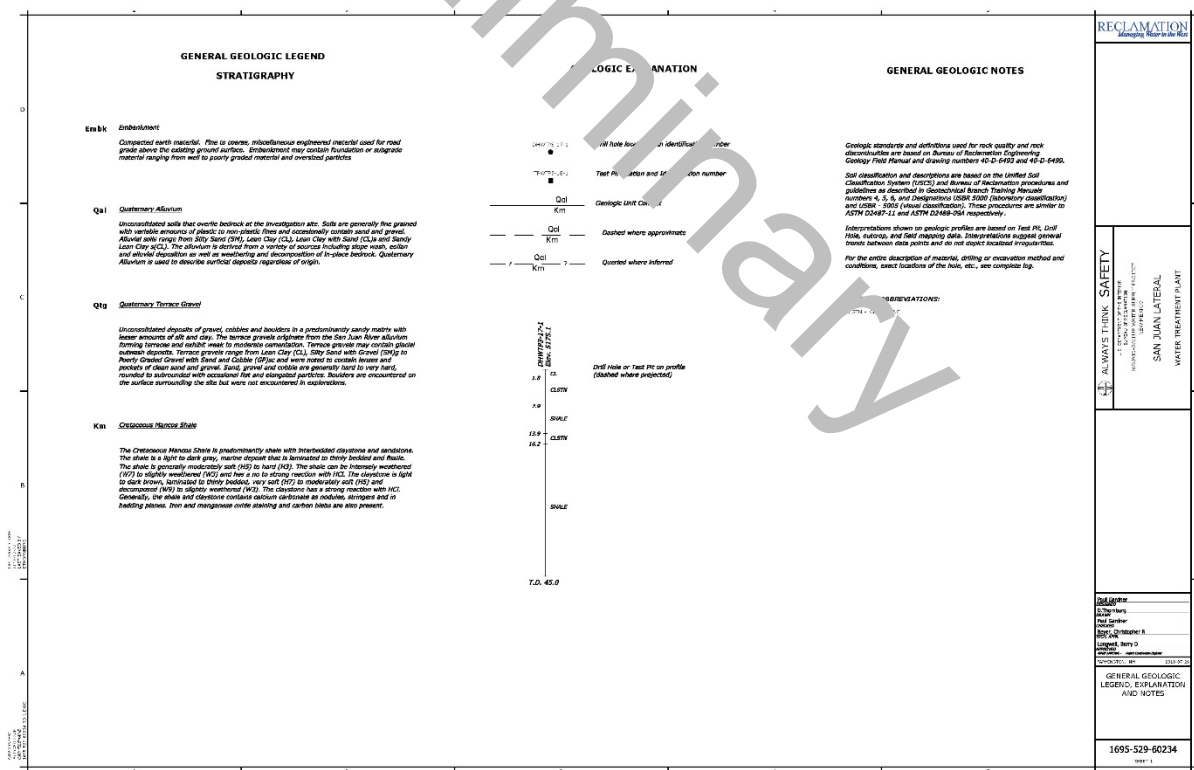
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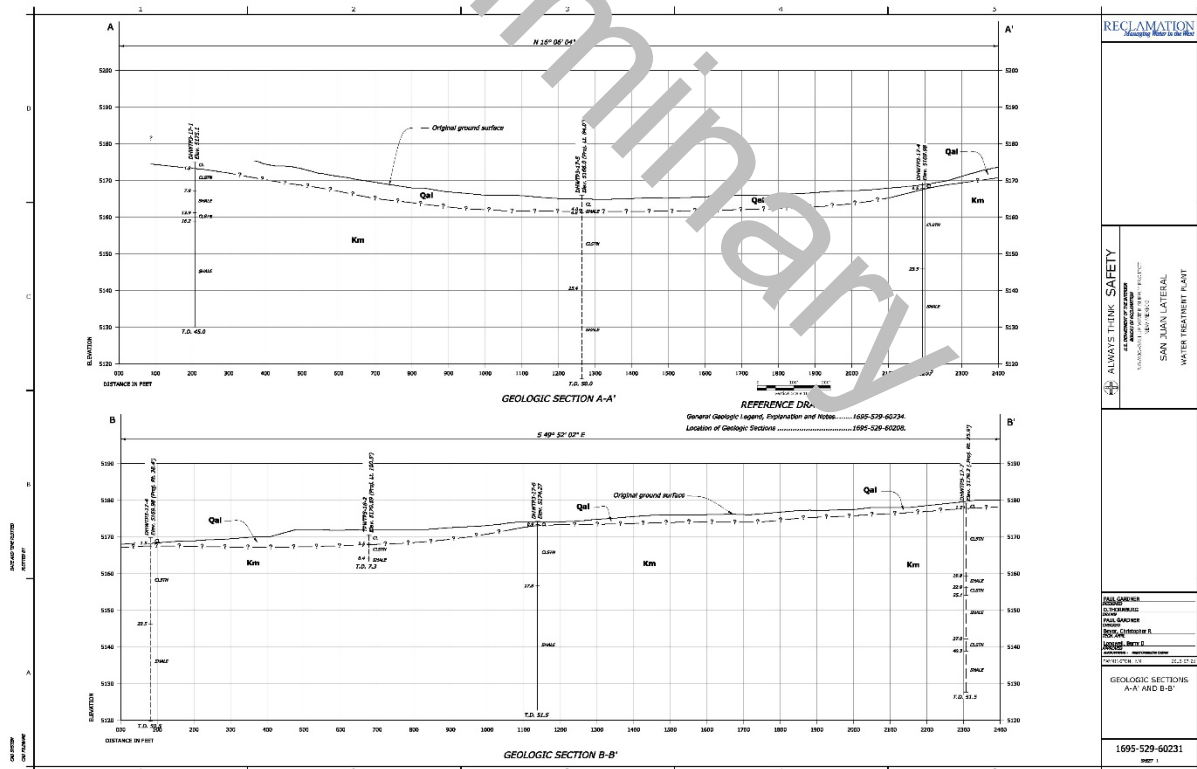
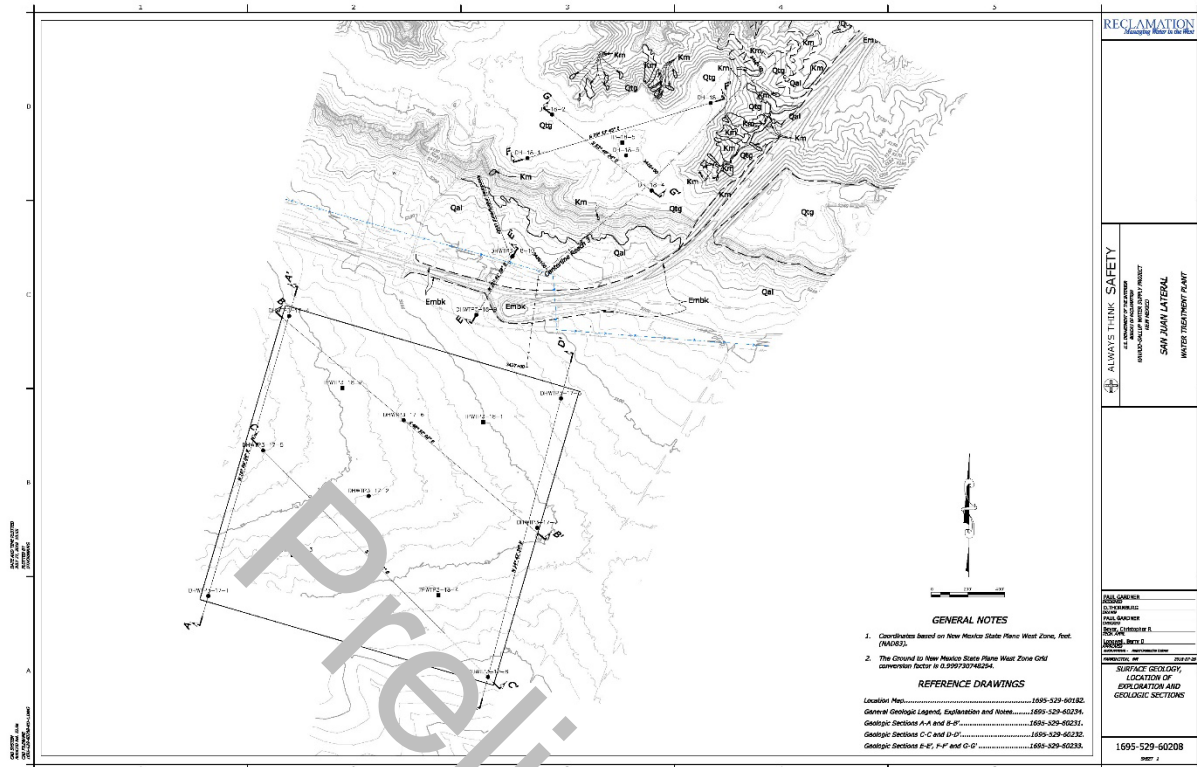
APPENDIX 4

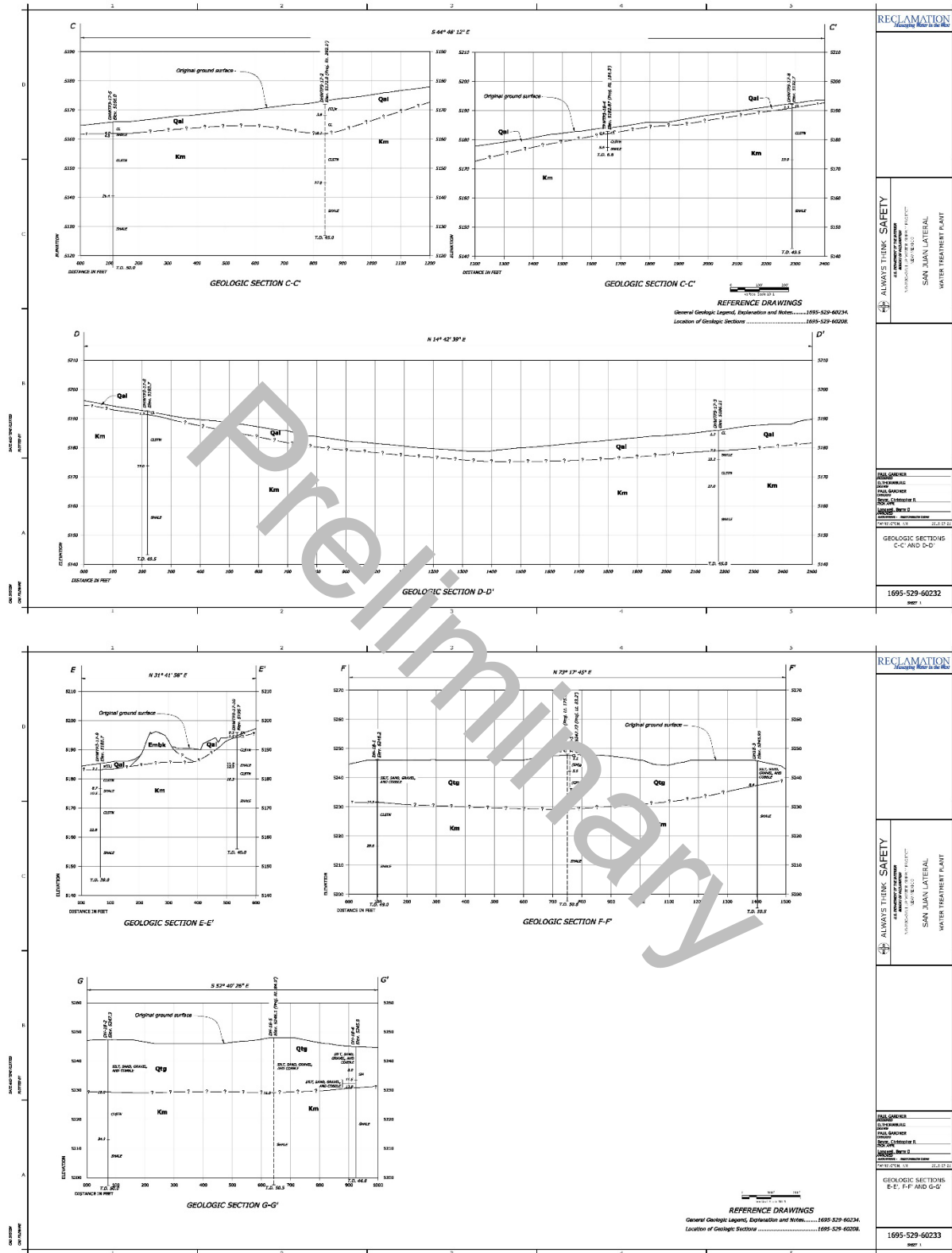
Preliminary

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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

Preliminary

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