RECLAMATION

Managing Water in the West

INDIAN SELF-DETERMINATION CONSTRUCTION CONTRACT FOR THE FISH BARRIER WEIR AT HOGBACK CANAL SAN JUAN RIVER RECOVERY IMPLEMENTATION PROGRAM NEW MEXICO

OCTOBER 1, 2012

CONTRACT NO. R13AV40003
VOLUME 2 OF 2

WESTERN COLORADO AREA OFFICE – GRAND JUNCTION,
GRAND JUNCTION, COLORADO

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 GENERAL

1.01 REQUIREMENT

A. Construct and complete the Hogback Canal Fish Barrier Weir, San Juan River Recovery Implementation Program - New Mexico, in accordance with contract provisions and clauses, these specifications, and drawings listed in Section 01011, Table 01011A, “List of Drawings."

1.02 LOCATION

A. The work is located approximately 18 miles west of Farmington, New Mexico in San Juan County on the Navajo Reservation.

1.03 SCHEDULE

A. The Hogback Canal supplies irrigation water to the farms, orchards, pastures and subdivisions along the length of the canal.

B. The flow of water in the canal will be terminated by Navajo Nation, Department of Water Resources (DNR) and the canal will be made available to the Contractor in an “as is” condition by approximately October 31, 2012.

C. Beginning approximately March 22, 2013, DNR may divert water into the Hogback Canal.

D. The Contractor shall complete all contract work by April 8, 2013.

1.04 PRINCIPAL COMPONENTS OF THE WORK

A. DIVISION 01 - GENERAL REQUIREMENTS

1. Specific administrative requirements, procedural requirements, temporary facilities, temporary construction access and controls which apply to the execution of the work of all sections of the specifications.

B. DIVISION 02 - SITEWORK

1. Removing existing canal lining.
2. Removing existing features.
3. Preparation and grading subgrades for site work.
4. Excavation.
5. Placing compacted backfill.

6. Clearing and grubbing for construction access and for general purposes.
7. Removing and Controlling Water for Construction Operations.
8. Furnishing and placing erosion protection.
9. Furnishing and placing controlled low strength materials.
10. Furnishing and placing gravel surfacing.
11. Furnishing and installing chain link fence.

C. DIVISION 03 - CONCRETE

1. Construct reinforced concrete structures including the weir wall and gate structure.
2. Furnishing and placing concrete lining.
3. Constructing a Control Building.

D. DIVISION 04 - MASONRY

Not Used

E. DIVISION 05 - METALS

1. Furnishing and installing miscellaneous embedded metalwork.
2. Furnishing and installing guardrail.
3. Furnishing and installing W-beam guardrail.
4. Furnishing and installing heavy duty grating.
5. Furnishing and installing adjustable weir blades and vent pipes.
6. Furnishing and installing different types of ladders and safety cables with floats.
7. Furnishing and installing flap gates.
8. Modifying the existing trashracks.

F. DIVISION 06 - WOOD AND PLASTIC

1. Not Used

G. DIVISION 07 - THERMAL AND MOISTURE PROTECTION

1. Furnishing and installing sponge rubber filler and sealants.

H. DIVISION 08 - DOORS AND WINDOWS

1. Furnishing and installing a bullet proof door in the Control Building.

I. DIVISION 09 – FINISHES

1. Prepare surfaces of the modified trashracks prior to furnishing and applying coatings.

J. DIVISION 10 - SPECIALITIES

Not Used

K. DIVISION 11 – EQUIPMENT

1. Furnishing and installing radial gates.
2. Furnishing and installing various sizes of side gates.
3. Furnishing and installing slotted baffles.
4. Furnishing and installing dual leaf gates.

L. DIVISION 12 - FURNISHINGS

Not Used

M. DIVISION 13 - SPECIAL CONSTRUCTION

Not Used

N. DIVISION 14 - CONVEYING SYSTEMS

1. Furnishing and installing radial gate hoists.

O. DIVISION 15 - MECHANICAL

Not Used

P. DIVISION 16 - ELECTRICAL

1. Furnishing and installing a Complete AC Electrical System.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01011 - DRAWINGS AND LIST OF 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”.

B. In accordance with clause at FAR 52.236-21 “Specifications and Drawings for Construction,” in case of discrepancies, specifications take precedence over drawings unless otherwise specified.

1.02 PROJECT CONDITIONS

A. Where there are minor 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 TYPICAL DRAWINGS

A. Typical drawings show installations and details of construction which are similar to or approximate to those that are part of work under these specifications. Dimensions and details shown on typical drawings may vary from those shown on construction drawings to be furnished after award of contract.

B. Use typical drawings for bidding purposes only.

1.04 INFORMATIONAL DRAWINGS

A. Some drawings are marked "for information only" in the drawing list and are included to show some feature about which additional knowledge is required for bidding.

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.

1.05 COPIES OF DRAWINGS

A. One set of full-size (22- by 34-inches) drawings, except standard drawings, will be furnished to the Contractor for construction purposes.

B. Upon request, additional half-size (11- by 17-inches) copies of standard drawings will be furnished to the Contractor for construction purposes.

1.06 LIST OF DRAWINGS

A. Drawings listed in Table 01011A - List of Drawings, are made a part of these specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

TABLE 01011A - LIST OF DRAWINGS

Sheet No.	Drawing No. Figure No.	Title
DRAWINGS:		
1	3704-417-1	Maps
2A	3704-417-2A	General Location Map
2B	3704-417-2B	Lower Canal, Site Plan , Sheet 1 of 2
2C	3704-417-2C	Headworks, Site Plan, Sheet 2 of 2
3	3704-D-3	General Plan, Sheet 1 of 7
4	3704-D-4	Upstream Walls, Plan and Sections, Sheet 2 of 7
5	3704-D-5	Gate Structure, Plan and Sections, Sheet 3 of 7
6	3704-D-6	Gate Structure, Section and Details, Sheet 4 of 7
7	3704-D-7	Gate Structure, Sections and Details, Sheet 5 of 7
8	3704-D-8	Gate Structure, Sections and Details, Sheet 6 of 7
9	3704-D-9	Adjustable Weir Plate, Sections and Details, Sheet 7 of 7
10	3704-D-10	W-Beam Guardrail, Sections and Details
11	3704-D-11	Concrete Structures, General Notes and Joint Details
12	Omitted	Drawing not used
13	3704-D-13	Trashrack Modification, Lower Trashrack Panels, Details
14	3704-417-14	Static Frame for Flap Gate, View and Sections, 1 of 2
15	3704-417-15	Dynamic Flap Gate, View and Sections, 2 of 2
16	3704-417-16	Slotted Baffles and Flow Restriction Angles, Typical Sections
17	3704-417-17	Control Building, Plans and Sections
18	3704-417-18	Guardrail, Fence Overhangs and Safety Cables, Views, Sections and Details
19	3704-417-19	Water Level Sensors, Elevations and Section
20	3704-417-20	Grounding, Electrical Conduits and Hydraulic Tubing, Plan View
21	3704-417-21	Electrical System and New Guardrails at Headworks, Plan View
22	3704-417-22	Panelboard Schedules for Control Building, Tables

Sheet No.	Drawing No. Figure No.	Title
23	3704-417-23	Panelboard Schedule for Headworks and Project Conduit and Cable Schedule, Tables

STANDARD DRAWINGS:

24	40-D-4334	Typical Grounding Details - Sheet 1 of 2
25	40-D-4335	Typical Grounding Details - Sheet 2 of 2
26	40-D-4753	Grounding Details
27	40-D-6032	Induction Motors – Design and Nameplate Data to be Furnished by the Contractor
28	40-D-6234	Standard Nameplates
29	40-D-6263	General Notes and Minimum Requirements for Detailing Reinforcement
30	40-D-6376	Fencing Grounding Details, Fence Grounding Installation
31	40-D-6460	Safety Ladder for Concrete Lined Canal
32	40-D-6463	PVC Waterstops – 6”, 9” & 12” Types
33	40-D-6576	Buried Conduit for Low Voltage Cable – Typical Details
34	40-D-6591	Miscellaneous Metalwork – Side Mounted Pipe Guardrails
35	40-D-6592	Miscellaneous Metalwork – Top Mounted Pipe Guardrails
36	40-D-6602	Miscellaneous Metalwork – Type 3 Ladder
37	40-D-7012	General Concrete Outline Notes
38	40-D-7016	Chain Link Fencing – Chainlink Fencing Requirements – Soil Installation
39	40-D-7017	Chain Link Fencing – Chainlink Fencing Requirements – Concrete Installation
40	104-D-757	Designations And Symbols
41	104-D-1150	Device Designations and Symbols to be used on Single-Line and Schematic Diagrams
42	104-D-1165	Main Control Board CSA - Panel 7R - Wiring Diagram

DRAWINGS – FOR INFORMATION ONLY:

43	809-D-5723	Trashrack, Installation, Guides, Details, Sheet 1 of 2
44	809-D-5724	Trashrack, Panels, Details, Sheet 2 of 2
45	122-DC-341	Check & Sluice Way, Main Canal, Sheet 1 of 4
46	122-DC-342	Weir Wall & Rad. Gates, Main Canal, Sheet 2 of 4
47	122-DC-343	Sections of Sluice Way, Main Canal, Sheet 3 of 4
48	122-DC-344	Details, Main Canal, Sheet 4 of 4

END OF SECTION

SECTION 01017 - CONTRACTOR USE OF PREMISES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Land use and landscape rehabilitation plan:

a. For each site of land to be impacted by Contractor use.

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

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

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

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

d) First-aid and medical facilities.

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

f) Temporary fences.

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

3) Describe methods to protect, and repair if damaged, existing improvements and utilities at or near the jobsite.

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

b. Submit revised drawings of changes in use of used land made as required.

1.03 PROJECT CONDITIONS

A. The Contractor will be permitted to use land as shown on Drawing No. 3704-417-2B and -2C, for field offices, construction plants and buildings, storage yards, shops, roadways, spoil areas, and other construction facilities required for construction purposes.

B. The Contractor shall not store equipment, fuel or any hazardous materials within the floodplain of the San Juan River.

C. Such use of project land shall not impede nor interfere with intermittent travel on the existing Hogback Canal O&M road used by the Department of Water Resources (DNR) or other landowners in the vicinity, nor with their agents. See Section 01550 (Roadways, Areas, and Haul Routes).

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

E. Location, construction, operation, maintenance, and removal of construction facilities on project land will be subject to approval of the CO.

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 RESTORATION

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

B. Scarify and regrade, after completion of work, land 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 natural revegetation, provide proper drainage, and prevent erosion.

END OF SECTION

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Mobilization and Preparatory Work:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall in accordance with the clause at WBR 1452.232-81 "Payment for Mobilization and Preparatory Work."

1.02 RELATED REQUIREMENTS

A. FAR 52.232-5 Payments Under Fixed-Price Construction Contracts

B. WBR 1452.232-81 Payment for Mobilization and Preparatory Work

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01050 - SURVEYING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Quantity survey notes and computations:

a. Copies required for progress payment. Include itemized statement for work covered by notes and computations.

2. Workday's survey notes:

a. Copies when requested by Government.

1.03 PRIMARY CONTROL

A. The Government has established primary control to be used for establishing work lines and grades.

B. Primary control consists of bench marks and horizontal control points in work vicinity.

C. The Government will provide complete listing and identification of primary control within 15 days after issuance of Notice to Proceed.

D. Check and verify primary control and resolve discrepancies with Government before beginning work.

E. Preserve and maintain primary control points until otherwise authorized. Government may reestablish damaged or destroyed primary control points and backcharge reestablishment cost to the Contractor.

1.04 QUALIFICATIONS

A. Surveyors: Experienced construction surveyors under supervision and direction of engineer or surveyor with minimum of 2 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 and equipment required for surveying work, including, but not limited to, instruments, stakes, spikes, steel pins, templates, platforms, and tools.

B. Except as required to be incorporated in work or left in place, surveying materials and equipment will remain property of Contractor.

PART 3 EXECUTION

3.01 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.

3.02 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 the Government to determine final quantities of work in place. Final payment quantities will be based on the Government's original terrain data and submitted survey notes and computations.

C. Perform quantity surveys in presence of an authorized Government representative, unless specifically waived. Notify the Government at least 24 hours before performing a quantity survey.

3.03 SURVEY REQUIREMENTS

A. Alignment 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, restake every 10 feet in elevation.

C. Structures: Stake out of structures and checkouts before and during construction.

D. Roads: Blue tops each 50 feet on tangent and each 25 feet on curves.

E. Cross-sections: Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys.

F. As-builts: As required for structures and other features of work.

3.04 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 0.10 foot, horizontally and vertically.
5. Vertical Elevation Surveys: Close within 0.05 foot times the square root of the circuit length in miles.

3.05 FIELD RECORDS

A. Record original field notes, computations, and other surveying data in fieldbooks.

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. Notes may be collected on an electronic data collection device with prior approval of the Contracting Officer.

1. Submit electronic files of notes in approved format.
2. Submit paper copies of notes.

END OF SECTION

SECTION 01095 - REFERENCE SPECIFICATIONS AND STANDARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCES

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

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

1.03 JOBSITE REFERENCES

A. Maintain at fabrication site, a copy of referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by the Government.

B. Maintain onsite, a copy of referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by the Government.

1.04 AVAILABILITY

A. Code of Federal Regulation (CFR):

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

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

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service, see the provision at FAR 52.211-1, "Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29."

2. Copies of Military Specifications may be obtained from Department of Defense, see the provision at FAR 52.211-2, “Availability of Specifications, Standards, and Data Item Descriptions Listed in the Acquisition Streamlining and Standardization Information System (ASSIST)”.

C. Bureau of Reclamation Documents:

1. Printed copies of Reclamation Safety and Health Standards (RSHS), stock number 024-003-00190-2, may be purchased from the Superintendent of Documents at the U.S. Government Printing Office, phone number (202) 512-1800. RSHS may be downloaded at http://www.usbr.gov/ssle/safety/RSHS/rshs.html

   a. Printed copies of RSHS are dated 2001. Electronic versions of the RSHS are dated 2002. These documents are identical. These specifications use the 2001 date.

2. Bureau of Reclamation Standard Specifications are designated with an M-series number. Copies of these documents may be obtained from Bureau of Reclamation, Attn 86-68170, PO Box 25007, Denver CO 80225-0007.

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

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

4. Bureau of Reclamation was officially named Water and Power Resources Service for a short period. References to Water and Power Resources Service or any derivative form are synonymous with Bureau of Reclamation.

D. Industrial and Governmental Documents

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

2. Addresses for obtaining industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in table 01095A - Addresses for Specifications, Standards, and Codes.

Table 01095A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW, Suite 249 Washington, DC 20001 www.aashto.org	(202) 624-5800 (800) 231-3475

Table 01095A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AGC	Associated General Contractors of America 333 John Carlyle Street, Suite 200 Alexandria VA 22314 www.agc.org	(703) 548-3118
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001 www.aisc.org	(312) 670-2400
ANSI	American National Standards Institute 1819 L. Street, N.W. Washington, DC 20036 www.ansi.org	(202) 293-8020
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	(253) 565-6600
ASME	American Society of Mechanical Engineers 3 Park Ave. New York, NY 10016-5990 www.asme.org	(800) 843-2763
ASTM	ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(601) 832-9585
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 www.chainlinkinfo.org	(301) 596-2583
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave.,17th Floor New York, NY 10016-5997 www.ieee.org	(212) 419-7900

Table 01095A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
NACE	NACE International 1440 South Creek Drive Houston, TX 77084 www.nace.org	(281) 228-6200
NEMA	National Electrical Manufacturers Association 1300 N 17th St., Suite 1847 Rosslyn, VA 22209 www.nema.org	(703) 841-3200
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org	(800) 344-3555 (617) 770-3000
SSPC	SSPC: The Society for Protective Coatings 40 24th St., 6th Floor Pittsburgh, PA 15222-4656 www.sspc.org	(800) 837-8303 (412) 281-2331
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062-2096 www.ul.com	(847) 272-8800

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01130 - PROTECTED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 PROJECT CONDITIONS

A. Certain native species on the Navajo Nation are protected plant or animal species under Tribal law(s). The Government has ascertained that 8 (bluehead sucker, flannelmouth sucker, mottled sculpin, roundtail chub, Colorado pikeminnow, speckled dace, razorback sucker, and bald eagle) are protected species which may exist in the areas to be disturbed by construction activities.

B. Insert this section in subcontracts which involve performance of work in areas where protected species may occur.

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01132 - ENDANGERED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 ENDANGERED SPECIES

A. Certain native species in the State of New Mexico are Federally listed as threatened or endangered plant or animal species. The Contracting Officer has ascertained that 3 (razorback sucker, Colorado pikeminnow, and Southwestern willow flycatcher) are endangered species which may exist in the areas to be disturbed by construction activities.

1.03 DELAYS AND CHANGES

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

1.04 SUBCONTRACTS

A. The Contractor shall insert this section in all subcontracts which involve the performance of work in areas where threatened or endangered species may occur.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 NOTIFICATION

A. If, in the performance of this contract, evidence of the possible occurrence of any Federally listed threatened or endangered species is encountered, notify the Contracting Officer immediately, giving the location and nature of the findings.

B. Forward written confirmation to the Contracting Officer within 2 days.

C. Do not disturb any threatened or endangered species during construction operations, and provide such cooperation and assistance as may be necessary to preserve and protect the species.

END OF SECTION

SECTION 01305 - SUBMISSION OF MATERIAL SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 DEFINITIONS

A. LHM: List of Hazardous Materials

B. MSDS: Material Safety Data Sheet.

1.03 APPLICATION

A. For the purposes of this contract, the definition of "materials delivered under this contract" in the clause at FAR 52.223-3 "Hazardous Material Identification and Material Safety Data" Alternate 1 includes materials delivered to the Government and all materials expected to be used during contract performance at the jobsite.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and List of Submittals.

1. Complete LHM and MSDS.
2. Updated LHM and MSDS:
    a. Comply with paragraph (e) of clause at FAR 52.223-3 "Hazardous Material Identification and Material Safety Data" Alternate 1.
    b. Submit the updated LHM and completed MSDS and identification and certification for each material to the Chief, Design & Construction Group, Bureau of Reclamation, Western Colorado Area Office, Grand Junction CO.

1.05 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on the original or previously updated LHM and MSDS before receipt of updated LHM and MSDS by Chief, Design and Construction Group, Bureau of Reclamation, Western Colorado Area Office, Grand Junction CO.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01330 – SUBMITTALS AND LIST OF SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 DEFINITIONS

A. Days: Calendar days.

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

C. Submittal Types, as listed in Table 01330A – List of Submittals:

1. A – Approval:
    a. Government approval is required.
    b. Within the terms of the clause at FAR 52.236-21 "Specifications and Drawings for Construction," Approval submittals are considered to be "shop drawings."
2. I – Informational:
    a. Government approval is not required.
    b. Within the terms of the clause at FAR 52.236-21 "Specifications and Drawings for Construction," Informational submittals are not considered to be "shop drawings."
    c. The Government may return an Informational submittal or ask for additional information when an Informational submittal does not comply with the specifications.

D. CO indicates Contracting Officer

E. CDCG indicates Chief Design and Construction Group.

1.03 SUBMITTAL REQUIREMENTS

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

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.

3. Measurement units: US Customary Units.

C. Drawings:

1. Minimum identification in title block:
   a. Contract number and title.
   b. Contractor's or supplier's title and drawing number.
   c. Date.
2. Allow space for review stamps.
3. Size: D size (22 inches by 34 inches) or smaller.
4. Draw to scale with neat lettering using drafting equipment or computer drafting equipment.
5. Final drawings:
   a. AutoCAD® format (.dwg) or Drawing Transfer Format (.dxf) on CD-ROM disc.
   b. Original D size (22 inches by 34 inches) plots.
   c. Show as-built changes, including revision dates, made during installation.

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 out items that do not apply.

E. Certifications:

1. Submittals requiring certification by a registered professional: Signed and sealed by registered professional.
2. Manufacturer’s certifications: Signed by authorized representative of manufacturer.

F. Manuals:

1. Copies: Bound and indexed.
2. Contents:
   a. Parts identification lists, lists of special tools, and accessories.
   b. Schematics and wiring diagrams.

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

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

G. 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.

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. The Government will select architectural color and pattern after product approval.

1.04 SUBMITTAL 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 01330A - List of Submittals. A complete set includes all listed items for RSNs with multiple parts.

C. Submit number of sets specified in "No. of sets to be sent to:" columns in Table 01330A - List of Submittals.

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. More than one RSN may be submitted under a transmittal letter, provided the responsible code is the same.

1.05 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 15 days for review of each submittal or resubmittal, unless otherwise specified.

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

B. Time in Excess of Specified:

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

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

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

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

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

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

   a. Approval was required under the contract, and

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

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

C. Return of Submittals:

1. One set of submittals required for approval will be returned either approved, approved subject to identified changes, or not approved.

2. Submittals not approved:

   a. Revise and resubmit for approval.

   b. Show changes and revisions with revision date.

   c. Describe reasons for significant changes in transmittal letter.

   d. Resubmit returned submittals within 15 days after receiving the comments, unless otherwise specified.

   e. Requirements for initial submittals apply to resubmittals.

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

4. The Government will acknowledge Informational submittals.

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

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

1.06 TRANSMITTAL

A. Addresses for codes listed in Table 01330A - List of Submittals:

1. Contracting Officer, Bureau of Reclamation, 125 South State Street, Room 6107, Salt Lake City UT 84138-1147

2. Chief Design and Construction Group, Bureau of Reclamation, 2764 Compass Drive, Suite 106, Grand Junction CO 81506.

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01330A – List of Submittals.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not the responsible code, but show "No. of sets to be sent to" in Table 01330A – List of Submittals.

D. When "No. of sets to be sent to" is 0, send a copy of transmittal letter to that office.

E. Submittals required by the specifications, but not listed in Table 01330A - List of Submittals:

1. Submit in accordance with this section.

2. Submit to Chief Design and Construction Group, Bureau of Reclamation, 2764 Compass Drive, Suite 106, Grand Junction CO 81506, unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
I-1	Payrolls and Basic Records I.28 (FAR 52.222.08)	Payrolls	Weekly	I	CDCG	0	1
		Statement of Compliance	Weekly	I	CDCG	0	1
I-2	Subcontracts I.31 (FAR 52.222-11)	List of Subcontracts	Within 14 days after award of contract, and within 14 days after award of any subcontract	A	CO	1	1
		Statement and Acknowledgment Form (SF-1413) for each subcontract	Within 14 days after award of contract, and within 14 days after award of any subcontract	A	CO	1	1
I-3	Preservation of Cultural Resources (FAR 52.223-3)	Maps showing locations of pits, borrow areas or commercial sources	Submitted and approved prior to use of pits, areas or borrow sources.	A	CDCG	0	3
I-4	Schedules for Construction Contracts (FAR 52.236-15)	Blackline Prints	Within 7 days after award of Notice to Proceed	A	CO	1	4
01017-1	Contractor use of Premises	Land use and landscape rehabilitation plan	At least 15 days before use of land	I	CDCG	0	4
01050-1	Surveying	Quantity survey notes and computations	Accompanying progress payment requests	I	CDCG	0	1
01050-2	Surveying	Workday's survey notes	At conclusion of workday if requested by Government	I	CDCG	0	1
01305-1	Material Safety Data Sheets	Complete LHM and MSDS	At least 15 days before jobsite delivery of hazardous material	I	CDCG	0	1
01305-2	Material Safety Data Sheets	Updated LHM and MSDS	At least 15 days before jobsite delivery of hazardous material not previously listed	I	CDCG	0	1

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
01527-1	Safety and Health (WBR 1452.223-81) and 01527	Safety program	Submitted at least 7 days prior to Preconstruction Meeting. Safety Program shall be approved or conditionally approved before commencing onsite work. See section 3 of RSHS	A	CDCG	1	5
01527-2	Safety and Health (WBR 1452.223-81) and 01527	Monthly accident summary report Form 7-2218 or other acceptable form (UC-103) in accordance with paragraph 3.8 of USBR RSHS	First day of each month. See paragraph 3.8 of RSHS.	I	CDCG	0	3
01529-1	First Aid	Medical Facilities Plan	Submitted and approved before start of operations	A	CDCG	0	3
01529-2	First Aid	Certificate Cards	Submitted before start of operations	I	CDCG	0	3
01561-1	Cleaning	Hazardous Waste production and disposal record	When applicable, within 7 days of hazardous waste disposal	I	CDCG	0	3
01561-2	Cleaning	Hazardous Waste Manifest	When applicable, within 7 days after disposing of waste	I	CDCG	0	3
01561-3	Cleaning	Environmental Consultant resume	When applicable, at least 15 days prior to performing environmental assessment	I	CDCG	0	3
01561-4	Cleaning	Environmental site assessment	When applicable, within 14 days of completion of work	I	CDCG	0	3
01566-1	Pesticides	Pesticide use plan	At least 15 days before application of first pesticide	A	CDCG	0	3
01566-2	Pesticides	Pesticide use plan for “restricted use” chmicals	At least 30 days before application of “restricted use” pesticides	A	CDCG	0	3
01569-1	Water Pollution Control	Pollution prevention plan	At least 30 days before start of onsite construction work	A	CDCG	0	4

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
01569-2	Water Pollution Control	Spill Prevention Control and Countermeasure Plan (SPCC)	At least 30 days before delivery or storage of oil	I	CDCG	0	4
01592-1	Protection of Real Estate Crossed by Right-of-Way	Notice from landowner of the damages off the right-of-way caused by the Contractor's action under this contract	Within 30 days of the Contractor's knowledge of damage.	I	CO	1	2
01600-1	Product Requirements	Written requests to deviate from, or use materials not covered by recognized specifications or standards	At least 30 days prior to shipment of materials.	A	CDCG	0	4
01600-2	Product Requirements	Written requests to use substitute materials	At least 30 days prior to shipment of materials.	A	CDCG	0	4
01600-3	Product Requirements	Copies of purchase orders	At least 30 days prior to shipment of materials.	A	CDCG	0	4
02222-1	Off-site Earth Materials	Maps showing locations of pits, borrow areas or commercial sources	Submitted and approved prior to use of pits, areas or borrow sources.	A	CDCG	0	3
02243-1	Removal and Control of Water	Removal and Control of Water Plan	At least 15 days prior to commencing on-site water removal activities.	I	CDCG	0	4
02274-1	Erosion Protection	Riprap borrow area locations for cultural resources	Submitted and approved prior to use of pits, areas or borrow sources.	A	CDCG	0	3
02274-2	Erosion Protection	Riprap approval data	At least 30 days prior to producing riprap materials.	A	CDCG	0	3
02274-3	Erosion Protection	Alternate erosion protection approval data	At least 15 days prior to producing alternate erosion product materials.	A	CDCG	0	3
02323-1	Controlled Low Strength Materials (CLSM)	Approval data	At least 15 days prior to using mix.	A	CDCG	0	3
02342-1	Geotextile	Approval data	At least 15 days prior to procuring geotextile.	A	CDCG	0	3

Table 01330A. - List of Submittals

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** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
03156-1	PVC Waterstop	Approval data	At least 15 days prior to procuring waterstop materials.	A	CDCG	0	3
03200-1	Concrete Reinforce-ment	Reinforcement diagrams and Lists	At least 15 days prior to placing concrete.	I	CDCG	0	3
03301-1	Cast-in-Place Concrete	Approval data	At least 15 days prior to placing concrete	A	CDCG	0	3
03301-2	Cast-in-Place Concrete	Method of repair	At least 15 days prior to making concrete repairs	A	CDCG	0	3
03301-3	Cast-in-Place Concrete	Mix design	At least 15 days prior to placing concrete	A	CDCG	0	3
03301-4	Cast-in-Place Concrete	Epoxy grout	At least 15 days prior to using epoxy grout	A	CDCG	0	3
03301-5	Cast-in-Place Concrete	Approval data for Control Building	At least 30 days prior to fabrication of the Control Building, if precast.	A	CDCG	0	3
03600-1	Grouting Mortar for Equipment and Metalwork	Approval data	At least 15 days prior to using grout.	A	CDCG	0	3
07925-1	Sealants	Approval data	At least 15 days prior to procuring sealant materials.	A	CDCG	0	3
08115-1	Bullet-Resistant Steel Doors and Frames	Approval Drawings	At least 15 days prior to procuring door.	A	CDCG	0	3
08115-2	Bullet-Resistant Steel Doors and Frames	Approval data	At least 15 days prior to procuring door.	A	CDCG	0	3
08115-3	Bullet-Resistant Steel Doors and Frames	Manufacturer's instructions	At least 15 days prior to procuring door.	A	CDCG	0	3
09908-1	Coatings	Approval data	At least 15 days prior to procuring coatings.	A	CDCG	0	3
09908-2	Coatings	Applicators qualifications	At least 15 days prior to applying coatings.	A	CDCG	0	3

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
09908-3	Coatings	Approval data for coating materials proposed as "equal" products	At least 30 days prior to procuring "equal" coatings.	A	CDCG	0	3
09971-1	Metallizing	Applicators qualifications	At least 15 days prior to applying coatings.	A	CDCG	0	3
11280-1	Radial Gates	Approval data	At least 30 days prior to radial gate fabrication.	A	CDCG	0	3
11280-2	Radial Gates	Final data	Not more than 15 days after installing radial gates.	I	CDCG	0	6
11285-1	Slotted baffles	Approval data	At least 30 days prior to fabricating slotted baffles.	A	CDCG	0	3
11285-2	Slotted baffles	Final data	Not more than 15 days after installing slotted baffles.	I	CDCG	0	6
11286-1	Dual Leaf Gates	Approval data	At least 30 days prior to fabricating dual leaf gates.	A	CDCG	0	3
11286-2	Dual Leaf Gates	Final data	Not more than 15 days after installing dual leaf gates.	I	CDCG	0	6
11288-1	Slide gates	Approval data	At least 30 days prior to fabricating slide gates.	A	CDCG	0	3
11288-2	Slide gates	Final data.	Not more than 15 days after installing slide gates.	I	CDCG	0	6
13427-1	Water Level Sensors	Approval data	At least 30 days prior to procuring water level sensors.	A	CDCG	0	6
14611-1	Radial Gate Hoists	Approval data	At least 30 days prior to fabricating radial gate hoists.	A	CDCG	0	3
14611-2	Radial Gate Hoists	Final data	Not more than 15 days after installing radial gate hoists	I	CDCG	0	6
14614-1	Gate Actuators and Control Panels	Approval data	At least 30 days prior to fabricating gate actuators and control panels.	A	CDCG	0	3

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer and CDCG indicates Chief, Design and Construction Group.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **	
						CO	CDCG
14614-2	Gate Actuators and Control Panels	Final data	Not more than 30 days after installing gate actuators and control panels.	A	CDCG	0	6
16051-1	Electrical Drawings and Data	Informational drawings and data	At least 30 days prior to purchasing electrical equipment	I	CDCG	0	3
16051-2	Electrical Drawings and Data	As-built drawings	Not more than 15 days after installing electrical equipment	I	CDCG	0	6
16051-3	Electrical Drawings and Data	Final drawings	Not more than 30 days after installing electrical equipment	I	CDCG	0	6
16051-4	Electrical Drawings and Data	Operation and Maintenance Instruction Books	Not more than 30 days after installing electrical equipment	I	CDCG	0	6
16081-1	Wiring Checkout and Tests	Results of Ground Resistance Test	Not more than 15 days after conducting test	I	CDCG	0	3
16240-1	Battery Equipment	Approval data	At least 15 days prior to purchasing equipment	A	CDCG	0	3
16240-2	Battery Equipment	Final data	At least 15 days prior to purchasing equipment	A	CDCG	0	6
16441-1	Distribution Panelboards	Informational drawings and data	At least 15 days prior to purchasing distribution panelboards	I	CDCG	0	3
16444-1	Control Panels	Informational drawings and data	At least 15 days prior to purchasing control panels	I	CDCG	0	3
16444-2	Control Panels	Operation and Maintenance Instruction Books	Not more than 30 days after installing control panels	I	CDCG	0	6

END OF SECTION

SECTION 01512 - TEMPORARY ELECTRICITY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCES

A. (OSHA) Occupational Safety and health Act Standards

B. (NEC) NFPA 70-08 National Electrical Code

C. ANSI/IEEE C2-2002 National Electrical Safety Code (NESC)

D. NECA- standard of installation

E. Uniform Building Code

F. Uniform Fire Code

1.03 TEMPORARY ELECTRICITY

A. Provide required electric power for construction.

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

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01514 - TEMPORARY WATER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 TEMPORARY WATER

A. Provide water required for construction purposes.

B. Water from the San Juan River will be available for earthwork operations at a point near the Headworks or at the Sluice Channel.

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

D. Provide means of conveying water to points of use.

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01527 - SAFETY AND HEALTH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

a. Available on the Internet at:
http://www.usbr.gov/ssle/safety/RSHS/rshs.html.

b. Hard copies available from:

The Government Printing Office
Superintendent of Documents
North Capitol and H St. N. W.
MS-SSMC - Room 566
Washington, D.C. 20401
(202) 512-1800
(Stock item GPO-024-003-00190-2)

c. Printed copies of RSHS are dated 2001. Electronic versions of the RSHS are dated 2002. These documents are identical. These specifications use the 2001 date.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Safety program:

a. Written safety program in accordance with Section 3 of USBR RSHS.

2. Monthly accident summary report:

a. Form 7-2218 or other acceptable form in accordance with paragraph 3.8 of USBR RSHS.

1.04 PROJECT CONDITIONS

A. Comply with USBR RSHS.

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

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

C. Do not require persons employed in performance of this contract, including subcontracts, to work under conditions which are unsanitary, hazardous, or dangerous to the employee's health or safety.

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

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

1. Death.
2. Occupational disease.
3. Traumatic injury to employees or the public.
4. Property damage in excess of $2,500.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01529 - FIRST AID

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCE

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

1.03 SERVICE

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

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

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

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Medical Facilities Plan:

a. Describe facilities for providing medical attention for injured or disabled employees.

b. Include onsite emergency facilities and ambulance service.

2. Certificate Cards:

a. Qualifications of employee designated to render first aid and cardiopulmonary resuscitation (CPR) in a competent manner prior to start of operations.

1.05 AMBULANCE SERVICE

A. Arrange for dependable ambulance service in accordance with USBR RSHS, paragraph 5.4.

1.06 AVAILABILITY

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

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01536 – EXISTING FENCES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 FENCE REMOVAL

A. Remove existing fences where necessary for performance of the work, only when authorized by the CO. 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. Where existing chain link fence is removed at substations, protect openings made in existing chain link fencing to prevent unauthorized entry into substation area.

1. Provide temporary fencing or other approved means to protect openings, such that, entry through or over protection will entail no less difficulty than that provided by adjacent existing fencing.
2. Maintain temporary protection until openings are closed by permanent construction.

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

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

3.03 FENCE REBUILDING

A. Rebuild fences in as good or better as condition found.

END OF SECTION

SECTION 01538 - TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work, except as specified.
2. Costs for repair or treatment of injured vegetation and replacement of trees or shrubs are the Contractor's responsibility.

PART 2 PRODUCTS

2.01 REPLACEMENT TREES AND SHRUBS

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

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

PART 3 EXECUTION

3.01 PRESERVATION AND PROTECTION

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

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

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

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

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

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

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

1. For such use, wrap the trunk with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.
2. Submit requests to use trees for anchorage, except for emergencies. Include description of protective material.

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

3.02 REPAIR, TREATMENT, OR REPLACEMENT

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

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

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

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

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

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

END OF SECTION

SECTION 01550 - CONSTRUCTION ACCESS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Except as provided below, include the cost of complying with the requirements of this section and of providing, maintaining, and repairing roadways, areas, and haul routes as described in this section in the prices bid in the schedule for other items of work.

2. The cost of clearing and grubbing the construction access shall be included in the payment for Construction Access Clearing and Grubbing.

3. The cost of performing any excavation for construction access shall be included in the payment for Excavation.

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 DEFINITIONS

A. Areas

1. Areas means any parking or service areas existing or constructed for temporary or permanent use under the contract.

B. Maintenance

1. Maintenance means any work required or necessary to keep roadways, areas, and haul routes in a sound condition free of general debris, excavated material, construction material and equipment, products, mud, snow, and ice.

C. Repair

1. Repair means any work required or necessary to bring existing and permanently constructed roadways, areas, and haul routes to original or specified condition.

1.04 SITE CONDITIONS

A. The existing steel bridge crossing the Hogback Canal is not rated and shall not be used by the Contractor.

1. The Contractor will be required to provide suitable off-site earth materials to fill the canal adjacent to the existing bridge to provide vehicle access to the construction site.

B. Rights-of-way for access to work will be from existing roads.

1. In accordance with the 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 the Contractor when and as authorized by the CO.

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

PART 2 PRODUCTS

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 the CO.

C. Materials to maintain roadways and parking areas constructed under this contract and used by the 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 ESTABLISHED ROADWAYS AND PARKING AREAS

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

B. Do not allow heavy vehicles, construction equipment or construction traffic to cross the existing bridge over the Hogback Canal.

3.03 TEMPORARY ROADWAYS AND PARKING AREAS

A. Roadways:

1. Construct temporary roadways for access from public thoroughfares to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.

2. Construct temporary bridges or culverts at stream crossings or cross-drainage channels to allow for unimpeded surface drainage.

B. Parking Areas:

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

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

3. Locate as approved by the CO.

3.04 HAUL ROUTES

A. Perform work on rights-of-way 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. Do not use the existing bridge over the Hogback Canal for routing of vehicles hauling sand, gravel, or earth materials, or for intrajob hauling of loads.

D. Minimize interference with or congestion of local traffic.

E. Provide barricades, flaggers, and other necessary precautions for safety of the public where haul routes cross public highways or roads.

F. Provide and maintain signs indicating the existing bridge over the Hogback Canal is not to be used for construction traffic.

3.05 MAINTENANCE

A. Maintain roadways, parking areas, and haul routes in a sound, smooth condition.

B. Maintain roadbed, side slopes, and surfacing of roads and parking areas until completion and acceptance of all work under this contract. As approved by the CO, defer until latest practicable date within specified completion period, placement of surfacing on roads or parking areas subject to heavy and deteriorating use by the Contractor's construction operations or equipment.

C. Maintain surfacing of gravel-surfaced roads and parking areas in a smooth condition until completion and acceptance of all work under this contract.

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

3.06 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.

3.07 REMOVAL

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

END OF SECTION

SECTION 01555 - TRAFFIC CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost: Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Federal Highway Administration, Department of Transportation

1. MUTCD, Part 6 Part 6, Temporary Traffic Control, MUTCD 2000, Manual on Uniform Traffic Control Devices, 2003 Edition, with Revision No. 1, July 21, 2004 (http://mutcd.fhwa.dot.gov/)

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TRAFFIC CONTROL

A. Meet requirements of MUTCD, Part 6.

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 one lane of traffic through construction operations.

G. Construct temporary connections for one lane of traffic between existing roadway and new construction.

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

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

J. Remove traffic control devices when no longer needed.

3.02 DETOURS

A. The Contractor shall construct detours that will allow safe traffic flow during construction for the Department of Water Resources (DNR) and other landowners.

B. The Contractor shall maintain detours in a smooth, serviceable condition as long as they are used.

C. Remove the detours when they are no longer needed.

3.03 ROAD SURFACE MAINTENANCE

A. The Contractor shall also maintain and repair road surfaces as needed for traffic control during construction activities.

END OF SECTION

SECTION 01561 - CLEANING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work except as specified.
2. Cost of environmental site assessments are the Contractor's responsibility.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

B. Code of Federal Regulations (CFR)

1. 40 CFR 261.3 Definition of Hazardous Waste
2. 49 CFR 171-179 Transportation - Hazardous Waste Regulations

1.03 DEFINITION

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, State, or local laws or regulations.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Waste production and disposal records.
2. Hazardous wastes manifest.
3. Environmental consultant resume:
    a. Describe experience on similar project.
4. Environmental site assessment.

1.05 QUALIFICATIONS

A. Environmental consultant: Minimum 2 years experience in conducting environmental site assessments for similar construction.

1.06 REGULATORY REQUIREMENTS

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

B. Comply with USBR RSHS.

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

1.07 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR.

1. Cease work in areas where waste may be hazardous until waste materials are investigated by the Government.
2. If waste is hazardous, the Contracting Officer may order delays in time of performance or changes in work, or both.
3. 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. Clean equipment and fixtures to a sanitary condition.

C. Replace filters of operating equipment.

3.03 NONHAZARDOUS WASTE DISPOSAL

A. Combustible waste materials: Dispose by removal from jobsite.

B. Noncombustible waste: Dispose by removal from jobsite.

C. Disposal by Removal:

1. Dispose of waste materials at a permitted landfill. Make arrangements with owner for use of landfill and pay required fees.

D. Do not burn waste materials.

E. Do not bury waste materials

3.04 HAZARDOUS WASTE DISPOSAL

A. Recycle hazardous waste whenever possible.

B. Dispose of hazardous waste materials at permitted treatment or disposal facilities.

C. Transport hazardous waste in accordance with 49 CFR 171-179.

3.05 ENVIRONMENTAL SITE ASSESSMENT

A. Upon completion of work, perform environmental site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation and storage areas.

2. Hazardous material and petroleum dispensing and storage areas where aggregate storage of hazardous materials or petroleum at jobsite was over 110 gallons.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels.

3.06 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

SECTION 01562 - ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the prices offered in the schedule for other items of work, except as specified.
2. Costs for damages and work stoppage are the Contractor's responsibility.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS Reclamation Safety and Health Standards, 2001 Edition

1.03 REGULATORY REQUIREMENTS

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

B. Comply with USBR RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and USBR 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. The CO may stop any construction activity in violation of Federal, State, or local laws and additional expenses resulting from work stoppage will be responsibility of Contractor.

1.04 DUST CONTROL

A. Provide dust control and abatement during construction.

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 methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, crops, orchards, cultivated fields, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

1.05 AIR POLLUTION CONTROL

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

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

1.06 NOISE CONTROL

A. Only construction activities approved by CO will be allowed during hours of 6 p.m. to 6 a.m.

1.07 LIGHT CONTROL

A. Direct stationary floodlights to shine 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 the CO.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01565 - VEGETATION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 RELATED REQUIREMENTS

A. FAR 52.236-7 Permits and Responsibilities

1.03 CONTRACTOR RESPONSIBILITY

A. The Contractor shall be responsible for the control of all existing and new vegetation that adversely affects construction activities, function of constructed facilities.

B. The Contractor shall be responsible for all damages resulting from vegetation-control operations under these specifications in accordance with the clause at FAR 52.236-7 "Permits and Responsibilities."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. The Contractor shall control vegetation by removing, disking, blading, mowing, or spraying.

B. If spraying is utilized, comply with requirements for the use plan, storage, mixing, application, and records specified in Section 01566 (Pesticides). All vegetation control, including need and method(s) of control, shall be subject to the approval of the Contracting Officer.

END OF SECTION

SECTION 01566 - PESTICIDES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.
2. The Contractor is responsible for damages resulting from use of pesticides under these specifications in accordance with the clause titled “Permits and Responsibilities”.

1.02 DEFINITIONS

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

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Pesticide use plan for pesticides proposed for use:
    a. Not required for insect repellant to be applied directly to clothing, or for small quantities of aerosol insecticides, such as fly and spider sprays, to be applied within or directly to offices or shop buildings.
    b. In lieu of specified 15-day-prior submission date, submit pesticide use plan at least 30 days prior to application of first pesticide if any of chemicals or applications meet following criteria:
        1) Chemicals categorized by the EPA for “restricted use”.
        2) Chemicals applied to or that can reasonably be expected to contact water; except this requirement does not apply to “Rodeo” or copper sulfate used for control of noxious weeds.
        3) Chemicals expected to endanger threatened animal or plant species.
        4) Applications involving 2,560 acres or more.
    c. For each pesticide:
        1) Pesticide Use Proposal Form 7-2223.
            a) Completed by entity to be responsible for pesticide application.
            b) Form available from:

Chief, Design and Construction Group
2764 Compass Drive
Grand Junction, Colorado 81506

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

a) Brand, common, and chemical names.

b) Ingredients and net contents.

c) Use classification and registered uses.

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

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

3) Material Safety Data Sheet (MSDS).

1.04 DELIVERY, STORAGE, AND HANDLING

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

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

PART 2 PRODUCTS

2.01 PESTICIDES

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

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01569 - WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

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)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. 402 Wastewater Permit Monitoring Results:
    a. Provide required monitoring results two weeks prior to submittal deadline.
    b. The Government shall provide comments for correction where necessary and, after comments have been incorporated, forward the results to the appropriate State Agency and the Environmental Protection Agency (EPA) Regional Administrator.
2. Pollution Prevention Plan:
    a. As required by the stormwater permit for discharges from construction sites.
3. Submit a Spill Prevention, Control, and Countermeasure (SPCC) Plan:
    a. Submit when SPCC Plan is required in accordance with 40 CFR, Part 112.
        1) 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.

2) 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).

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, 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, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, immediately (verbally) report noncompliance to the CO. Submit specific written information within 2 days.

2. Violation of applicable Federal, State, or local laws, orders, regulations, or Water Quality Standards may result in the CO stopping site activity until compliance is ensured.

3. The 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 the Contractor's expense.

1.05 REQUIRED PERMITS

A. Wastewater Discharge Permit:

1. Permit:

   a. Prior to discharging wastewater or other pollutants, secure a permit to discharge pollutants as required under section 402 of the Clean Water Act (Public Law 92-500 as amended).

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

3. Monitoring and Treatment:

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

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

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

5. Monitoring and Treatment:

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

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

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

B. Dredge and Fill Permit:

1. The Bureau of Reclamation has made application for a permit to discharge dredged or fill material into waters of the United States (including wetlands) as required under section 404 of the Clean Water Act (Public Law 92-500 as amended).

2. If the Bureau of Reclamation is the section 404 dredge and fill permit holder (permittee), Reclamation will make known the conditions of permit to the Contractor and then may transfer the permit to the Contractor.

C. Stormwater Discharge Permit Associated With a Construction Site:

1. Notice of Intent (NOI):

a. The Contractor shall sign the NOI to obtain coverage under a stormwater general permit to control stormwater discharges from the construction site as required under section 402 of the Clean Water Act (Public Law 92-500, as amended).

2. Pollution Prevention Plan:

a. The Contractor shall prepare a Pollution Prevention Plan as required by the permit.

b. Comply with terms and conditions to obtain and maintain this stormwater discharge permit.

3. Monitoring and Water Treatment:

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

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

1.06 CONTRACTOR RESPONSIBILITIES

A. Permits:

1. Any permits obtained by the Bureau of Reclamation are exceptions to the clause at FAR 52.236-7, Permits and Responsibilities, which requires the Contractor to obtain necessary licenses and permits.

B. Monitoring:

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

a. Sampling,

b. Site inspections, and

c. Required laboratory tests to determine effluent characteristics.

C. Reporting Results:

1. The Contractor shall report required monitoring results to appropriate agencies. The section 402 wastewater discharge permit has specific reporting requirements for the permittee for noncompliance when effluent limitations are exceeded.

D. Recordkeeping:

1. Retain records and data required by permits.

PART 2 PRODUCTS

Not Used

2.01 STRAW BALES

A. Straw bales, if used: Certified weed free.

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 State and local control requirements.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion which address vegetative practices, structural control, silt fences, straw dikes, 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 erosion, and which will intercept and settle any runoff of sediment-ladened waters.

b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, 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 section 402, the National Pollutant Discharge Elimination System (NPDES) permit.

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

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 in any way encroach upon the watercourse.

3. Petroleum product storage tanks management:

    a. Place oil or other petroleum product storage tanks at least 20 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source.

    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 the 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

SECTION 01570 - SITE SECURITY

PART 1 GENERAL

1.01 MEASRUEMENT AND PAYMENT

A. Cost:

1. Include in prices offered in schedule for other items of work.

1.02 SITE CONDITIONS

A. The construction site is a remote area and access is currently not restricted. Existing access is via vehicle and by foot.

B. Department of Water Resources (DNR) has experienced repeated vandalism and theft at the Hogback Diversion Dam and at the canal gauging station.

1.03 RESPONSIBILITIES

A. Protect work and existing facilities from unauthorized entry, theft, and vandalism.

B. Initiate appropriate levels of security upon job mobilization.

C. Maintain appropriate levels of security throughout construction period until acceptance of work by the CO.

1.04 ENTRY CONTROL

A. Restrict entrance of personnel and vehicles into project site and existing facilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

01591 - PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2002 National Electrical Safety Code (NESC)

B. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

1.03 PROJECT CONDITIONS

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

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

C. An existing 16-inch municipal water line is shown on the drawings.

D. The water line is buried on both sides of the existing sluice channel.

E. The water line is suspended above ground to cross the existing sluice channel.

F. The Contractor shall not interrupt the flow in the water line and shall protect the existing water line and appurtenances from damage during the construction.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INTERFERENCE WITH OPERATION OR MAINTENANCE

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

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

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

3.02 CLEARANCES

A. Clearances in accordance with IEEE C2 provided by Government:

1. Where existing overhead powerline or communication line crosses a feature of work to be constructed, the Government will provide clearance at the crossing site between the line and the higher of (1) original ground; or (2) final elevation of constructed work.

2. Where existing buried powerline or communication line crosses a feature of work to be constructed, the Government will provide clearance at the crossing site between the line and the lower of (1) original ground; or (2) final elevation of constructed work.

B. Additional clearances required for construction operations: The Contractor shall provide in accordance with USBR RSHS.

END OF SECTION

SECTION 01592 - PROTECTION OF REAL ESTATE CROSSED BY RIGHT-OF-WAY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 RELATED REQUIREMENTS

A. FAR 52.236-7 Permits and Responsibilities

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Notify the Contracting Officer in writing within 30 days after the Contractor's knowledge of, or notice from a landowner of, damages off the rights-of-way caused by the Contractor's operations under this contract, as to the Contractor's disposition of each such claim or assumption of responsibility for damage caused by any such unauthorized use.

1.04 CONTRACTOR'S RESPONSIBILITY

A. The Contractor will be held strictly responsible for all damages to persons or properties that occur as a result of the Contractor's fault or negligence as provided in the clause at FAR 52.236-7 "Permits and Responsibilities." Promptly notify the property owners of any damage which is the Contractor's responsibility.

1.05 WITHHOLDING OF PAYMENT

A. In order to adequately protect the Government against claims, demands, or liabilities arising out of the Contractor's construction operations under this contract, the Contracting Officer may withhold such sums as the Contracting Officer may deem appropriate from progress payments due the Contractor until the matter is settled. The Contracting Officer may also withhold final payment, or any part thereof, under the provisions of the clause at FAR "Payments Under Fixed-Price Construction Contracts," until the Contractor presents evidence which is satisfactory to the Contracting Officer that all proper claims which are the responsibility of the Contractor have been settled.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 MOVEMENT OF CREWS AND EQUIPMENT

A. The Contractor shall limit the movement of crews and equipment on rights-of-way, so as to minimize damage to grazing land, crops, orchards, or property and endeavor to avoid marring the lands.

END OF SECTION

SECTION 01595 - PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 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 the jobsite.

B. Obtain the location of embedded conduit, pipe, cable, ground mat, and other buried items before performing any drilling or cutting of concrete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 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 the Government's option, damage may be repaired by the Government, and the Contractor will be backcharged repair costs.

3.02 PROTECTION

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

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

3.03 REMOVAL OF PROTECTIVE INSTALLATIONS

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

END OF SECTION

SECTION 01598 - CONSTRUCTION AT EXISTING WATERCOURSES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost

1. Except as provided below for BACK CHARGES to the Contractor and additional work, include the cost of all work described in this section in the prices bid in the schedule for other items of work.

1.02 RELATED REQUIREMENTS

A. FAR 52.243-4 Changes

1.03 DEFINITIONS

A. The term "watercourses" means natural and artificial watercourses including canals, ditches, terraces, furrows, or other features of surface irrigation systems.

1.04 SITE CONDITIONS

A. The locations of watercourses shown on the drawings may not be exact.

1.05 CONTRACTOR RESPONSIBILITIES

A. The Contractor is liable for all damage that may result from failure to provide for watercourses during the progress of the work.

B. Indemnify and hold harmless the Government from claims arising out of or connected with damage to watercourses encountered during construction, damages resulting from disruption of service, and injury to persons or damage to property resulting from the negligent, accidental, or intentional breaching of watercourses.

1.06 BACK CHARGE TO CONTRACTOR

A. If the Contractor does not maintain the existing watercourses in such condition that no damage will result to either public or private interests, the Government will cause the necessary repairs to be made and back charge the Contractor for such work.

1.07 ADDITIONAL WORK

A. Where construction of new structures or modifications of existing structures are required in order to continue a watercourse in operation beyond the period of the contract, notify the Chief, Design and Construction Group so that arrangements can be made with the owners for the construction or modifications required. When it is determined that such

work is to be performed by the Contractor, and such items of work are not provided for in the schedule, perform the necessary work in accordance with the clause at FAR 52.243-4 "Changes."

B. Where watercourses are encountered, but are not shown on the drawings or otherwise provided for in these specifications, perform all additional work required as a result of encountering the watercourses in accordance with the clause at FAR 52.243-4 "Changes."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. The Contractor shall determine the actual locations of and make provisions for all watercourses.

B. The Contractor shall obtain permission from the owner and Chief, Design and Construction Group before any watercourse is taken out of service.

3.02 MAINTENANCE OF WATERCOURSES

A. Where the work to be performed under these specifications crosses or otherwise interferes with artificial or natural watercourses, the Contractor shall provide for such watercourses, and perform such construction during the progress of the work so that no damage will result to either public or private interests.

3.03 RESTORATION

A. The Contractor shall restore watercourses disturbed by the work in the location and in as good condition as found, except as otherwise approved.

END OF SECTION

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When a separate item which includes furnishing of a material is provided in the schedule, include cost of furnishing, hauling, storing, and handling in the price offered in the schedule for the item.

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

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Written requests to deviate from, or to use materials not covered by recognized specifications or standards. See article 2.01.

2. Written requests to use substitute materials. See article 2.02.

3. Copies of purchase orders. See article 2.04.

1.03 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2003 Thread Form	Unified Inch Screw Threads, UN and UNR
2.	ASME B1.20.1-1983(2001)	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (USBR)

1.	USBR RSHS-2001	Reclamation Safety and Health Standards

1.04 DEFINITIONS

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

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

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

C. Remove and replace damaged items with new items.

D. Protect materials subject to adverse effects from moisture, sunlight, ultraviolet light, or weather during storage at jobsite.

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

1.06 MAINTENANCE

A. Extra Materials:

1. Furnish additional maintenance materials specified as "extra materials" in the specifications. Provide maintenance material identical to installed material and provide from the same manufacturer's production lot as installed material.
2. Package extra materials for storage and label with complete product identification on packaging.
3. Deliver extra materials to the Government at jobsite and place in storage as directed by the CO.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials required for completion of work.

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

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

1. References to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor my, at its option, use any equipment, material, article, or process that, in the judgment of the CO, is equal to that named in the specifications, unless otherwise specified.

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

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

F. Make parts accurately to standard gauge where possible.

1. Use unified screw threads conforming to ASME B1.1 or B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipe fittings.

2. For internal connections only, the Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

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

2.02 SUBSTITUTIONS

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

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

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

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

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

2.03 WORKMANSHIP

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

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

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

2.04 SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause 52.246-12 "Inspection of Construction" at any one or more of the following locations, as determined by the CO:

1. At place of production or manufacture.
2. At shipping point.
3. At jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, copies of purchase orders, including drawings and other pertinent information, covering material on which inspection will be made as advised by the CO, or submit other evidence if such purchase orders are issued verbally or by letter.

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

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

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's recommendations unless otherwise specified.

3.02 FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at the jobsite after installation and testing.

END OF SECTION

DIVISION 2 - SITE CONSTRUCTION

SECTION 02220 - REMOVING EXISTING CANAL LINING AND OTHER FEATURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removing Existing Canal Lining:

1. Measurement: Surface area to the limits and details shown on the drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Square yard price offered in the schedule. The unit price shall include the cost of all labor, equipment, materials for removing existing canal lining in accordance with the provisions of this section and referenced sections.

B. Removing Existing Features:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials for removing existing features in accordance with the provisions of this section and referenced sections.

1.02 REQUIREMENTS

A. The Contractor shall remove approximately 2,000 square yards of existing 4-inch thick (approximately) unreinforced concrete canal lining to the limits shown on the Drawing No. 3704-D-3 to facilitate construction of the fish barrier weir.

B. Existing features to be removed by the Contractor includes:

1. The entire existing sluice way structure (Note: See FOR INFORMATION ONLY DRAWING No's 122-DC-341 and 343).

   a. Reinforced concrete, estimated to be 80 cubic yards.

   b. One 4-foot high by 16-foot wide steel radial sluice gate with gate hoist.

   c. Corrugated metal guardrail and posts, estimated to be 50 linear feet.

2. Items to remove from the existing radial gate structure (Note: See FOR INFORMATION ONLY DRAWING No's 122-DC-341, 342 and 344).

   a. 1 ½" Diameter galvanized pipe handrail, estimated to be 40 linear feet.

   b. Two 12-foot radial gates and gate hoists.

      1) Removal includes the existing trunion pins, motor mounts, hoist shafts, drums, cables and cable connectors.

3. The radial gates and associated hoisting equipment that has been removed shall be placed, stored and protected from damage in the Contractor's staging area. These items will remain property of DRN for use on other project features.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. BUREAU OF RECLAMATION (BUREC)

a. BUREC M-47-8/96, Concrete Repair available at http://www.usbr.gov/standardspecs/

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL OF CANAL LINING

A. The Contractor shall remove the existing unreinforced concrete canal as indicated on Drawing Nos. 3704-D-3, -4 and -5 or directed by the Contracting Officer.

1. Saw cutting the existing concrete canal lining shall be assumed.

2. Removal shall produce clean sharp edges to facilitate placement of new concrete canal lining.

3. In general, transverse (perpendicular to canal centerline) limits of removal shall include the full width of the invert and up to the existing contraction (or control) joint on the side slope.

a. In the location of the upstream wall, near Station 0+75, the right (relative to looking downstream) side slope shall be removed.

b. In the location where the new transition to the gate structure is to be constructed, the left side slope shall be removed.

4. Longitudinal (approximately 400 linear feet along canal centerline) limits shall be removed from approximate Station 0+75 to the existing Hogback canal gates.

B. Keep edges of remaining canal lining free from contamination, including oil, solvent, dirt accumulation, and foreign material. Any contamination shall be removed by sandblasting or pressure washing prior to placing new canal lining.

3.02 REMOVAL OF FEATURES

A. The Contractor shall remove the existing reinforced concrete structure where indicated on the drawings or directed by the Contracting Officer.

1. The limits are typically defined by existing construction joints that may contain rubber waterstop and/or steel dowels.

2. A corner portion of the existing structure may have to be saw cut to facilitate the new construction.

B. Saw cutting along the existing joints may be also be necessary.

C. Removal shall produce clean sharp edges to facilitate placement of the new concrete structures.

D. Clean loose concrete from surfaces on which new concrete will be placed.

E. Use methods which will not damage concrete or reinforcement to remain in place.

F. Blasting will not be permitted.

3.03 REPAIRING REINFORCED CONCRETE INTENDED TO REMAIN

A. Repair concrete and reinforcement outside of prescribed removal lines which is damaged or loosened during cutting and removal operations.

B. Repair or replace as directed by Contracting Officer.

C. Repair or replace in accordance with applicable sections of these specifications.

3.04 DISPOSAL

A. Except for the radial gate and associated hoisting equipment to be salvaged, dispose of removed materials in accordance with Section 01561 (Cleaning).

END OF SECTION

SECTION 02221 - EXCAVATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation:

1. Measurement: Made to excavation paylines shown on the drawings, the provisions of this section or to paylines directed by the Contracting.

    a. Where pay lines are not shown on the drawings, a slope of 1:1 will be used from the required subgrade elevation to the original ground surface.

    b. The excavation paylines in areas to receive erosion protection will be made to the finish grade (not the subgrade) of the erosion protection.

    c. Where excavation pay lines overlap, the excavation within the overlap of pay lines will be measured for payment only once.

    d. Regardless of quantities removed, measurement for payment will be made to the prescribed paylines.

    e. For safety or other reasons, the Government reserves the right to require the Contractor to excavate beyond the prescribed paylines.

    f. Measurement for payment for additional excavation will be made to limits and depths directed by Contracting Officer.

2. Payment: Cubic yard price offered in the schedule. The unit price shall include all costs of labor, equipment and materials required for excavation in accordance with the provisions of this section and referenced sections.

    a. Include the cost of general clearing and grubbing; excavating materials to designated depths; of segregating the various materials, where required; of loading; of transporting materials from the excavations to points of use, including temporary stockpiling and reloading, if required; of drying otherwise suitable backfill materials; and of disposing of all excavated materials that are to be wasted.

    b. Where additional excavation is directed by the Contracting Officer to remove material unsuitable for concrete structure foundations or prior to placement of compacted backfill or erosion protection, payment for all such excavation, and all compacted backfill required due to additional excavation will be made at the applicable unit prices bid in the schedule.

    c. Overexcavation performed beyond specified or directed paylines and compaction of backfill for such overexcavation shall be at the expense of the Contractor.

    d. Except as otherwise provided in Section 02243 (Removal and Control of Water), the unit prices bid in the schedule for excavation shall include the

cost of all labor and materials for temporary construction; of all pumping, bailing, draining, sheeting, bracing, and other work necessary to maintain the excavations in good order during construction; and of removing such temporary construction where required.

e. No payment will be made for excavation or removal of material which is outside the specified or directed pay lines unless such excavation or removal is directed by the Contracting Officer.

f. No payment will be made for excavation performed in compacted backfill that has been placed under these specifications.

g. No direct payment will be made to the Contractor for excavation required to conform to Section 22 of RECLAMATION RSHS.

3. Cost:

a. The cost of excavating trenches for buried electrical grounding cables, insulated cables or conductors, and conduit shall be included in the prices bid in the schedule for items for which the excavation is required.

b. The cost of clearing and grubbing the construction access areas shall be included in the unit prices bid in the schedule for Construction Access Clearing and Grubbing.

1.02 DEFINITIONS

A. Rock: Rock is not classified for payment.

B. Additional Excavation: Excavation beyond specified lines as directed by the Contracting Officer to remove unsuitable foundation material.

C. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.

D. Cover: Distance between the top surface of buried cables, conductors, or conduits and the finished grade.

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

A. The Contractor's operations in excavations shall be such that excavations will yield as much suitable material for use in permanent construction required under these specifications as practicable.

B. Place excavated materials which are too wet for immediate compaction temporarily in stockpiles until moisture content is reduced sufficiently to permit them to be placed in embankments.

PART 3 EXECUTION

3.01 EXCAVATION, GENERAL

A. Excavate subgrades for concrete structures and concrete canal lining to elevations shown on the drawings or established by the Contracting Officer.

1. As determined by the Contracting Officer, if suitable material exists beneath areas to receive concrete structures and concrete canal linings, the Contracting Officer will direct the Contractor to limit the excavation to that which will facilitate the proper placement of the structure and canal lining.

B. The Government reserves the right, during progress of work, to vary slopes, grades, and dimensions of excavations from those specified.

C. The Government does not represent that excavation performed under these specifications can be made to or maintained at paylines shown on the drawings or described in these specifications.

D. Perform excavation in the dry.

E. Do not excavate in frozen materials without written approval.

F. Where excavating in compacted backfill placed under these specifications, excavate in accordance with applicable provisions for excavation.

G. Blasting: Not allowed

H. Take precautions to preserve material below and beyond established lines of excavation in the soundest possible condition.

1. Damage to work due to the Contractor's operations shall be repaired by and at the expense of the Contractor.

2. Material beyond required or prescribed excavation lines which is loosened by the Contractor's operations shall be removed by and at the expense of the Contractor.

3.02 PREPARATION OF STRUCTURE FOUNDATIONS AND CANAL LINING SUBGRADES

A. Prepare foundations at structure sites and canal lining subgrades by methods which will provide firm foundations for structures and subgrade for the canal lining.

1. Finish bottom and side slopes of excavation, upon or against which the structure is to be placed, to prescribed dimensions.

2. Moisten and tamp prepared surfaces with suitable equipment to form firm foundations upon or against which to place the structure.

B. Where unsuitable material is encountered in the foundation for a structure, the Contracting Officer will direct performance of additional excavation to remove unsuitable material.

1. Refill additional excavation with compacted backfill in accordance with Section 02223 – Compacted Backfill.

C. Keep surfaces of shale exposed by excavation moist until concrete, coarse aggregate, or earth material are placed on it.

3.03 OVEREXCAVATION

A. If foundation material is excavated beyond lines required to receive the structure, fill overexcavation with suitable materials and compact in accordance with Section 02224 - Compacting Earth Materials.

B. If foundation material is disturbed or loosened during excavation or otherwise, compact foundation in place or remove and replace it with suitable material and compact in accordance with Section 02224 - Compacting Earth Materials.

3.04 TRENCHES FOR BURIED ELECTRICAL CABLES, CONDUCTORS AND CONDUITS

A. Excavate trenches to depths to provide a minimum of 24 inches of cover over the cables, conduits, and conductors.

3.05 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of excavated materials which are unsuitable for or are in excess of compacted backfill, or other earthwork requirements, as determined by the Contracting Officer, as provided in Section 02297 - Disposal of Excavated Materials.

END OF SECTION

SECTION 02222 - OFF-SITE EARTH MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. The cost of off-site earth materials shall be included in the prices bid in the schedule where offsite materials are required. Include the costs for procuring, excavating, processing, hauling, placing, and compacting.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals

1. Preservation of Cultural Resources: Submit for approval, and prior to use, maps showing locations of pits or commercial sources.

PART 2 PRODUCTS

2.01 MATERIAL

A. When suitable compacted backfill is not available from the required excavation, the Contractor shall obtain the suitable materials from off-site sources.

B. The material obtained from off-site sources shall meet the gradation, quality and other applicable requirements for the intended use in accordance with these specifications.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02223 - COMPACTED BACKFILL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Compacted Backfill:

1. Measurement: Made in place to the paylines shown on the drawings, the provisions of this section or to paylines directed by the Contracting.

   a. Where the compacted backfill paylines overlap, the compacted backfill within the overlap of pay lines will be measured for payment only once.

   b. Where pay lines are not shown on the drawings, a slope of 1:1 will be used from the required subgrade elevation to the original ground surface or to the finished grade of compacted backfill.

   c. In areas where excavation is not required, a slope of 1:1 will be used from the required finished grade of compacted backfill down to the original ground surface.

   d. The compacted backfill paylines in areas to receive erosion protection will be made to the finish grade (not the subgrade) of the erosion protection.

   e. Regardless of quantities excavated, measurement for payment, of compacted backfill will be made to the prescribed pay lines.

2. Payment: Cubic yard price offered in the schedule. The unit price shall include all costs of labor, equipment and materials required for compacted backfill in accordance with the provisions of this section and referenced sections.

   a. Include the cost of all work required for procuring, processing, hauling placing and compacting of suitable backfill material: Provided, that material from required (on-site) excavation used for compacted backfill will be paid for both as excavation when removed from original position and as compacted backfill when placed. Where compacted backfill is obtained from an off-site borrow source by the Contractor, payment will be made for the compacted backfill only.

   b. No payment will be made for compacted backfill required to fill any overexcavation not prescribed by the Contracting Officer and performed by the Contractor. Compacted backfill in such overexcavation shall be placed by and at the expense of the Contractor.

   c. No payment will be made for the removal and reconstruction of defective and nonconforming compacted backfill compacted to an insufficient density or moisture content, or not meeting gradation requirements. All work required to remove and to replace compacted backfill or any backfill above the compacted backfill shall be at the Contractor's expense.

3. Cost: The cost of all other compacted backfill required by these specifications, including but not limited to, buried electrical ground cable, buried electrical conduit, buried insulated electrical conductors and miscellaneous piping less than 12-inches in diameter shall be included in the applicable price(s) bid in the schedule for the items of work for which earthwork is required.

1.02 DEFINITIONS

A. Compacted Backfill

1. Except as specified below as Controlled Low Strength Materials, shown on the drawings or directed by the Contracting Officer, all backfill materials required to be placed and compacted under this specification shall be considered Compacted Backfill. All earth materials required to be placed and compacted under this specification shall be considered Compacted Backfill. Refer to Section 02224 (Compacting Earth Materials) for compacting and material requirements.

2. Acceptable materials resulting from any required excavation shall be used for Compacted Backfill.

3. All materials used for compacted backfill shall meet the approval of the COR.

B. Controlled Low Strength Materials (CLSM)

1. CLSM is shown on Drawing. No. 3704-D-8, Section F-F between new and existing concrete walls where it is impractical to place and compact backfill.

2. See Section 02323 for requirements of CLSM.

PART 2 PRODUCTS

2.01 MATERIALS

A. Contractor Responsibility and Material Source

1. The Contractor shall be responsible for providing materials meeting the requirements of this section and Section 02224 (Compacting Earth Materials).

2. The Contractor may, at its discretion, provide such materials from the materials removed in required excavation or from other sources arranged for by the Contractor.

3. The Contractor shall provide all processing equipment and perform all work necessary to process excavated materials to produce materials meeting the requirements of these specifications.

B. The compacted backfill material (whether obtained on-site from required excavation or from an off-site borrow source) shall be a reasonably well graded material meeting the following requirements for the intended use in accordance with these specifications:

Sieve Designation Inches	Percent by weight passing square mesh openings of sieve
4	100
3	60 to 90
1 1/2	45 to 75
3/4	30 to 55
No. 4	15 to 40
No. 200	8 to 15

PART 3 EXECUTION

3.01 COMPACTING BACKFILL

A. Compact backfill for subgrades beneath concrete structures, against structures and beneath concrete canal lining to elevations shown on the drawings or established by the Contracting Officer.

1. As determined by the Contracting Officer, if suitable material exists beneath areas to receive concrete structures and concrete canal linings, the Contracting Officer will direct the Contractor to limit the excavation to that which will facilitate the proper placement of the structure and canal lining.

B. Place, moisten, and compact materials in backfill as provided in Section 02302 - Compacting Earth Materials.

3.02 PROTECTION

A. To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the Contractor to place a sufficient amount of backfill or embankment material over compacted backfill within 72 hours after completion of compacting backfill.

END OF SECTION

SECTION 02224 - COMPACTING EARTH MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of compacting earth materials, including furnishing water and moistening materials, in prices offered in the schedule for compacted backfill and for other items of work where earth materials are required to be compacted.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 422-63(2002)	Particle-Size Analysis of Soils
2.	ASTM D 653-04	Terminology Relating to Soil, Rock, and Contained Fluids
3.	ASTM D 698-00a	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4.	ASTM D 1140-00	Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5.	ASTM D 1556-00	Density and Unit Weight of Soil in Place by the Sand-Cone Method
6.	ASTM D 2216-98	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7.	ASTM D 2487-00	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8.	ASTM D 2488-00	Description and Identification of Soils (Visual-Manual Procedure)
9.	ASTM D 2922-04	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
10.	ASTM D 3017-04	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
11.	ASTM D 4253-00	Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
12.	ASTM D 4254-00	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

13.	ASTM D 4318-00	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
14.	ASTM D 4564-02a	Density of Soil in Place by the Sleeve Method
15.	ASTM D 4643-00	Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating
16.	ASTM D 4718-87(2001)	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
17.	ASTM D 4914-99	Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit
18.	ASTM D 4959-00	Determination of Water (Moisture) Content of Soil by Direct Heating
19.	ASTM D 5030-04	Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit
20.	ASTM D 5080-00	Rapid Determination of Percent Compaction

B. Bureau of Reclamation (USBR)

1. USBR EM - Earth Manual, Part 2, Third Edition (1990)

2. Procedure No. and Title:

a.	USBR 3900-89	Standard Definitions of Terms and Symbols Relating to Soil Mechanics
b.	USBR 5000-86	Determining Unified Soil Classification (Laboratory Method)
c.	USBR 5005-86	Determining Unified Soil Classification (Visual Method)
d.	USBR 5300-89	Determining Moisture Content of Soil and Rock by the Oven Method
e.	USBR 5315-89	Determining Moisture Content by the Microwave Method
f.	USBR 5325-89	Performing Gradation Analysis of Gravel Size Fraction of Soils
g.	USBR 5330-89	Performing Gradation Analysis of Fines and Sand Size Fraction of Soils, Including Hydrometer Analysis
h.	USBR 5335-89	Performing Gradation Analysis of Soils Without Hydrometer
i.	USBR 5350-89	Determining the Liquid Limit of Soils by the One-Point Method

j.	USBR 5355-89	Determining the Liquid Limit of Soils by the Three-Point Method
k.	USBR 5360-89	Determining the Plastic Limit and Plasticity Index of Soils
l.	USBR 5500-89	Performing Laboratory Compaction of Soils--5.5-lbm Rammer and 18-in Drop
m.	USBR 5525-89	Determining the Minimum Index Unit Weight of Cohesionless Soils
n.	USBR 5530-89	Determining the Maximum Index Unit Weight of Cohesionless Soils
o.	USBR 5605-89	Determining Permeability and Settlement of Soils Containing Gravel
p.	USBR 7205-89	Determining Unit Weight of Soils In-Place by the Sand-Cone Method
q.	USBR 7215-89	Determining the Unit Weight of Soils In-Place by the Sleeve Method
r.	USBR 7220-89	Determining Unit Weight of Soils In-Place by the Sand Replacement Method in a Test Pit
s.	USBR 7221-89	Determining Unit Weight of Soils In-Place by the Water Replacement Method in a Test Pit
t.	USBR 7230-89	Determining Unit Weight and Moisture Content of Soil In-Place - Nuclear Moisture-Density Gauge
u.	USBR 7240-89	Performing Rapid Method of Construction Control
v.	USBR 7250-89	Determination of Percent Relative Density
w.	USBR 7255-89	Determining the Percent Compaction of Earthwork for Construction Control

1.03 DEFINITIONS

A. Use definitions from USBR 3900 or ASTM D 653.

B. Control Fraction: The portion of a soil sample consisting of particles smaller than a designated sieve size. The fraction is used to compare in-place unit weight with standard laboratory unit weight. The control sieve size depends on the laboratory test used (USBR 7230).

C. C-Value: The expressed as a percentage of (1) in-place unit weight at fill moisture content to (2) the wet unit weight of a laboratory-compacted specimen prepared at fill moisture content as determined by the rapid method of construction control (USBR 7240,

ASTM D 5080). The C-Value is a comparison of compactive effort of field compaction equipment to standard laboratory compactive effort.

D. D-value: The ratio expressed as a percentage of (1) in-place wet unit weight at fill moisture content to (2) laboratory maximum wet unit weight as determined from a compaction curve constructed at fill moisture content as determined by the rapid method of construction control. The D-value is the equivalent of percent compaction (USBR 7240, ASTM D 5080).

E. Percent Relative Compaction: The percent compaction of a cohesionless soil where the laboratory maximum density is determined by Maximum Index Unit Weight test (USBR 5530, ASTM D 4253).

F. Percent Relative Density - (D_d percent) : The ratio of, (1) the difference between void ratio of a cohesionless soil in the loosest state and any given void ratio, to (2) the difference between its void ratios in the loosest state and densest state (USBR 7250)

1.04 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Do not place and compact soil under following conditions:

1. Ambient air temperature below freezing.
2. Rain that creates puddles in clayey or silty materials.
3. Heat or wind or both that dries material below special moisture conditions.
4. Ice or snow pockets are visible in soil being placed.

PART 2 PRODUCTS

2.01 CLASSIFICATION

A. When required, classify earth materials using the Unified Soil Classification System (USCS) according to ASTM D 2487 (or USBR 5000) or ASTM D 2488 (or USBR 5005).

1. Gradation tests for classification: ASTM D 422 or D 1140 (USBR 5325, 5330, or 5335).
2. Atterberg limits testing for classification: ASTM D 4318 (USBR 5350, 5355, or 5360).

2.02 SOIL TYPES

A. Clean Fill:

1. Any soil classification except for Peat (PT), Organic Silts and Organic Clays (OL and OH), and Elastic Silt (MH).
2. Free of roots, stumps, limbs, vegetation, organic matter, and ice.

3. Does not contain construction debris, scrap materials, refuse, man-made wastes, or chemical or hydro-carbon contamination.

B. Do not use frozen soils.

C. Special Gradations/Plasticity

1. In some cases, such as embedment for buried pipe, special gradations and/or plasticity characteristics may be required. These requirements are given for each special material required in the appropriate section.

2.03 DESIGNATION OF SOILS FOR COMPACTION

A. Requirements for lift thickness, method of compaction, and method of determining degree of compaction depends on whether soil is considered to be silty or clayey, cohesionless, or cohesionless containing some silt and clay.

B. Silty or Clayey Soils:

1. Contain appreciable amounts of fines (generally more than 15 percent fines).

2. Classified as GM, GC, SM, SC, CL, ML, CH, or any dual symbol or borderline soil beginning with one of these symbols.

C. Cohesionless Soils:

1. Contain few fines (generally less than 5 percent fines).

2. Classified as GW, SW, GP, SP, or any borderline soil beginning with any of these symbols.

D. Cohesionless Soils Containing Some Clay and Silt:

1. Contain some clay and silt contain between 5 and 15 percent fines.

2. Classified with dual symbol soils such as GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Clear, grub, and strip.

B. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified compaction, if necessary.

C. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing layer of material to be compacted.

D. Do not place soil on frozen surface.

3.02 SOIL MOISTURE CONTENT

A. Moisten or aerate material, as necessary, to provide moisture content that will readily facilitate obtaining specified compaction. Add water to soil only in increments that will permit moisture content to be uniform and homogenous throughout each layer after mixing.

B. Silty and Clayey Soils:

1. Moisture content during compaction: Not greater than 2 percentage points wet or not less than 2 percentage points dry of optimum moisture content.

2. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.

   a. If clayey borrow soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in the clods.

   b. Use of disks, harrows, or rakes may be required to blend moisture in the borrow area.

3. Moisture content will be determined as follows:

   a. Moisture content is determined on the minus no. 4 sieve size control fraction material.

   b. Variation from Optimum Moisture Content:

      1) Difference between optimum moisture and compaction moisture can be measured in accordance with ASTM D 5080 (or USBR 7240).

   c. Moisture Content Comparison:

      1) Optimum moisture content determined by ASTM D 698 (or USBR 5500).

      2) Compared to field compaction moisture content with moisture contents determined in accordance with:

         a) ASTM D 2216 (or USBR 5300), or

         b) ASTM D 3017 (USBR 7230). The moisture from the nuclear gage will require corrections for gage error for the specific soils tested and the moisture content of the total material may require adjustment for the control fraction (see USBR 7230, Method C; ASTM D 4718), or

         c) ASTM D 4959, or ASTM D 4643 (USBR 5315), provided the results have been correlated to ASTM D 2216 (USBR 5300) for specific soil tested.

C. Cohesionless Soils:

1. Add water during compaction, as necessary, since these soils are free-draining.

3.03 PLACEMENT

A. Place soils to be compacted in horizontal layers.

B. If necessary, blend materials so that compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations, or other imperfections.

3.04 COMPACTION EQUIPMENT

A. Rollers used for compacting silty or clayey soils for water retaining embankment:

1. Roller drum length, maximum: 6 feet.
2. Roller tamping feet:
    a. Staggered and uniformly spaced.
    b. Similar to sheepfoot, chevron, or padfoot designs.
    c. Length of tamping foot measured from drum surface to surface of tamper head, minimum:
        1) Clayey soils: 7 inches.
        2) Silty soils (Plasticity Index $\leq$ 10, ASTM D 4318, USBR 5360): 3.9 inches, and vibratory pad foot roller is allowed.
3. Roller weight: Sufficient for proper compaction.
4. Tamping heads and cleaner bars: Properly maintained.
5. Keep spaces between tamping feet clear of materials which impair effectiveness of tamping roller.

3.05 COMPACTION

A. Compact material with following methods and techniques appropriate to type of soil.

1. Special compaction: Compaction close to structures or in confined space.

B. Silty or clayey material in water retaining embankment:

1. Compact with tamping rollers specified above.
2. Uniformly distribute roller passes.
3. Compact in horizontal layers to compacted thickness of 6 inches or less.
4. Scarify lifts as required for lift bonding.
5. Density:
    a. Percent Compaction, minimum: 95 percent, or

b. C-Value and D-value, minimum: 95 percent

c. As determined on portion of soil passing the No. 4 sieve.

C. Silty or clayey material:

1. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers, other suitable compaction equipment, or equipment travel.

a. Uniformly distribute equipment passes.

b. Compact in horizontal layers to compacted thickness of 6 inches or less.

2. Special compaction: Compact with hand held impact tampers, or small tamping equipment.

a. Uniformly distribute effort.

b. Compact in horizontal layers to compacted thickness of 4 inches.

3. Density:

a. Percent Compaction, minimum: 95 percent, or

b. D-value, minimum: 95 percent

c. As determined on portion of soil passing the No. 4 sieve.

D. Cohesionless free-draining material:

1. Compact in horizontal layers in maximum compacted lift thicknesses of:

a. Tampers or rollers: 6 inches

b. Crawler-type tractors, vibrating drum rollers, surface vibrator, or similar equipment: 12 inches

c. Saturation and internal vibration: Penetrating depth of vibrator.

2. Special compaction: Compact with hand held impact tampers, vibrating plate tampers, or small tamping equipment.

a. Uniformly distribute effort.

b. Compact in horizontal layers to compacted thickness of 6 inches.

3. Density:

a. Relative Density, minimum: 70 percent, or

b. Relative Compaction. Minimum: 95 percent.

c. As determined on portion passing the 3-inch sieve

E. Cohesionless Soils Containing Some Silt and Clay:

1. Compact in accordance with either procedure above.

2. Density:

a. Percent Compaction, minimum: 95 percent, or

b. Relative Density, minimum: 70 percent, or

c. Relative Compaction, minimum: 95 percent.

d. Using whichever testing procedure result requires higher in-place dry density.

F. Adjustment:

1. Silty and clayey soils containing more than 50 percent gravel: Required D ratio or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 4 in USBR 5605.

G. Demonstration:

1. Lift thicknesses may vary depending on equipment and methods. Before changing requirements in this section, demonstrate that required density will be obtained.

3.06 MEASURE OF COMPACTION

A. Degree of soil compaction will be determined by one of the following.

B. Silty or clayey soils:

1. Unit weight of soils in-place:

a. ASTM D 1556 (or USBR 7205), or

b. ASTM D 4914 (or USBR 7220), or

c. ASTM D 5030 (or USBR 7221), or

d. ASTM D 2922 and D 3017 (or USBR 7230.

2. Percent Compaction will be determined by one of the following:

a. Rapid Method: ASTM D 5080 (or USBR 7240).

b. Laboratory Compaction Test: Comparison of in-place density of minus no. 4 sieve size control fraction to laboratory maximum dry density as determined by ASTM D 698, Procedure A (or USBR 5500).

c. Silty and clayey soils containing more than 5 percent gravel:

1) In-place unit weight of minus no. 4 size control fraction determined by screening gravel, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (USBR 7205).

C. Cohesionless soils: Compaction will be measured by determination of Percent Relative Density or Percent Relative Compaction as specified.

1. Unit weight of soils in-place:

a. ASTM D 1556 (or USBR 7205), or

b. ASTM D 4564 (or USBR 7215), or

c. ASTM D 4914 (or USBR 7220), or

d. ASTM D 5030 (or USBR 7221), or

e. ASTM D 2922 and D 3017 (or USBR 7230).

2. Percent Relative Density: ASTM D 4254 (or USBR 7250)

a. In-place density of minus 3-inch size control fraction is compared to minimum and maximum index densities.

b. Laboratory test for minimum index density: ASTM D 4254 (or USBR 5525)

c. Laboratory test for maximum index density, ASTM D 4253 (or USBR 5530).

d. Cohesionless soils containing more than 5 percent cobbles:

1) In-place unit weight of minus 3-inchsize control fraction determined by screening cobbles, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (or USBR 7205).

3. Percent relative compaction:

a. In-place density of minus 3-inch size control fraction is compared to maximum index density determined by ASTM D 4253 (or USBR 5530).

b. In-place unit weight of minus 3-inchsize control fraction determined by screening cobbles, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (or USBR 7205).

3.07 FIELD QUALITY CONTROL

A. Testing

1. The Government or its representative will perform tests as required to verify that type of soil used, placement of soil, and compaction of soil conform to contract requirements.

2. Notify the Government 24 hours before compaction work begins and 24 hours before significant change in compaction operations (major change in equipment or procedure used).

3. Notify the Government immediately of equipment change due to breakdown, or re-deployment.

B. Testing Frequency

1. Frequency of testing is at discretion of the Government.

2. Tests may be performed at sites considered questionable by a Government Inspector; such as suspected incomplete compaction, surfaces that may have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.

3. Greater frequency of testing is normally performed at beginning of new work, new work crew, or new equipment.

C. Tests:

1. Standards listed in Table 02224A - Standard Used for Testing, will be used by the Government or its representative for testing compacted soil for conformance with specification requirements. Substitution or modification of standards shall be done only with concurrence of all parties.

Table 02224A - Standard Used For Testing

PROCEDURE	STANDARD NO.
Soil Classification	ASTM D 2487 (or USBR 5000) ASTM D 2488 (or USBR 5005)
Gradation Analysis	ASTM D 422 (or USBR 5325, 5330, 5335)
Atterberg Limits	ASTM D 4318 (or USBR 5350, 5355, 5360)
Moisture Content	ASTM D 2216 (or USBR 5300) ASTM D 3017 (or USBR 7230) ASTM D 4643 (or USBR 5315)
Relative Density of Cohesionless Soils	ASTM D 4253 and ASTM D 4254 (or USBR 5525 and 5530 and 7250)
In-Place Density: Sand Cone Test Pits Sleeve	 ASTM D 1556 (or USBR 7205) ASTM D 4914 (or USBR 7220) ASTM D 5030 (or USBR 7221) ASTM D 4564 (or USBR 7215)
Rapid Construction Control	ASTM D 5080 (or USBR 7240)
Laboratory Maximum Density	ASTM D 698, Procedure A (USBR 5500)

D. Contractor Support

1. Provide timely access to areas for density testing and excavate and level an area in compacted material to provide a surface for testing.

a. Fills compacted by sheepsfoot rollers are normally tested one or two lifts below surface.

2. When density is being measured by a sand-cone device (ASTM D 1556, USBR 7205), cease construction activity in immediate vicinity of testing.

3. Dig test pits as requested to examine compacted soil against structures or pipe.

4. Backfill test pits to original requirements.

5. Provide warning lights, flags, or other safety devices as needed by testing personnel.

6. Provide adequate lighting for performing test if required because of darkness.

END OF SECTION

SECTION 02232 - CLEARING AND GRUBBING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Construction Access Clearing and Grubbing:

1. Measurement: Surface area to the limits and details shown on the drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Acre price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for construction access clearing and grubbing in accordance with the provisions of this section and referenced sections.

B. General Clearing and Grubbing:

1. Cost: Include in prices offered for excavation, including disposal of cleared material.

1.02 DEFINITIONS

A. Construction Access Clearing and Grubbing is shown on Drawing No. 3704-417-2B and is along the right bank of the existing Hogback Canal to provide access for construction, as well as permanent access for future operation and maintenance of the fish barrier weir.

B. General Clearing and Grubbing is not specifically shown on the drawings and may be required prior to excavation and for the Contractor's staging area.

C. Vegetation: Trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEARING

A. The Contractor shall clear those areas to be occupied by permanent construction under these specifications and those portions required for access to the work, and surfaces of stockpile sites, and waste areas.

B. The Contractor shall clear adjacent to cut or fill sections to a minimum distance of 3 feet outside of slope lines.

C. Remove vegetation such as trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds; and of other objectionable material as determined by the Contracting Officer.

D. The Contractor shall preserve and protect vegetation designated for preservation within clearing limits, and all vegetation outside clearing limits in accordance with Section 01565 (Vegetation Control) and Section 01130 (Protected Species).

3.02 GRUBBING

A. The Contractor shall grub the ground surface of stumps, roots, and vegetable matter of every kind under areas to receive concrete, compacted backfill, erosion protection and under other areas where directed by the Contracting Officer.

B. Pull or otherwise remove the stumps, roots, and vegetative matter.

3.03 DISPOSAL OF CLEARED MATERIAL

A. The Contractor shall remove from jobsite and dispose of the stumps and roots and any other vegetative material, subject to approval and direction by the Contracting Officer, in accordance with Section 01561 (Cleaning).

B. The Contractor shall remove from jobsite and dispose of non-vegetative material from clearing operations in accordance with Section 01561 (Cleaning).

END OF SECTION

SECTION 02243 - REMOVAL AND CONTROL OF WATER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removal and Control of Water:

1. Payment: Lump-sum price offered in the schedule.

   a. Except as otherwise provided in Section – 02221 (Excavation), the lump-sum price includes costs of furnishing labor, equipment, and materials for maintaining the work free from water as required by this section.

2. Payment Allocation:

   a. In the plan for removal of water and control of water, allocate the total lump sum price to not more than 3 major divisions of work to be performed for removal of water and control of water.

   b. Outline each major division of work and identify by title.

   c. Allocation of the lump-sum price is subject to approval of the Contracting Officer.

   d. In preparing monthly estimates for progress payments, consideration will be given to the percentage of each major division of work performed during that month.

1.02 DEFINITION

A. Dewatering: Removal and control of groundwater from pores or other open spaces in soil or rock formations to allow construction activities to proceed as intended, and includes relief of groundwater pressure.

B. Unwatering: Unwatering shall mean the removal and control of ponded or flowing surface water from within open excavations, cofferdams, channels, watercourses, ditches, sumps, dikes, and other similar sources.

1.03 SITE CONDITIONS

A. The Government assumes no responsibility for any deductions, interpretations, or conclusions made by the Contractor based on the information made available by the Government, in accordance with the clause at FAR 52.236-3, Site Investigations and Conditions Affecting the Work.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

B. Removal and Control of water plan:

1. Showing proposed method for removal and control of water.
2. For payment purposes, prepare the plan with not more than 3 major divisions.
3. The plan may be placed in operation upon review, but nothing in this paragraph shall relieve the Contractor from full responsibility for the adequacy of the water removal installation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL AND CONTROL OF WATER

A. The Contractor's method of removal and control of water for construction operations shall be subject to review by the Government.

B. Methods used, if allowed to remain in place by the Contracting Officer following construction, shall not allow movement of water (piping) under concrete structures, along concrete walls, through compacted backfill.

C. The Contractor shall be responsible for the selection of suitable method(s), and for design, installation, and operation of the water removal and control facilities required during the performance of the work under these specifications.

D. Procedures used for removal and control of water may at the option of the Contractor, consist of the installation of limited facilities initially with the expectation of progressively increasing the scope, and complexity until the installation functions as required by these specifications.

E. Different areas of the work may require different methods of removal and control of water and design of facilities.

F. The Contractor is required to design and install adequate water removal and control facilities in a timely fashion in accordance with his schedule of construction and the requirements of these specifications.

G. Failure of the Contractor to adequately familiarize himself with and address the surface water and groundwater conditions which impact the work may result in unnecessary construction delays and associated increased costs for which the Contractor shall be solely responsible.

H. The Contractor shall furnish, install, maintain, and operate all facilities necessary for removal and control of water from the various parts of the work and for maintaining slopes, excavations, and foundations stable and free from water as required for constructing each part of the work.

3.02 REMOVAL OF WATER BELOW GROUND-WATER LEVEL

A. Where excavation extends below the ground water level, dewater the portion below the water level in advance of excavation.

B. Accomplish the dewatering in a manner that will prevent loss of fines from the foundation, will maintain stability of the excavated slopes and bottom of the excavations, and will result in all construction operations being performed in the dry.

C. Before excavating to final grade for placement of concrete or compacted backfill, bring the water level to an elevation at least 3 feet below the bottom concrete to be placed and 2 feet below the grade of which backfill is to be placed.

D. Maintain this water level until the concrete structure is completed and compacted backfill and erosion protection have been placed.

E. After the concrete have been completed and backfilled, subject to the approval of the Chief, Design & Construction Group, allow the ground water to rise about structure and erosion protection.

F. Control the pumping operations so that the water level rises slowly and uniformly.

3.03 CLEANUP

A. All materials and equipment used for the removal and control of water shall be removed from the site and shall be disposed of in accordance with Section 01561 (Cleaning) or Section 02297 (Disposal of Excavated Materials), as appropriate.

END OF SECTION

SECTION 02274 - EROSION PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Erosion Protection:

1. Measurement: Surface area required to be protected as shown on the drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Square foot price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and placing erosion protection in accordance with the provisions of this section and referenced sections. The unit price shall also include the cost of excavation for the thickness of erosion protection provided and the cost of furnishing and placing geotextile.

1.02 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Riprap materials:

a. Informational Data:

1) Preservation of Cultural Resources for Riprap Materials.

a) Areas or borrow sources, maps showing locations of borrow area or commercial sources.

b. Approval Data:

1) Test data documenting that the riprap meets the required specifications.

2. Alternate Erosion Protection Products: If erosion protection is proposed to be provided by products other than riprap materials, submit the following:

a. Approval Data:

1) General information including product supplier and manufacturer.

2) Product description including specifications, dimensions, weights, strengths, installation drawings, details and instructions.

3) Design analysis, including assumptions and criteria, by product supplier showing product has been designed for this application stating maximum discharge, velocity, depth and resulting safety factors.

4) Details for anchoring, if needed. If anchors are not needed the submittal shall state such.

PART 2 PRODUCTS

2.01 RIPRAP

A. General:

1. Riprap shall be hard, dense, and durable.
2. Either quarried rock or boulders.
3. Reasonably well-graded to meet the requirements in the tables below.
4. Shape
   a. Maximum dimension not greater than 3 times the minimum dimension.
5. Potential Riprap Sources:
   a. Bureau of Reclamation tests performed on samples of riprap obtained from sources in the following locations indicate that these sources contained, when sampled, materials meeting the quality requirements of these specifications for riprap.
      1) Sec. 16, T.41S., R.20E., Salt Lake Meridian, Holiday Construction, Blanding UT / Private
      2) Sec. 11, T.23N., R.21E. Gila and Salt River Meridian, Brimhall Sand and Rock, Indian Wells AZ / Private
6. Other sources:
   a. If riprap is to be obtained from a source not previously tested and approved by Reclamation, the Contractor shall submit test data documenting that the source meets the required specifications.
   b. Reclamation reserves the option to perform independent testing at the source.
   c. The approval of material by Reclamation from sources other than above shall not be construed as constituting the approval of all or any specific materials taken from the source, and the Contractor will be held responsible for the specified quality of all such materials used in the work.
7. Quality: Riprap materials from any source(s) may be rejected if it fails to meet any of the following quality requirements:
   a. Los Angeles abrasion loss (ASTM C 131, using grading A). - Seven percent maximum loss of weight at 100 revolutions.
   b. Sodium sulfate test for soundness (Designation 19, Eighth Edition - Revised Reprint of the Bureau of Reclamation Concrete Manual). - Three percent maximum weighted average loss, by weight, after 5 cycles.
   c. Specific gravity (ASTM C 127, saturated, surface-dry basis). - 2.65 minimum.

8. Gradation for riprap:

Riprap Gradation

Stone Size d50 (nominal stone size) **Inches**	Material Smaller Than Typical Stone (based on typical rock mass) **Percent (%)**	Typical Stone Size **Inches**
15	100	25
	50 to 85	18
	40 to 50	15
	No more than 15	6

2.02 ALTERNATE ERIOSION PROTECTION PRODUCTS

A. Articulated Concrete Block

1. General:

a. In lieu of the riprap specified above that is to be placed over geotextile, an alternate method of erosion protection will be considered. The alternate product shall provide the same protection as the riprap specified above.

b. Alternate erosion protection products that will be considered are articulated concrete blocks. The articulated concrete blocks shall be Cable Concrete designed and produced by International Erosion Control Systems, or equal.

c. Articulated concrete blocks shall be made up of mattresses measuring approximately 4 feet by 16 feet and 8 feet by 16 feet which are placed side by side and clamped together to provide one homogeneous erosion protection system.

d. If needed, irregular mat sizes shall be designed and utilized to form the sluice channel.

e. Each mat shall be made up of concrete blocks interconnected by integrally woven stainless steel cables which are placed within the concrete blocks.

f. The concrete blocks shall be held together by integrally woven stainless steel cables, which are placed within the concrete blocks.

g. A geotextile fabric shall be attached to the base of each concrete mat.

h. The size of the concrete blocks shall be 15.5" square at the base and 11.5" square at the top face (a truncated pyramid shape). The resulting height and weight of the blocks shall be determined by the manufacturer and based on the following design criteria:

1) The sluice channel geometry shown on Drawing No. 3704-D-3 and -5.

2) Impinging velocity in the bend of the channel: 10 feet per second minimum.

3) Non-impinging velocity protection: 13 feet per second minimum.

i. Concrete

1) Compressive strength shall be 4000 psi @ 28 days.

2) Air entrainment shall range between the range of 4% to 7%.

3) All ASTM standards shall be satisfied in the production of the concrete.

4) Finished concrete product shall consist of a minimum density of 140 lbs/cf, in an average of 3 units.

5) No individual block shall consist of a minimum concrete density lower than 135lbs/cf.

j. Cables

1) Stainless steel aircraft cable, Type 302 or Type 304.

2) Type 1 x 19 construction.

3) Cables shall be integral (placed into) to the concrete block, and shall traverse through each block in both longitudinal & lateral directions of the mat system.

4) Diameter of cable to be determined by the manufacturer's designer.

k. Cable Clamps

1) Sufficient stainless steel wire rope clamps shall be used to secure loops of adjoining mats.

2) The number of loop connections shall be based on project specifics, and shall be shown in the installation drawings and in typical detail sheets.

3) Clamping in field shall be in accordance with the manufacture's project layout details.

l. Geotextile

1) The geotextile used under the articualated concrete blocks shall be determined by the manufacturer's designer.

2) The geotextile shall be a. needle punched non-woven fabric.

3) The geotextile shall be attached to the bottom of the concrete block mats.

4) A minimum overlap of 2 feet. shall be incorporated on three sides of the mat. The overlap shall provide an area for the adjoining mats to be placed upon and prevent undermining of the erosion control system.

5) The weight and thickness of the geotextile used under the articualated concrete blocks shall be determined by the manufacturer's designer. The minimum weight of geotextile shall be 8 ounces per square yard.

PART 3 EXECUTION

3.01 PLACING RIPRAP

A. The Contractor shall place riprap to as near as possible the prescribed outlines and thicknesses as shown on the drawings for the protection for erosion control.

B. The Contractor shall demonstrate, for the Contracting Officer's approval, the proposed method of placing riprap on the geotextile. The Contractor's placing method shall ensure that the geotextile will not be damaged as a result of the placing method.

C. Begin placing at the toe of the slope to be protected, and work upslope.

D. Position riprap in such a manner as to ensure stability and without tendency to slide, and so that there will be no unreasonably large unfilled spaces within the riprap.

E. Position riprap in close to final position without use of pushing material with dozers or other equipment to minimize segregation.

F. After riprap is placed in final position, consolidate riprap by operating tracked equipment upon it as approved by the Contracting Officer.

3.02 PLACING ARTICULATED CONCRETE BLOCKS

A. Follow manufacture's instructions for installation.

B. The supplier shall have a technician experienced in the installation of the articulated concrete blocks available at the start of the installation to assure a proper installation.

C. The mats shall be laid from the downstream end of project to the upstream end, so the geotextile joints are shingled to direct flow over the joint and to prevent undermining.

D. Provide intimate contact with the blocks and the subgrade.

E. The gaps between each mat shall not be greater then 2 inches; or else the gap must be closed using concrete.

F. The outside edges of the mat system shall be entrenched edges as specified by the manufacturer's designer.

END OF SECTION

SECTION 02297 - DISPOSAL OF EXCAVATED MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost in prices offered in the schedule for excavation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DISPOSAL OF EXCAVATED MATERIALS

A. Waste material from required excavation which is not suitable or required for compacted backfill.

B. Deposit waste excavated material in waste banks on rights-of-way controlled by the Department of Natural Resources (DNR).

C. Waste areas for excavated materials are shown on Drawing No. 3704-417-2B and shall be subject to the approval of the Contracting Officer.

D. Do not place waste material in wetlands, within 12 feet of drainage channels.

E. Do not waste material by dumping from top of slope.

F. Grade waste banks to reasonably even and uniform surfaces that blend with natural terrain.

1. Minimum slope: 2 percent.
2. Maximum slope: 4:1.

G. Leave surface in a condition that will facilitate natural revegetation.

END OF SECTION

SECTION 02323 - CONTROLLED LOW STRENGTH MATERIALS (CLSM)

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Controlled Low Strength Material:

1. Measurement: Volume measured in place to lines, grades, and dimensions shown on drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Cubic yard price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and placing Controlled Low Strength Material in accordance with the provisions of this section and referenced sections.

   a. Payment for Controlled Low Strength Material is limited to the following:

      1) Area between the existing radial gate structure and the West wall of the flap gate structure where proper compaction of backfill would be difficult.

      2) Triangle shape area located between the gate structure and flap gate structure.

   b. Unless otherwise approved by the Contracting Officer, furnishing and placing Controlled Low Strength Material, at other locations and in lieu of placing compacted backfill, payment will be made at the unit price bid for Compacted Backfill.

1.02 DEFINITIONS

A. Other terms used to describe CLSM include:

1. Soil-cement slurry
2. Slurry cement backfill
3. K-Krete
4. Flowable fill

B. Refer to ACI 229-94 Report “Controlled Low Strength Materials (CLSM)”.

1.03 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 33-03 Concrete Aggregates
2. ASTM C 94/C 94M-04a Ready-Mixed Concrete

3.	ASTM C 114-05	Chemical Analysis of Hydraulic Cement
4.	ASTM C 150-04a	Portland Cement
5.	ASTM C 595-03	Blended Hydraulic Cements
6.	ASTM C 618-03	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
7.	ASTM D 4832-02	Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinder
8.	ASTM D 6103-04	Flow Consistency of Controlled Low Strength Material (CLSM)

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Data:

a. Mix design with test results showing conformance with specified requirements for compressive strength and spread.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of CLSM in accordance with ASTM C 94. Deliver ticket to Contracting Officer's Representative at jobsite during batch delivery.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Cementitous Materials Option:

1. Specified portland cement plus 20 percent plus or minus 5 percent by weight specified pozzolan.

2. Blended hydraulic cement.

B. Portland Cement:

1. ASTM C 150, Type II.

2. Meet equivalent alkalies requirements of ASTM C 150 - Table 2.

3. Meet false-set requirements of ASTM C 150 - Table 4

C. Pozzolan:

1. ASTM C 618, Class F, except,

a. Sulfur trioxide for Class F, maximum: 4.0 percent.

b. Loss on ignition, maximum: 2.5 percent.

c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C 618. Use low-alkali cement for test.

d. Does not decrease sulfate resistance of concrete by use of pozzolan.

1) Demonstrate pozzolan will have an "R" factor less than 2.5.

2) R = (C-5)/F

3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C 114.

4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C 114.

D. Blended hydraulic cement:

1. ASTM C 595, except,

a. Portland cement plus pozzolan only.

b. At least 20 percent pozzolan.

2.02 WATER

A. ASTM C 94

2.03 AGGREGATE

A. Aggregate: ASTM C 33

B. Gradation

1. Maximum particle size: 1-1/2 inches or 1/8 of open distance between pipe and trench wall, whichever is less.

2.04 MIX

A. Use one of specified cementitious materials options.

B. Water-cementitious materials ratio, maximum: 3.5 to 1, by weight.

C. Water content: Not to exceed that required to provide a mix that will flow and can be pumped.

D. 7-day Compressive strength, ASTM D 4832: Not less than 50 lb/in2 and not more than 200 lb/in2.

E. Consistency:

1. Spread, ASTM D 6103: 8 to 9 inches.

2.05 SLURRY TEMPERATURE

A. Slurry temperature at time of placement: 50 degrees F or greater

2.06 SOURCE QUALITY CONTROL

A. Make trial mixes prior to construction to determine mixture adequacy.

1. Determine compressive strength in accordance with ASTM D 4832.
2. Determine spread in accordance with ASTM D 6103.

PART 3 EXECUTION

3.01 BATCHING EQUIPMENT

A. Design and operation of mixers: Slurry, as discharged, is uniform in composition and consistency throughout each batch.

3.02 PLACING

A. Do not place slurry during rain.

B. Do not mix or place slurry when ambient temperature is below 40 degrees F. When ambient temperature is 35 degrees F or above, slurry may be placed when ambient temperature is rising.

C. Place slurry to lines, grade, and dimensions shown on drawings.

D. Do not place backfill material over slurry until slurry has reached initial set.

3.03 FIELD QUALITY ASSURANCE

A. The Government will obtain samples and test for compressive strength in accordance with ASTM D 4832 and spread in accordance with ASTM D 6103.

3.04 PROTECTION

A. If backfill will not be placed over slurry within 8 hours, place 6-inch minimum cover of moist backfill over slurry. Maintain moisture in 6-inch soil cover until additional backfill is placed.

B. If ambient temperature is 50 degrees F or less, place 12-inch minimum additional cover of loose backfill over 6-inch moist backfill cover before end of work day.

END OF SECTION

SECTION 02342 - GEOTEXTILE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Geotextile:

1. Cost: The cost of furnishing and placing geotextile beneath erosion protection shall be included in the payment for erosion protection.

1.02 REQUIREMENT

A. Geotextile shall be placed in locations shown on the drawings and in locations directed by the Contracting Officer.

B. In general, geotextile shall be placed on undisturbed subgrade or on compacted backfill subgrade prior to placing erosion protection.

C. In lieu of riprap, if alternate erosion protection products is submitted and approved, the erosion protection products shall utilize geotextile to prevent the loss of finer grade subgrade materials.

1.03 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 3786-01	Hydraulic Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method
2.	ASTM D 4355-02	Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
3.	ASTM D 4491-99a	Water Permeability of Geotextiles by Permittivity
4.	ASTM D 4533-91(1996)	Trapezoid Tearing Strength of Geotextiles
5.	ASTM D 4632-91(2003)	Grab Breaking Load and Elongation of Geotextiles
6.	ASTM D 4751-99a	Determining Apparent Opening Size of a Geotextile
7.	ASTM D 4833-00	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
8.	ASTM D 5261-92(2003)	Measuring Mass per Unit Area of Geotextiles

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Data:

a. Manufacturer's certification: Submit information indicating that the geotextile meets specified chemical, physical, and manufacturing requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Wrap geotextile rolls in relatively impermeable and opaque protective covers.

B. Mark or tag geotextile rolls with manufacturer's name, product identification, lot number, roll number, and roll dimensions.

C. Mark geomembrane with special handling requirements such as "This Side Up" or "This Side Against Soil to be Retained."

D. Protect geotextile from ultraviolet light exposure, temperatures greater than 140°F (60°C), precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions.

E. Elevate and cover material stored outside with waterproof membrane.

PART 2 PRODUCTS

2.01 GEOTEXTILE BENEATH RIPRAP

A. Needle-punched, non-woven geotextile comprised of long-chain polymeric filaments composed of at least 85 percent, by weight, polyolefins or polyesters.

B. Orient filaments into stable network which retains its structure during handling, placement, and long-term service.

C. Stabilizers or inhibitors added to filament base material: Resist deterioration due to ultraviolet or heat exposure.

D. Geotextile edges: Salvaged or otherwise finished to prevent outer material from pulling away.

E. Conform to average roll values listed in Table 02342B - Geotextile Physical Properties.

F. Values listed are minimum average roll values (MARV’s), unless otherwise noted.

G. Test results for weaker principal direction shall meet or exceed minimum values listed in Table 02342B.

H. Direct exposure to sunlight: Withstand 14 days with no measurable deterioration.

Table 02342B. - Geotextile Mechanical and Physical Properties (for use beneath Riprap)

Property	Test method	Test Value	Units
Grab tensile	ASTM D 4632	380	Lbs
Elongation at break	ASTM D 4632	50	Percent
Trapezoidal tear	ASTM D 4533	140	Lbs
Puncture strength	ASTM D 4833	235	lbs
Burst strength	ASTM D 3786	740	lb/in^2
Permittivity	ASTM D 4491	0.54	sec^{-1}
Apparent opening size (minimum US Sieve No. / maximum opening size)	ASTM D 4751	100	US Sieve
UV resistance, strength retained	ASTM D 4355 (500 hrs)	70	percent retained
Weight	ASTM D 5621	15	Oz/yd^2

I. Geotextile placed beneath riprap shall be Mirafi 1160N as manufactured by TC Mirafi, Pendergrass, GA 30567, or equal.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Remove and control of water in accordance with Section 02243 (Removal and Control of Water).

B. Prepare surface upon which geotextile is to be placed to a firm surface, reasonably even and smooth, and free of abrupt indentations and protruding materials.

C. Fill low spots with compacted backfill material.

D. Limit offsets.

E. Obtain Contracting Officer approval of subgrade before placing geotextile.

3.02 INSTALLATION

A. Place geotextile in the manner and at locations shown on drawings.

B. Lay geotextile smoothly, free of tension, stress, folds, wrinkles, or creases so far as is practical and except where required in these specifications.

C. Anchor geotextile at top of slopes in anchor trenches.

D. Shingle overlaps on slopes with upstream roll placed over downstream roll.

E. Pin, staple, or weight to hold geotextile in position.

F. Anchor terminal ends of geotextile with key trenches or aprons at crest and toe of slopes.

G. In the presence of wind, weight geotextiles with sandbags or equivalent until cover material placed.

H. Do not entrap stones, soil, excessive dust, or moisture in geotextile that could damage geotextile or hamper subsequent seaming.

3.03 SEAMING

A. Join adjacent sheets of geotextile by overlapping.

B. Overlapped seams:

1. Overlap minimum: 36 inches.

C. Upstream/upslope roll placed over the downstream/down slope roll.

D. Weight or pin on 3-foot centers to secure the overlap during placement of cover material.

1. Do not use pins when installed over geomembranes.

2. Pins: 3/16-inch diameter, 18-inches long steel pins, pointed at one end, and fitted with 1-1/2 inch diameter washer at other end.

3.04 RIPRAP INSTALLATION

A. Cover geotextile with riprap on the same day as geotextile placement.

B. Before placing riprap, demonstrate that placing technique will not damage geotextile. If the demonstration does not show that riprap can be installed without damaging geotextile, modify riprap placing technique (such as reducing drop height, installing additional layer of sacrificial geotextile, or installing gravel cushion).

C. On slopes greater than 5:1, begin riprap placement at toe and proceed up slope.

3.05 REPAIRS

A. During placement, geotextile will be rejected if it has defects, rips, holes, flaws, deterioration, or damage.

B. Replace or repair geotextile damaged during installation or placement of cover in the following manner:

1. Remove cover from damaged area of geotextile.
2. Remove any soil or other material which may have penetrated torn geotextile.
3. Repair damaged geotextile by placing additional layer of geotextile to cover damaged area and overlap undamaged geotextile by at least 3 feet on all sides.

3.06 INSPECTION

A. After installation, examine entire geotextile surface to ensure that potentially harmful foreign objects (such as needles) are not present.

B. Remove foreign objects or replace geotextile.

END OF SECTION

SECTION 02732 - GRAVEL SURFACING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Gravel Surfacing:

1. Measurement: Area measured in place to lines, grades, and thickness shown on drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Square yard price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and placing Gravel Surfacing in accordance with the provisions of this section and referenced sections.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM D 1241-00 Materials for Soil-Aggregate Subbase, Base, and Surface Courses

PART 2 PRODUCTS

2.01 GRAVEL

A. Gravel surfacing shall meet the gradations listed in the following table:

Sieve Designation Inches	Percent by weight passing square mesh openings of sieve
1 ½	100
No. 4	30 to 65
No. 8	25 to 55
No. 200	3 to 12

PART 3 EXECUTION

3.01 LOCATIONS

A. Place gravel surfacing at the following locations or in locations directed by the CO:

1. Along the realigned shown on Drawing No. OA74-D-3.

2. Within the fenced area shown on Drawing No. OA74-D-5.

3.02 PREPARATION

A. Grade and prepare subgrade free from depressions and soft spots.

B. Obtain Government approval of subgrade before placing surfacing.

3.03 PLACING

A. Provide and compact (refer to Section 02223, Compacting Earth Materials) gravel surfacing to thickness shown on drawings or as directed.

END SECTION

SECTION 02822 - CHAIN LINK FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Chain Link Fence:

1. Measurement: Sloping length along toprail from centerline to centerline of posts, including gates and overhangs.
2. Payment: Linear foot price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing, installing and grounding Chain Link Fence in accordance with the provisions of this section and referenced sections.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 121-99(2004)	Metallic-Coated Carbon Steel Barbed Wire
2.	ASTM A 392-03	Zinc-Coated Steel Chain-Link Fence Fabric
3.	ASTM A 824-01	Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
4.	ASTM C 33-03	Concrete Aggregates
5.	ASTM C 94/C 94M-04	Ready-Mixed Concrete
6.	ASTM C 150-04	Portland Cement
7.	ASTM F 567-00	Installation of Chain-Link Fence
8.	ASTM F 626-96a(2003)	Fence Fittings
9.	ASTM F 900-03	Industrial and Commercial Swing Gates

B. Chain Link Fence Manufacturers Institute (CLFMI)

1. CLFMI 2445-97 Product Manual

PART 2 PRODUCTS

2.01 CHAIN LINK FABRIC

A. Zinc-Coated Steel Fabric: ASTM A 392

1. Fabric height shall be six feet.
2. 2-inch mesh
3. Diameter of Coated Wire: 0.148-inch-diameter (no. 9-gauge)

4. Coating weight before weaving, Class 1 zinc.

2.02 INTERMEDIATE POSTS

A. CLFMI 2445, Type I round pipe.

2.03 TERMINAL POSTS, BRACES, AND RAILS

A. CLFMI 2445, Type I round pipe.

2.04 TENSION WIRE

A. Zinc-coated steel marcelled tension wire: ASTM A 824

1. Coating: Type II, Class 4

2.05 BARBED WIRE

A. Steel barbed wire: ASTM A 121

1. Coating: Type Z, Class 1
2. Three No. 12-1/2-gauge twisted line wires
3. Barbs: Four-point, 5-inch barb spacing, no. 14-gauge, round barbs.

2.06 FITTINGS

A. Post Caps, Rail Ends, Brace Ends, and Barbed Wire Arms: ASTM F 626, zinc-coated steel or zinc-coated cast iron.

B. Top rail Sleeves, Tension Bars, and Truss Rods: ASTM F 626, zinc-coated steel.

2.07 MISCELLANEOUS METALWORK

A. Plates, bars and adhesive anchors: In accordance with Section 05500 (Metal Fabrications).

2.08 TIE WIRES, CLIPS, BANDS, AND OTHER FITTINGS

A. Tie Wires and Clips: ASTM F 626

1. Standard round wire ties
    a. 9 gage steel
    b. Zinc coating, minimum 1.2 oz/ft2

2.09 GATES

A. Gates: ASTM F 900.

1. Single- and double-swing types.
2. Directions of swing: 180 degrees outward opening

B. Frame: CLFMI 2445, Type I round pipe.

1. Corners:

a. Welded or heavy fittings.

b. Rigid and watertight.

C. Fabric: Same type used in fence.

D. Accessories:

1. ASTM F 900

2. Provide zinc-coated steel or zinc-coated cast iron gate hinges, latches, stops, and keepers.

2.10 CONCRETE

A. Manufacture and delivery: In accordance with Section 03301 - Cast-In-Place Concrete.

2.11 GROUT

A. Packaged grout:

1. ASTM C 1107.

2. Mix in accordance with manufacturers instructions.

3. Consistency: No wetter than necessary for satisfactory placement.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear and remove trees, brush, ground surface irregularities, and other obstacles which interfere with proper erection of fence in advance of starting fencing work.

B. Dispose of removed material in accordance with Section 01561 – Cleaning.

3.02 INSTALLATION

A. Install six foot high chain link fence with three strands of barbed wire at location shown on Drawing No. 3704-D-5 and 40-D-7016.

B. Install fence overhangs on the end of the concrete structure transition and over the earth lined canal as shown on Drawing No.s 3704-D-5 and 3704-417-18. Install fence overhang on each side of the gate structure and parallel to the existing 16” municipal pipeline as shown on Drawing No. 3704-D-5.

C. Construct two 16-foot double drive gates as shown on Drawing No. 3714-D-5.

D. Install chain link fence in accordance with ASTM F 567 and CLFMI 2445, except as shown on the drawing or specified.

E. Terminal posts:

1. Maximum intervals: 500 feet

2. At vertical and horizontal changes in alignment equal to or greater than 30 degrees.

3.03 GROUND CONNECTIONS

A. After connections are made, metal finishes that have been damaged as a result of grounding connections shall be repaired

B. Grounding connections shall be made in accordance with methods outlined on Drawing No. 40-D-6376.

C. Ground rods shall be driven vertically the full length of the rod until top of rod is at required depth below established grade elevation. When solid rock is encountered within 3 feet of the established grade elevation, the Contractor shall drill a vertical hole of such depth that top of ground rod will be at required depth. Diameter of hole shall be at least 1-1/2 times the diameter of ground rod. Rod shall be grouted in hole. When solid rock is encountered more than 3 feet below established grade elevation, rod shall be driven to refusal at approximately 45^{o}, then top of rod bent to lie horizontally at required depth.

3.04 REPAIR

A. Repair damage to zinc coatings with commercial zinc-rich priming paint.

3.05 TESTING AND ADJUSTING

A. After installation, test and adjust gates for proper operation.

END OF SECTION

DIVISION 3 - CONCRETE

SECTIOM 03100 – CONCRETE FORMWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and constructing forms in applicable prices offered in schedule for concrete items for which forms are required.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS Reclamation Safety and Health Standards, 2001 Edition

B. APA – The Engineered Wood Association (APA)

1. APA PS 1-95 Construction and Industrial Plywood

C. Western Wood Products Association (WWPA)

1. WWPA G5 Western Lumber Grading Rules ‘05

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 FORM MATERIALS

A. Sheathing or Lining: Conform to Table 03100A - Form Sheathing or Lining Materials, or provide other materials which will produce equivalent results.

Table 03100A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common, or better, shiplap or plywood	Steel sheathing permitted Steel lining permitted if approved

Table 03100A - Form Sheathing or Lining Materials

F3	Plywood	Steel sheathing permitted Steel lining not permitted
F4	Plane surfaces: Plywood. Warped surfaces: Plywood, or lumber which is free from knots and other imperfections and which can be cut and bent accurately without splinters or splitting. Severe curvature: May be lined with continuously supported flexible material such as masonite or thin plywood. Use of material is subject to CO approval.	Steel sheathing permitted Steel lining not permitted.

B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.

C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.

D. Plywood: APA PS 1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

E. Softwood Lumber:

1. Meet requirements of WWPA G5 for dressed lumber or worked lumber of specified grade.
2. Use common boards surfaced on both edges (S2E) in accordance with WWPA G5.
3. Use 6- or 8-inch wide lumber for shiplap forms.
4. Use same lumber width in forms for F2 finishes.

F. F3 Finish Forms: Use material with basic modular size of 4- by 8-feet.

3.02 INSTALLATION

A. Construct forms to confine and shape concrete to required lines so that completed work meets specified structural deviations, surface tolerances, and finish requirements.

B. Construct forms with sufficient strength to withstand pressure from placing and vibrating concrete. Maintain in proper position.

C. For concrete containing type 1 or 2 plasticizer chemical admixtures, adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.

D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.

E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.

F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.

G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.

H. F2 Finish:

1. Use one type of form sheathing or lining material for exposed F2 surfaces.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.
5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.

I. F3 and F4 Finish:

1. Use one type of form sheathing or lining material for F3 surfaces. Fabricate filler panels for corners, soffits, and similar offsets from same material as used for forms.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Align sheathing or lining horizontally and vertically and place to minimize joint marks on surfaces.
4. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.

5. Make vertical form marks continuous for entire height of surface.

6. Fill and smooth finish voids at joints in plywood form lining or sheathing.

7. Do not construct forms continuously from lift to lift. Remove forms after concrete in a lift has hardened and reset forms for next lift.

8. Reset forms to overlap hardened concrete in previous lift by 1 inch, maximum.

9. Tighten forms snugly against hardened concrete so that forms will not spread and cause offsets or loss of mortar at construction joints when concrete placement is resumed. Provide additional bolts or form ties required to hold reset forms tight against hardened concrete.

J. Form Ties and Anchors

1. Embed ties for holding forms.

2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.

3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.

4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.

K. Cleaning and Oiling Forms:

1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.

2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3.03 REMOVAL

A. Remove forms within 24 hours after concrete has hardened sufficiently to prevent damage by form removal. Begin required repair and curing immediately after form removal.

B. Remove forms on upper sloping faces of concrete, such as forms on waterside of warped transitions, as soon as concrete has attained sufficient stiffness to prevent sagging.

C. Loosen wood forms for wall openings as soon as loosening can be accomplished without damage to concrete to prevent excessive stress in concrete from swelling of forms. Construct forms for openings to facilitate loosening.

D. Do not remove forms until concrete strength is such that form removal will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete.

E. Remove forms in a manner which prevents damage to concrete.

F. Repair damaged concrete in accordance with Section 03301 – Cast-In-Place Concrete.

END OF SECTION

SECTION 03156 - PVC WATERSTOP

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing PVC waterstops in applicable prices offered in schedule for concrete items for which PVC waterstops are required.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 638-03	Tensile Properties of Plastics
2.	ASTM D 746-04	Brittleness Temperature of Plastics and Elastomers by Impact
3.	ASTM D 747-02	Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
4.	ASTM D 1203-94(2003)	Volatile Loss From Plastics Using Activated Carbon Methods

B. United States Army Corps of Engineers (COE)

1.	COE CRD-C-572-74	Polyvinylchloride Waterstop

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

B. Approval Data:

1. 2-foot-long sample of each size and type of waterstop to be used in work.
2. Manufacturer's certification for PVC compound used to fabricate waterstop.
    a. Include physical property test data on compound from tests performed by manufacturer or other laboratory within 18 months before submittal.
3. Sampling certification that samples are representative of waterstop to be used in work.
4. Manufacturer's recommendations for installing and splicing waterstop.

1.04 QUALIFICATIONS

A. Use skilled workmen to make splices.

B. Demonstrate to CO that workmen are sufficiently skilled to fabricate required splices.

PART 2 PRODUCTS

2.01 PVC WATERSTOPS

A. PVC Compound:

1. Domestic virgin PVC with additional resins, plasticizers, stabilizers, or other materials required to meet specified requirements.
2. Do not use reclaimed PVC or manufacturer's scrap.

B. Meet physical characteristic requirements specified in Table 03156A - PVC Waterstop Physical Characteristics.

Table 03156A - PVC Waterstop Physical Characteristics

Property	Test Method	Requirement
Tensile test, minimum	ASTM D 638,speed D, specimen type IV	2,000 lbs/in^2
Ultimate elongation, minimum	ASTM D 638, speed D, specimen type IV	300 percent
Stiffness in flexure, minimum	ASTM D 747	600 lbs/in^2
Low temperature brittleness at -35 degrees F	ASTM D 746	No cracking or chipping
Volatile loss, change in weight, maximum	ASTM D 1203, method A, 0.08-inch-thick specimen	0.50 percent
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	COE CRD-C-572	80 percent
Ultimate elongation after accelerated extraction test, percent of ultimate elongation before extraction test, minimum	COE CRD-C-572	80 percent
Change in weight after effect of alkalies test	COE CRD-C-572	+0.25 percent -0.10 percent
Change in Shore durometer hardness after effect of alkalies test	COE CRD-C-572	∀ 5 percent

C. Prepare test specimens in accordance with COE CRD-C-572.

2.02 FABRICATION

A. Mold or extrude so that cross section will be dense, homogeneous, and free from porosity and other imperfections.

B. Conform to detail dimensions and tolerances indicated on Standard Drawing 40-D-6463.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install waterstops at locations shown on drawings.

B. Install in accordance with manufacturer's recommendations.

C. Embed waterstop so that one-half of waterstop width will be embedded on each side of concrete joint.

D. Position waterstop and secure during installation so that a continuous watertight diaphragm will be formed in joint unless otherwise shown on drawings. Do not nail, puncture, or cut waterstop.

E. Support and protect waterstop during work.

F. Protect waterstop from oil, grease, and curing compound.

G. Remove large pieces of aggregate near waterstop by hand so that complete contact is maintained between waterstop and surrounding concrete.

H. Vibrate concrete surrounding waterstop with additional vibration so that waterstop is completely embedded in concrete.

3.02 SPLICING

A. Splice waterstops at joints in waterstop sections and at intersections of waterstops.

B. Make neat splices with waterstop ends joined in true alignment.

C. Use a miter-box guide and portable saw to make cuts so that ends to be joined will be in proper alignment and contact will be maintained between joined surfaces.

D. Splice by heat sealing adjacent surfaces in accordance with manufacturer's recommendations.

1. Use a thermostatically controlled electric heat source.
2. Use correct temperature to melt material.
3. Do not char material.

E. Make splice so that cooled splice when bent by hand to as sharp an angle as possible shows no sign of separation.

END OF SECTION

SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete reinforcement in applicable prices offered in the schedule for concrete items for which concrete reinforcement is required.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM A 615/A 615M-06 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. ASTM A 996/A 996M-05a Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

B. Reinforcement Diagrams and Lists:

1. Shop Drawings – For information only
    a. Submit clear, legible, accurate, and checked, before submittal, reinforcement detail drawings.
    b. Submit one print and one reproducible of all drawings.
    c. Reinforcement Detail Drawings prepared by the Contractor for all concrete structures and the Control Building.
    d. Drawing Preparation:
        1) Prepare reinforcement detail drawings following the recommendations established by ACI 315 R-80 unless otherwise shown on the reinforcement design drawings.
        2) Include bar-placing drawings, bar-bending diagrams, and bar lists in such reinforcement detail drawings.
        3) Show necessary details on the drawings for checking the bars during placement.
    e. Submittal Times of Drawings:

1) Submit to the Chief, Design and Construction Group, one print and one reproducible that will permit clear, legible copies to be made of each of the Contractor's reinforcement detail drawings at least 15 calendar days before scheduled concrete placement.

2) If any reinforcement detail drawing or group of drawings is not of a quality acceptable to the Chief, Design and Construction Group, the entire set or group of drawings will be returned to the Contractor, to be corrected and resubmitted.

3) Acceptable reinforcement detail drawings shall be reviewed by the Contractor for adequacy of general design and controlling dimensions.

2. At least two weeks prior placing reinforcement in any structure, reinforcement detail drawings describing the reinforcement shall been submitted.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid rusting.

B. Protect from contaminants such as grease, oil, and dirt.

C. Provide for identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars:

1. ASTM A 615, Grade 60; or ASTM A 996, Type A, Grade 60.

2. Deformed steel bar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.

B. Accurately place and secure in position so that reinforcement will not be displaced during concrete placement.

C. Field bending not allowed unless approved by COR.

D. Do not weld or tack weld reinforcing bars.

E. Place reinforcement with a clear distance of 1 inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.

F. Tolerances:

1. Maintain concrete cover over reinforcement within ½ inch of specified cover where specified cover is greater than 2-1/2 inches.

2. Maintain concrete cover over reinforcement within ¼ inch of specified cover where specified cover is 2-1/2 inches or less.

3. Maintain spacing of reinforcing bars within 1 inch of required spacing.

END OF SECTION

SECTION 03301 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Concrete for Structures:

1. Measurement: Volume measured to structure neatlines shown on drawings, the provisions of this section or as directed by the Contracting.

    a. Volume of openings, recesses, embedded pipes, and metalwork larger than 100 square inches in cross section will be deducted.

2. Payment: Cubic yard price offered in the schedule. The unit price shall include all costs of labor, equipment and materials required for furnishing and placing concrete for structures in accordance with the provisions of this section and referenced sections.

B. Concrete for Canal Lining:

1. Measurement: Surface area to the limits and details shown on the drawings, the provisions of this section or as directed by the Contracting Officer.

2. Payment: Square yard price offered in the schedule. The unit price shall include all costs of labor, equipment and materials required for furnishing and placing concrete for canal lining in accordance with the provisions of this section and referenced sections.

C. Control Building:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials required for furnishing and constructing the complete Control Building in accordance with the provisions of this section and referenced sections. The lump sum price shall also include all cost of furnishing the Control Building's lights, vents, door and provisions for electrical conduits and mechanical equipment.

D. Cost:

1. The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the Contractor.

2. The cost of Removing Existing Canal Lining and Removing Existing Features shall be included in the applicable lump sum bid items.

3. The cost of providing electrical equipment for the Control Building shall be included in the lump sum prices bid in the schedule for a Complete AC Electrical System and Complete 24 Volt DC Battery System.

4. The cost of providing mechanical equipment for the Control Building shall be included in the applicable lump sum costs for which the mechanical equipment is needed.
5. The cost of concrete for installing posts for the chain link fence shall be included in the unit price for Chain Link Fence.
6. The cost of concrete for installing posts for the W-beam guardrail shall be included in the unit price for W-Beam Guardrail.

1.02 DEFINITIONS

A. Cementitious Materials

1. Cementitious materials means Portland cement plus a pozzolan.

B. For purposes of this specification, concrete structures will be defined as:

1. Fish barrier weir
2. Upstream walls (right side slope near Sta. 1+00)
3. Transition (left side slope between Sta. 4+30 to 4+56.13)
4. Gate structure (between Sta. 4+56.13 to 5+26.13)

C. In regards, to measurement and payment purposes, the Control Building is not considered a concrete structure.

1.03 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 31/C 31M-03a	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C 33-03	Concrete Aggregates
3.	ASTM C 39/C 39M-05	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C 42/C 42M-04	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5.	ASTM C 94/C 94M-04a	Ready-Mixed Concrete
6.	ASTM C 114-05	Chemical Analysis of Hydraulic Cement
7.	ASTM C 143/C 143M-05a	Slump of Hydraulic-Cement Concrete
8.	ASTM C 150-05	Portland Cement
9.	ASTM C 171-03	Sheet Materials for Curing Concrete

10.	ASTM C 231-04	Air Content of Freshly Mixed Concrete by the Pressure Method
11.	ASTM C 260-01	Air-Entraining Admixtures for Concrete
12.	ASTM C 309-03	Liquid Membrane-Forming Compounds for Curing Concrete
13.	ASTM C 494/C 494M-05	Chemical Admixtures for Concrete
14.	ASTM C 618-05	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
15.	ASTM C 1017/C 1017M-03	Chemical Admixtures for Use in Producing Flowing Concrete
16.	ASTM C 1602/C 1602M-05	Mixing Water Used in the Production of Hydraulic Cement Concrete
17.	ASTM D 1751-04	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
18.	ASTM D 1752-04a	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

B. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specifications for Repair of Concrete, August 1996
2.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval data
    a. Name and manufacturer of each:
        1) cementitious material
        2) admixture
        3) curing compound
        4) aggregate source
    b. The Contracting Officer reserves the right to require submission of manufacturer's test data and certification of compliance with specifications, and to require submission of samples of all concrete materials for testing prior to or during use in concrete.

2. Methods of Repair

   a. Make submittals as required for the method of concrete repair or replacement directed by the Contracting Officer in accordance with BUREC M-47.

3. Mix Design

   a. Submit each concrete mix design.

4. Epoxy grout manufacturer's technical product data, environmental, product storage, preparation, mixing, and installation instructions.

5. Control Building

   a. Pre-cast construction of the Control Building will be considered and will be subject to approval by the Contracting Officer.

   b. If pre-cast is proposed by the Contractor, the following approval data shall be submitted prior to fabrication of the Control Building:

      1) Drawings, specifications and notes for the proposed building must be designed and stamped by a Professional Engineer (P.E.), registered in the State of New Mexico.

         a) Exception - Requirement of stamped drawings by a P.E. will not be required if the pre-cast building has been designed by department of the United States Government or the State of New Mexico.

      2) Provide information demonstrating the pre-cast fabricator has a minimum of 10-years experience of fabrication, delivery and erection of similar size structures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of concrete in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Cementitious Materials Options:

1. Specified portland cement plus 20 percent plus or minus 5 percent by weight specified pozzolan.

B. Portland Cement:

1. ASTM C 150, Type II and Type V.

2. Meet equivalent alkalies requirements of ASTM C 150 - Table 2.

3. Meet false-set requirements of ASTM C 150 - Table 4.

C. Pozzolan:

1. ASTM C 618, Class F, except,

a. Sulfur trioxide, maximum: 4.0 percent.

b. Loss on ignition, maximum: 2.5 percent.

c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C 618. Use low-alkali cement for test.

d. Does not decrease sulfate resistance of concrete by use of pozzolan.

1) Demonstrate pozzolan will have an "R" factor less than 2.5.

2) R = (C-5)/F

3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C 114.

4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C 114.

2.02 WATER

A. ASTM C 1602, including optional requirements of Table 2.

2.03 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C 33.

B. Coarse Aggregate: ASTM C 33, Size No. 57 (1 inch to No.4).

2.04 ADMIXTURES

A. Air-Entraining Admixture:

1. ASTM C 260.

2. Use a neutralized vinsol resin formulation for air-entraining admixture used with ASTM C 494, Type F or G; and ASTM C 1017, Type I or II chemical admixtures.

B. Chemical Admixtures:

1. Allowable Chemical Admixtures:

a. ASTM C 494, Type A, D, F, or G.

b. ASTM C 1017, Type I or II.

c. ASTM C 494, Type C and E, provided they do not contain chlorides.

2. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2.05 CURING MATERIALS

A. Water: ASTM C 1602, including optional requirements of Table 2.

B. Curing Compound: White wax cure, water-based formulation of white pigments and solids that produces a moisture-resistant membrane film meeting the requirements of ASTM C-309, Type 2, Class A.

C. Polyethylene Film: ASTM C 171, {white opaque}.

2.06 ACCESSORIES

A. Sponge Rubber Joint Filler:

1. See Section 07921.

2.07 MIX

A. The Contractor shall design and adjust concrete mix.

1. The Government reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.

a. Adjustment of mix proportions by the Government will be in accordance with USBR Concrete Manual.

B. Use one of specified cementitious materials options.

C. Net Water-Cementitious Materials Ratio: 0.45 maximum, by weight.

D. Slump: In accordance with ASTM C 143.

1. Concrete in Slabs: 1 to 3 inches at placement, except as specified.

2. Other Concrete: 2 to 4 inches at placement, except as specified.

3. When first mixed, maximum: 5 inches.

4. Concrete with ASTM C 1017, Type I or II chemical admixtures: Use slump appropriate for placing conditions.

E. Compressive Strength:

1. At 28 days, minimum: 4,000 lb/in^2 for concrete structures and 3,000 lb/in^2 for canal lining

a. Acceptance criteria:

1) In accordance with ASTM C 94, plus the following

a) 90 Percent of test cylinders exceed specified compressive strength at 28 days.

2. Quality assurance:

a. In addition to the Contractors quality control program, the Government will test compressive strength in accordance with ASTM C 31 and ASTM C 39 for 6- by 12-inch cast cylinders.

b. Compressive strength may also be determined by Government in accordance with ASTM C 42 for concrete cores.

1) Concrete in an area represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 85 percent of the specified compressive strength (3,400 lb/in2 and 2,550 lb/in2) and no single core has a compressive strength of less than 75 percent of the specified compressive strength (3,000 lb/in2 and 2,250 lb/in2).

F. Air Entrainment: 4 to 6 percent air by volume of concrete as discharged at placement, in accordance with ASTM C 231.

2.08 BATCHING, MIXING, AND TRANSPORTING

A. Manufacture and deliver in accordance with ASTM C 94.

B. Prevent appreciable segregation of ingredients, or slump loss exceeding 2 inches in concrete delivered to work.

2.09 CONCRETE TEMPERATURE

A. Concrete temperature at placing: 50 to 90 degrees F (10 to 32 degrees C).

2.10 ANCHOR BARS (DOWELS) INTO EXISTING CONCRETE

A. Deformed reinforcing bars conforming to ASTM A 615, or A617, grade 60.

B. Epoxy Grout for Anchor Bars

1. Epoxy grout conforming to ASTM C 881, Type IV

C. Epoxy resin and aggregate system for bonding steel to concrete.

1. Epoxy grout shall be HIT RE 500 by Hilti, Inc., 1-800-879-8000 or approved equal.

2.11 CONTROL BUILDING MATERIALS (OTHER THAN CONCRETE)

A. Fluorescent lights

1. Provide two light units

2. Designed for wet locations
3. Minimum start temperature 0 °F
4. 120 VAC
5. 48-inch , T12 type bulbs
6. Two 34 watt bulbs per unit
7. McMaster Catalog No. 8309K93 or equal

B. Rectangular wall vents
1. Provide two vents
2. Low-profile, heavy duty, for new construction
3. Fixed blade wall louvers, 1/8" thick extruded aluminum
4. Insect screen
5. Approximate size of opening 16.5" wide by 7.75" high
6. McMaster Catalog No. 19715K81 or equal

C. Round wall vent
1. Provide one vent
2. 4-inch round, aluminum construction
3. Insect screen
4. McMaster Catalog No. 2016K36 or equal

D. Bullet proof door
1. In accordance with Section 08115.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

B. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with an air-water jet and dry to a uniform surface-dry condition.

C. Prepare earth foundations free from frost or ice.

D. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete.

E. Clean, roughen, and surface dry surfaces of existing concrete and construction joints to be covered with fresh concrete.

1. Remove laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material.

2. Wet sandblast or bushhammer surface, wash thoroughly, and surface dry immediately before placement of adjoining concrete.

3. Do not use a mortar layer on construction joints.

3.02 PLACING

A. Do not use aluminum pipes and chutes for placing or pumping concrete.

B. Do not retemper concrete.

C. Do not use concrete which has become so stiff that concrete cannot be properly placed.

D. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20 inches in depth of layers.

E. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.

3.03 FINISHING

A. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.

B. Notify CO before finishing concrete.

C. Finish concrete in presence of Government inspector unless inspection is waived in each specific case.

D. Formed Surfaces:

1. Finish class is designated by symbols F1, F2, F3, and F4.

2. Finish F1:

a. Applies to formed surfaces to be covered by fill material, grout, or concrete, and construction joint surfaces as specified in Table 03301D – Formed Surfaces.

b. Protect form tie rod ends on surfaces in contact with fill material from moisture where they will be below the water table or waterline.

1) Recess tie rod ends and fill recess with dry pack or other material approved by CO.

c. Cut off flush with formed surface form tie rod ends on surfaces in contact with concrete or fill material and above maximum water table or waterline elevation.

3. Finish F2:

a. Applies to exposed formed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish F3 or F4, and to contraction joint surfaces and expansion joint surfaces as specified in Table 03301D – Formed Surfaces.

1) Recess tie rod ends and fill recess with dry pack or other material approved by CO.

4. Finish F3:

a. Applies to formed surfaces with special appearance requirements, such as surfaces exposed to view, and not required to receive finish F4, as specified in schedule below.

b. After required patching and correction of imperfections has been completed, sack rub surface as follows:

1) Thoroughly wet surface and sack rub while surface is still damp.

2) Use mortar consisting of 1 part cement; 2 parts, by volume, of sand passing a No. 16 screen; and enough water so that mortar has consistency of thick cream. Blend standard cement with white cement as necessary to obtain a color which will match surrounding concrete surface.

3) Thoroughly rub mortar over area with clean burlap or a sponge rubber float to fill pits, bugholes, and other defects.

4) While mortar in pits is still plastic, rub surface with a dry mix of above proportions and material to remove excess plastic material and place enough dry material in the pits to stiffen and solidify mortar so that filling will be flush with surface. Remove material remaining on surface except material within pits.

5) Continue curing surface as specified.

5. Finish F4:

a. Applies to formed surfaces with accurate alignment and evenness of surface requirements to eliminate destructive effects of water as specified in Table 03301D – Formed Surfaces.

E. Unformed Surfaces:

1. Finish class is designated by symbols U1, U2, and U3.

2. Finish U1 (Screeded Finish):

a. Applies to unformed surfaces to be covered by fill material, grout, or concrete as specified in schedule below.

b. Use as first stage of finish U2 and U3.

c. Level and screed concrete to produce even uniform surfaces.

3. Finish U2 (Floated Finish):

a. Applies to unformed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish U3, as specified in Table 03301E – Unformed Surfaces.

b. Use hand- or power-driven equipment.

c. Begin floating as soon as screeded surface has sufficiently stiffened and before bleed water forms.

d. Finish surface with minimum floating necessary to produce a surface that is free of screed marks and is uniform in texture.

e. Use as second stage of finish U3.

4. Finish U3 (troweled finish):

a. Applies to unformed surfaces where appearance and porosity is considered by Government to be of special importance as specified in Table 03301E – Unformed Surfaces.

b. Begin steel troweling after bleed water has disappeared and floated surface has sufficiently hardened to prevent an excess of fine material from being drawn to surface.

c. Trowel with firm pressure to flatten sandy texture of floated surface.

d. Trowel to a dense uniform surface free from blemishes and trowel marks.

3.04 JOINTS AND EDGES

A. Construction Joints (CJ):

1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.

2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.

3. Locate construction joints where shown on drawings or approved by CO.

4. Relocation, addition, or elimination of construction joints will be subject to approval by CO.

B. Contraction Joints (Cr.J):

1. A Cr.J shall be as shown on Drawing No. 3704-D-7.
2. Contraction joints are tool formed joints placed in concrete to provide for volumetric shrinkage of a monolithic unit.

C. Control Joints (Ct.J)

1. A Ct.J shall be as shown on Drawing No. 3704-D-7.
2. Control joints are required where new canal lining is placed back against a clean sawcut edge of existing canal lining.

D. Expansion Joints (EJ), expansion joint between a Structure and New Canal Lining (S/LJ) and Expansion Joints with Waterstop (EJW):

1. An EJ shall be as shown on Drawing No. 3704-D-7.
2. An S/LJ shall be as shown on Drawing No. 3704-D-7.
3. An EJW shall be as shown on Drawing No. 3704-D-1.
4. Cut sponge rubber joint filler size and shape of joint surface to receive filler. Rubber joint fuller shall cover entire surface without voids
5. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.
6. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

E. Tooled Edges: Tool exposed edges of slabs and top edges of curbs to a radius of 1/4 inch.

3.05 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effect that permissible variations may have upon a structure. CO reserves the right to diminish specified structural deviations and surface tolerances where such variations impair structural action, operational function, or architectural appearance of a structure or portion of structure.

D. Construct concrete within stated variations even though more than one may be specified.

1. Specified variation for one element of a structure will not apply when it will permit another element of same structure to exceed its allowable variation.
2. Where variations are not specified or shown on drawings for a particular structure, variations shall be those specified for similar work. As an exception to clause at

FAR 52.236-21 "Specifications and Drawings for Construction," specific tolerances shown on drawings in connection with any dimension shall govern.

E. Structural Deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03301B - Deviations from Specified Lines, Grades, and Dimensions.

2. Variation is distance between actual position of structure or any element of structure and specified position in plan for structure or particular element.

   a. Plus or minus variations, shown as (∀), indicate a permitted actual position up or down and in or out from specified position in plan.

   b. Variations not designated as (+) or (-) indicate maximum deviation permitted between designated successive points on completed element of construction.

3. Specified position in plan is defined as lines, grades, and dimensions described in these specifications, shown on drawings, or prescribed by CO.

Table 03301B - Deviations from specified lines, grades, and dimensions

A. CANAL LINING	
1. *Departure from established alignment (centerline).....	∀2 inches on tangents, ∀4 inches on curves
2. *Departure from established profile grade.....	∀1 inch, Maintain minimum reinforcement cover
* Any departure from alignment or grade shall be uniform. No other departure and no correction in alignment or grade shall be made in less than 20 feet.	
3. Reduction in unreinforced lining thickness	10 percent of specified thickness, average thickness not less than specified thickness
4. Reduction in reinforced lining thickness	0 percent of specified thickness
5. Variation from specified width of section at any height.....	∀(0.25 percent of specified width plus 1 inch)
6. Variation from established lining height	∀(0.50 percent of established height plus 1 inch)

B. CANAL AND PIPELINE STRUCTURES			
1.	Footings:		
	(a)	Variation of length and width dimensions from those specified.....	-1/2 inch +2 inches
	(b)	Misplacement or eccentricity:.....	2 percent of footing width in direction of misplacement, but not more than 2 inches
	(c)	Reduction in thickness from that specified.....	5 percent of specified thickness not to exceed 1 inch
2.	Monolithic siphons and culverts:		
	(a)	Departure from established alignment.....	∀2 inches
	(b)	Departure from established profile grade.....	∀2 inches
	(c)	Variation from specified thickness: At any point.....	-2.5 percent of specified thickness or -1/4 inch, whichever is greater
		At any point.....	+5 percent of specified thickness or +1/2 inch, whichever is greater
	(d)	Variation from specified inside dimensions	∀0.5 percent of inside dimensions

3.	Checks, overchutes, drops, turnouts, inlets, chutes, and similar structures:		
	(a)	Departure from established alignment	∀1 inch
	(b)	Departure from established grade	∀1 inch
	(c)	Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:	
		(1) When overall length of line or surface is:	
		Less than 10 feet	Exposed: ∀3/8 inch Buried: ∀3/4 inch
		10 feet or more	Exposed: ∀1/2 inch Buried: ∀1 inch
		(2) For any two successive intermediate points on the line or surface separated by:	
		10 to 20 feet, inclusive	Exposed: 3/8 inch Buried: 3/4 inch
		More than 20 feet	Exposed: 1/2 inch Buried: 1 inch
4.	Variations from level or specified grades for slabs, beams, and horizontal grooves:		
	(a)	When overall length of line or surface is:	
		Less than 10 feet	Exposed: ∀3/8 inch Buried: ∀3/4 inch
		10 feet or more	Exposed: ∀1/2 inch Buried: ∀1 inch
	(b)	For any two successive intermediate points on the line or surface separated by:	
		10 to 20 feet, inclusive	Exposed: 3/8 inch Buried: 3/4 inch
		More than 20 feet	Exposed: 1/2 inch Buried: 1 inch

5.	Variation in cross-sectional dimensions of columns, piers, slabs, walls, beams, and similar parts of the structure in B.3 above from those specified.....	-1/4 inch +1/2 inch
6.	Variation in sizes and locations from those specified for slab and wall openings.....	∀1/2 inch
7.	**Variation from plumb or level for sills and sidewalls for radial gates and similar watertight joints.....	Not greater than a rate of 1/8 inch in 10 feet
** Dimensions between sidewalls for radial gates: No more than shown on drawings at sills and not less than shown on drawings at top of walls.		
8.	Variation from plumb of pipe erected vertically in any length of 10 feet.....	∀1/2 inch
9.	Variation from plumb or level for invert and sidewalls of each wheel-mounted gate slot, for sidewalls of each penstock stoplog guide, and for similar watertight joints:	
	(a) When overall length of line is: Less than 10 feet..... 10 feet or more.....	 ∀1/8 inch ∀3/4 inch
	(b) For any two successive intermediate points on the line or surface separated by: 10 to 20 feet, inclusive..... More than 20 feet.....	 1/8 inch 3/4 inch
10.	Variation from that specified in distance between vertical sidewalls of each wheel-mounted gate slot and between sidewalls of penstock stoplog guides.....	∀1/2 inch
11.	Variation in location from specified position in plan of sleeves, floor openings, and wall openings.....	∀1/2 inch
12.	Variation in sizes from those specified for sleeves, floor openings, and wall openings.....	∀1/4 inch

F. Surface Irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.

2. Surface irregularities are classified as "abrupt" or "gradual" and allowable tolerances are specified in Table 03301C - Surface Tolerances.

   a. A surface tolerance is designated by a capital "T" followed by a number 1 through 5.

b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt Surface Irregularities:

a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

b. Abrupt surface irregularities include all incidences of isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual Surface Irregularities:

a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Surface Tolerances:

Table 03301C - Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1 inch	1/4 inch/inch
T2	1/2 inch	1/8 inch/inch
T3	1/4 inch	1/16 inch/inch
T4	1/8 inch	1/32 inch/inch
T5	1/32 inch	1/120 inch/inch

H. Repair of Hardened Concrete Not Within Specified Tolerances:

1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.

2. Perform repair after consultation with a Government inspector regarding method of repair. Notify CO as to time when repair will be performed.

3. Repair concrete which will be exposed to view in a manner which will result in a concrete surface with uniform appearance.

a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16 inch in cross section at finished surface.

b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16 inch in cross section at finished surface, repair concrete by excavating and replacing concrete.

I. Field Verification of Surface Tolerances:

1. Determine compliance of a surface with specified surface tolerances.

2. Evaluate surface roughness.

a. Measure roughness height or depth and check for compliance with values specified in Table 03301C - Surface Tolerances and Table 03301B - Deviations from Specified Lines, Grades, and Dimensions.

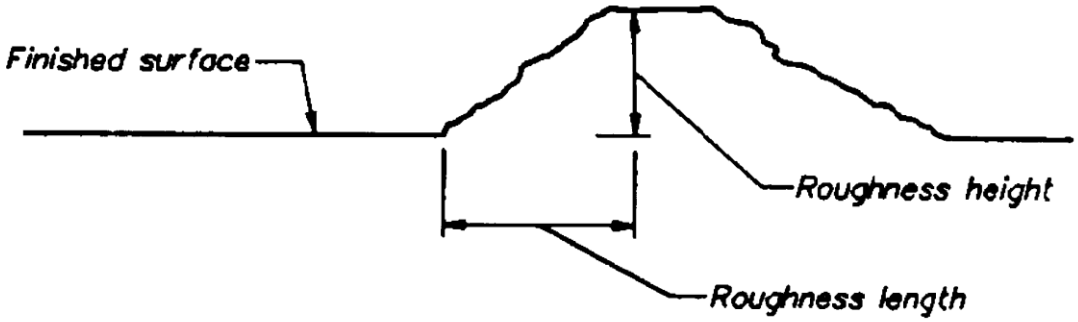
b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed any applicable value specified in Table 03301B - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification.

1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

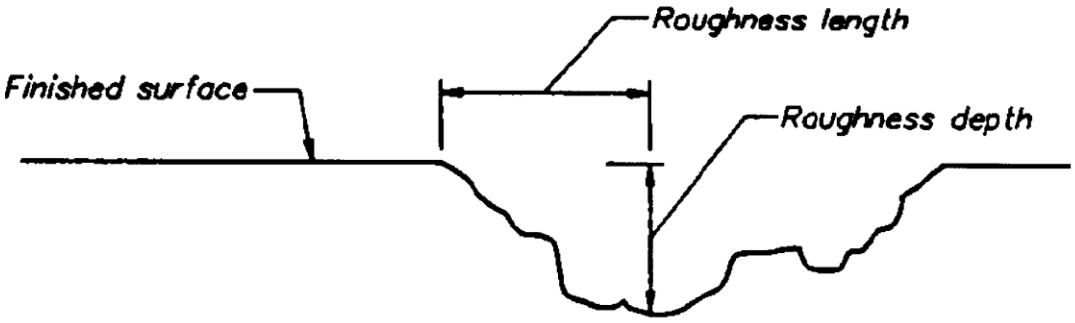
2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

J. Measuring Surface Roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. A roughness protruding above the surface should be measured with a straightedge that is at least 20 times longer than the roughness height being measured.

   b. Position the straightedge with one end resting on top of the roughness, as shown in Figure 2 (case 1).

   c. Determine the roughness height by measuring the maximum gap that occurs normal to the straight edge.

   d. Also, note the position on the straightedge from which the normal distance is measured.

   e. To determine the roughness length, measure the distance along the straightedge from the point where the height was measured to the point of contact between the straightedge and the top of the roughness.

   f. The roughness slope is defined as the ratio of the roughness height to the roughness length.

   g. As roughness is seldom symmetric, moving the position of the straightedge about the roughness may be necessary to locate the point where the maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

   a. A roughness occurring as an indentation to the surface is measured by placing the straightedge across the indentation, as shown in Figure 2 (case 2).

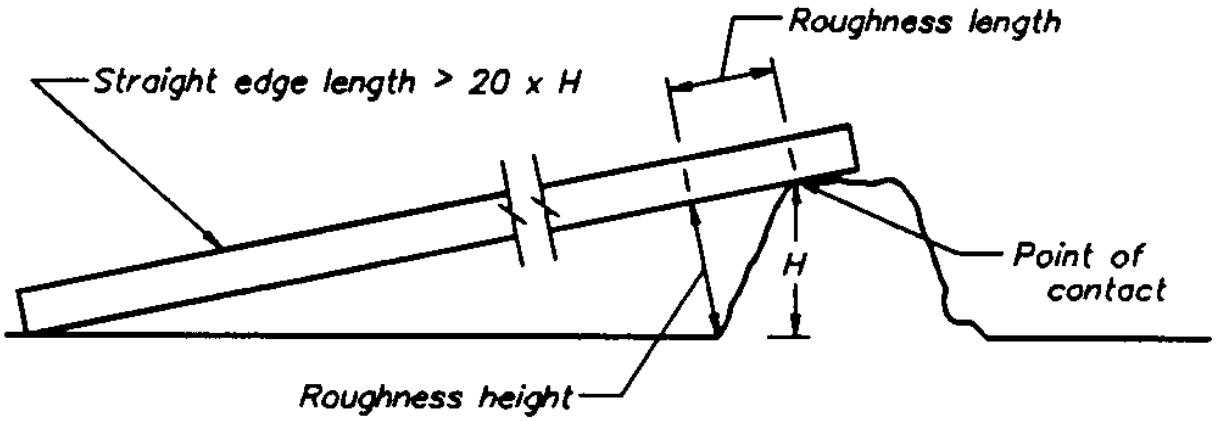
   b. Measure the maximum gap between the straightedge and the surface and note the location of the measurement on the straightedge.

   c. From the point of the depth measurement, measure along the straightedge in both directions to the point of contact with the surface.

   d. The shortest length measured is used as the roughness length.

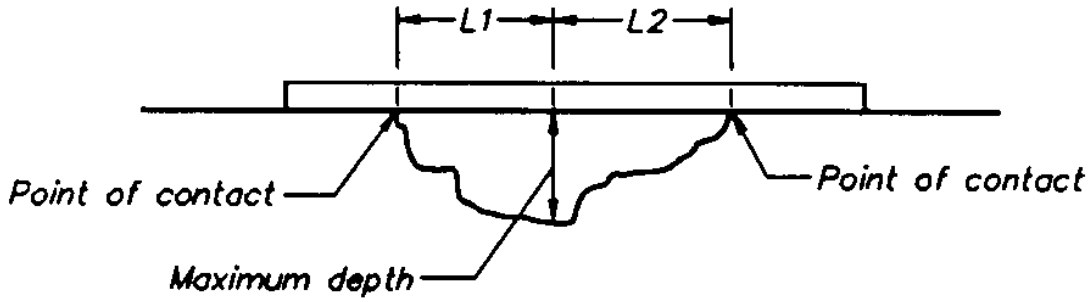
   e. Divide the roughness depth by the roughness length to determine the roughness slope.

4. A simple measuring device can be constructed to perform surface tolerance measurements and evaluation process directly and quickly. Information concerning concrete tolerance measuring devices can be obtained from Bureau of Reclamation, Attn D-8180, PO Box 25007, Denver CO 80225-0007, telephone (303) 445-2399.



CASE 1

$$\text{Roughness slope} = \frac{\text{Roughness depth}}{\text{The shortest distance L1 or L2}}$$



CASE 2

FIGURE 2

K. Prevention of Repeated Failure to Meet Tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to CO an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by CO.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by CO are implemented.

3.06 CURING

A. Curing with Curing Compound:

1. Apply to concrete surface to provide a water-retaining film. Reapply as necessary to maintain a continuous, water-retaining film on surface for 28 days.

2. Thoroughly mix compound and spray apply in one coat to provide a continuous, uniform film over surface.

3. Do not exceed coverage rate of 150 square feet per gallon. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.

4. Ensure ample coverage on edges, corners, and rough surfaces.

5. Spray equipment and equipment performance will be subject to approval by CO. Repair or replace equipment when directed by CO.

6. Use personnel qualified in using specified spray technique, as determined by CO, to perform application.

3.07 PROTECTION

A. Protect concrete from damage until final acceptance by Government.

1. Do not load, remove forms or shoring, or compact backfill against concrete until it has attained a compressive strength of 4,000 psi or gained sufficient strength to safely support its weight and all imposed loads, as determined by the Chief, Design and Construction Group.

2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.

3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

B. Protect concrete when freezing temperatures are imminent:

1. Protect concrete against freezing temperatures by keeping the concrete at a temperature as shown in Table 3301-E for a minimum of 72 hours. Where

artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented combustion heaters will not be permitted during the first 24 hours of curing unless unformed concrete surfaces are sealed from the resulting carbon dioxide rich environment.

2. Discontinuance of protection against cold temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed the limits in Table 3301-E.

3. When precipitation (or freezing weather) appears imminent, the Contractor shall immediately make ready at the placement site all materials which may be required for protection of concrete. The Government may delay placement of concrete until adequate provisions for protection against weather are made.

C. Concrete curing membranes shall be kept intact, and other curing materials and processes shall be maintained as necessary to assure continuous curing for the minimum specified curing time.

Table 3301-E

Section size, minimum dimension			
<12-inch	12-36-inch	36-72-inch	>72-inch
Minimum concrete temperature as placed and maintained			
55° F	50° F	45° F	40° F
Maximum allowable gradual temperature drop in first 24 hrs after end of protection			
50° F	40° F	30° F	20° F

D. Protect concrete and concrete-curing compound against heavy foot traffic and other.

3.08 ANCHOR BARS

A. Clean bars. Remove heavy flaky rust, loose mill scale, dirt, grease, and other foreign substances.

B. Clean and prepare in accordance with grout manufacturer's instructions.

C. Drill holes for anchor bars where indicated and as shown on the drawings.

D. Except for depth, drill, clean, and prepare anchor hole in accordance with epoxy grout manufacturer's instructions.

E. Make hole diameter as recommended by epoxy grout manufacturer for bar size.

F. Provide the following minimum embedment depth (hole) and anchor length for size of anchor bar:

No. 8 bar: 12-7/8 inches

No. 7 bar: 12-3/8 inches

No. 6 bar: 9-3/8 inches

No. 5 bar: 8-7/8 inches

No. 4 bar: 5-5/8 inches

G. Remove dust and standing water from hole.

H. Mix and install epoxy grout in accordance with manufacturer's instructions.

I. Remove epoxy grout form exposed end of anchor bar by methods recommended by epoxy grout manufacturer.

3.09 REPAIR

A. Repair concrete in accordance with USBR M-47.

B. Use repair or replacement method directed by CO.

3.10 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03300F - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	White wax-base, or white water-emulsified resin-base curing compound
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	White wax-base, or white water-emulsified resin-base curing compound
Canal and lateral structures	F2	T3	White wax-base, or white water-emulsified resin-base curing compound
Galleries and tunnels in dams	F2	T2	White wax-base, or white water-emulsified resin-base curing compound
Interior walls and ceilings of vaults, sumps, pullboxes, and entry boxes	F2	T4	White wax-base or white water-emulsified resin-base curing compound
Exterior walls, interior walls and ceilings of Control Building	F2	T5	Clear water-emulsified resin-base curing compound
Expansion joints	F2	T3	White wax-base or white water-emulsified resin-base curing compound
Contraction joints	F2	T3	White wax-base curing compound

Table 03300F - Unformed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by fill material or concrete	U1	T1	White wax-base or white water-emulsified resin-base curing compound Polyethylene film
Surfaces to be covered by grout	U1	T3	White wax-base or white water-emulsified resin-base curing compound
Canal structures	U2	T3	White wax-base or white water-emulsified resin-base curing compound
Surfaces of operating platforms for canal structures	U2 plus broom finish	T3	White wax-base or white water-emulsified resin-base curing compound
Outdoor entrance slabs, walks, and stoops	U2	T3	White wax-base or white water-emulsified resin-base curing compound
Outdoor decks and roofs	U2	T3	White wax-base or white water-emulsified resin-base curing compound
Tops of walls prominently exposed to public view	U2	T5	White wax-base or white water-emulsified resin-base curing compound
Roadway slabs and concrete bridges not to be covered by sealant	U2 plus broom finish	T3	White wax-base or white water-emulsified resin-base curing compound
Canal, lateral, and drain linings	U2	T2	White wax-base or water-emulsified resin-base curing compound

END OF SECTION

SECTION 03600 - GROUTING MORTAR FOR EQUIPMENT AND METALWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring nonshrink grout or grouting mortar.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 33-03 Concrete Aggregates
2. ASTM C 150-05 Portland Cement
3. ASTM C 1107-05 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Packaged nonshrink grout approval data:
   a. Manufacturer’s product data for approval for nonshrink grout.
   b. Manufacturer’s certification that product meets specifications.
   c. Manufacturer’s surface preparation, mixing, installation, and curing instructions.

PART 2 PRODUCTS

2.01 PACKAGED NONSHRINK GROUT

A. Pre-mixed commercial grout mixture:

1. ASTM C 1107.
2. Cement in mixture: ASTM C 150, Type II

B. Water:

1. Clean.
2. Free of detrimental quantities of silt, organic matters, salts, or other impurities.
3. As recommended by grout manufacturer.

C. Mix: In accordance with manufacturer's instructions to consistency recommended by manufacturer for application.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and prepare base concrete surface to which nonshrink grout or grouting mortar will be bonded in accordance with manufacturer's instructions or as directed by COR:

1. Roughen surface.
2. Remove dirt, laitance, loose or defective concrete, curing compound, coatings, and other foreign material.
3. Wash with water.

B. Lubricate concrete surface by washing with water immediately before placing nonshrink grout or grouting mortar when delay occurs between washing and placing nonshrink grout or grouting mortar.

3.02 PLACING

A. Place nonshrink grout in accordance with manufacturer's instructions to completely fill space to be grouted.

B. Place grouting mortar to completely fill spaces adjacent to equipment and metalwork as shown on drawings.

C. Use forms, where required, to confine nonshrink grout.

3.03 CURING

A. Cure exposed surface of packaged nonshrink grout by method recommended by manufacturer.

B. Cure exposed surface of grouting mortar for 72 hours with burlap, damp sand, or other means approved by the COR

C. Do not apply loads sooner than 72 hours after placement and only after mortar has attained compressive strength of at least 3,000 lb/in^2.

END OF SECTION

DIVISION 5 - METALS

SECTION 05500 - METAL FABRICATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Miscellaneous Metalwork:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials required for furnishing and installing the miscellaneous metalwork specified below in article 1.03.A of this section and not expressly paid for below or in other sections of these specifications.

B. Guardrail:

1. Measurement: Length along toprail including returns.
2. Payment: Linear foot price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing, installing and grounding Guardrail in accordance with the provisions of this section and referenced sections. Note: Two sections are required to be at the existing headworks, see Drawing No.s 3704-417-18 and 21.

C. W-Beam Guardrail:

1. Measurement: Length along rail.
2. Payment: Linear foot price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing, and installing W-Beam Guardrail in accordance with the provisions of this section and referenced sections.

D. Heavy Duty Grating Planks:

1. Measurement: Surface area to the limits and details shown on the drawings, the provisions of this section or as directed by the Contracting Officer.
2. Payment: Square foot price offered in the schedule. The unit price shall include all costs of labor, equipment and materials required for furnishing and installing heavy duty grating planks in accordance with the provisions of this section and referenced sections.

E. Adjustable Weir Plates with Vent Pipes:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials required for furnishing and installing the adjustable weir plates with vent pipes in accordance with the provisions of this section and referenced sections.

F. Type 3 Ladders:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and installing the Type 3 Ladders in accordance with the provisions of this section and referenced sections.

G. Safety Ladders:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and installing the Safety Ladders in accordance with the provisions of this section and referenced sections.

H. Safety Cable with Floats:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and installing the Safety Cable with Floats in accordance with the provisions of this section and referenced sections.

I. Flap Gate with Static Frame:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and installing the Flap Gate with Static Frame in accordance with the provisions of this section and referenced sections.

1.02 REFERENCES

A. Aluminum Association (AA)

1. AA ADM-1 Aluminum Design Manual - 2000

B. American Institute of Steel Construction (AISC)

1. AISC M016 Manual of Steel Construction - Allowable Stress Design - 9th Edition

C. American Society of Mechanical Engineers (ASME)

1. ASME B18.2.1-1996(with 1999 Addenda) Square and Hex Bolts and Screws (Inch Series)

D. ASTM International (ASTM)

1.	ASTM A 36/A 36M-02	Carbon Structural Steel
2.	ASTM A 48/A 48M-00	Gray Iron Castings
3.	ASTM A 53/A 53M-02	Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless
4.	ASTM A 108-99	Steel Bars, Carbon, Cold-Finished, Standard Quality
5.	ASTM A 123/A 123M-02	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6.	ASTM A 153/A 153M-03	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7.	ASTM A 276-03	Stainless Steel Bars and Shapes
8.	ASTM A 307-02	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
9.	ASTM A 325-02	Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
10.	ASTM A 385-03	Providing High-Quality Zinc Coatings (Hot-Dip)
11.	ASTM A 500-03	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
12.	ASTM A 501-01	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
13.	ASTM A 513-00	Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
14.	ASTM A 563-00	Carbon and Alloy Steel Nuts
15.	ASTM A 653/A 653M-03	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
16.	ASTM A 668/A 668M-03	Steel Forgings, Carbon and Alloy, for General Industrial Use
17.	ASTM A 786/A 786M-00b	Rolled Steel Floor Plates
18.	ASTM A 992/A 992M-02	Structural Steel Shapes
19.	ASTM A 1008/A 1008M-03	Steel, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
20.	ASTM A 1011/A 1011M-03	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
21.	ASTM B 209-02a	Aluminum and Aluminum-Alloy Sheet and Plate
22.	ASTM B 221-00	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

23.	ASTM B 632/B 632M-02	Aluminum-Alloy Rolled Tread Plate
24.	ASTM C 578-03	Rigid Cellular Polystyrene Thermal Insulation
25.	ASTM D 412-98a(2002)	Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
26.	ASTM D 1056-00	Flexible Cellular Materials - Sponge or Expanded Rubber
27.	ASTM F 436-02	Hardened Steel Washers
28.	ASTM F 844-00	Washers, Steel, Plain (Flat), Unhardened for General Use
29.	ASTM F 1267-01	Metal, Expanded, Steel

E. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-02	Structural Welding Code - Steel
2.	AWS D1.2/D1.2M-03	Structural Welding Code - Aluminum

F. Federal Specifications (FS)

1.	FS FF-S-85C(3)	Screw, Cap, Slotted and Hexagon Head
2.	FS RR-C-271D(1)	Chains and Attachments, Welded and Weldless
3.	FS RR-T-650E	Treads, Metallic and Nonmetallic, Skid Resistant

G. Military Specifications (MIL)

1.	MIL-DTL-24441C/19B	Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III

H. National Association of Architectural Metal Mfrs. (NAAMM)

1.	NAAMM MBG 531-00	Metal Bar Grating Manual

I. Society of Protective Coatings (SSPC)/NACE International (NACE)

1.	NACE 3/SSPC-SP6-00	Joint Surface Preparation Standard - NACE No. 3/ SSPC-SP6 - Commercial Blast Cleaning
2.	NACE 4/SSPC-SP7-00	Joint Surface Preparation Standard - NACE No. 4/ SSPC-SP7 - Brush-Off Blast Cleaning

1.03 DEFINITIONS

A. Miscellaneous metalwork: Where either shown on the drawings or specified elsewhere in this section or these specifications means metal fabrications as used in this section. Miscellaneous metalwork includes, but is not limited to:

1. Edge angle for the deck of the gate structure: Drawing No. 3704-D-7 and 8

2. Safety chains at termination points of guardrails: As required.
3. Guides for the flap gates: Drawing No. 3704-D-6 and 8
4. Support angles for grating planks: Drawing No. 3704-D-8
5. Flow restriction angles: Drawing No. 3704-417-16

B. Miscellaneous metalwork includes all associated hardware, bolts, nuts, washers, adhesive anchors, bearing plates, and grout. Other structural and miscellaneous metalwork as shown on the drawings and not otherwise specifically paid for under other items of work

1.04 QUALIFICATION OF WELDERS

A. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Protect from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.01 MATERIALS

A. Arc-Welding Electrodes:
1. Filler metal and required shielding gases or fluxes: AWS D1.
2. Filler metal for steel, minimum tensile strength: 70,000 psi.

B. Bolts, Nuts, And Washers:
1. Eyebolts: Forged steel, ASTM A 668, class C.
2. Nuts: ASTM A 563.
3. Capscrews: FS FF-S-85.
4. Washers:
   a. For use with ASTM A 325 bolts: ASTM F 436
   b. Unhardened for general use: ASTM F 844.
5. Bolts:
   a. ASTM A 307, except anchor bolts and studbolts.
   b. Anchor bolts as shown on drawings

c. ASTM A 36 steel

d. Length of bolt threads: ASME B18.2.1.

e. Thread class: 2 free-fit, American National coarse-thread series.

6. Studbolts:

a. Suitable for end welding to steel with automatically timed stud-welding equipment.

C. Chain: FS RR-C-271, type 1, class 1, 2, or 4.

D. Gaskets:

1. Dense sheet neoprene gaskets: ASTM D 1056, Grade 2A1.

2. Bond gasket to metal with manufacturer's standard adhesive.

E. Round Hollow Structural Shapes (HSS): ASTM A500, Grade B.

F. Square Hollow Structural Shapes (HSS):

1. HSS 2 inches and larger: ASTM A 500 or A 501

2. HSS less than 2 inches: ASTM A 513.

G. Steel Floor Plate: ASTM A 786, pattern 1, 2, 3, or 5, with material conforming to ASTM A 36.

H. Steel Pipe: ASTM A 53, type E or S, Grade B.

1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.

2. Government inspection at the mill and hydrostatic tests will not be required.

I. Steel Pipe Sleeves: ASTM A 53, standard weight, galvanized.

1. Government inspection at the mill and hydrostatic tests will not be required. Or, at the Contractor's option, steel pipe sleeves fabricated from No. 12-gauge, minimum, sheet steel. Provide steel pipe sleeves 6 inches and larger in diameter for installation in floors with three equally spaced anchoring lugs around the center of the sleeve. Galvanize fabricated pipe sleeves after fabrication.

J. Sheet Steel: ASTM A 1008, or ASTM A 1011 galvanized sheet steel.

K. Structural steel, bars and plates:

1. Shapes except wide flange sections: ASTM A 36.

2. Wide flange sections: ASTM A 992/A 992 M

2.02 GUARDRAIL:

A. 1-1/2-inch diameter schedule 40 pipe, ASTM A53 Grade B, Type S

B. Guardrail radius: 1-5/8-inch inside radius, schedule 40 ASTM A53 Type S Ells.

C. Guardrail expansion joints to be installed at each guardrail panel.

D. Use adhesive anchors to install all guardrails. Expansion anchors as shown on Drawing No.'s 40-D-6591 and 6592 will not be permitted.

2.03 W-BEAM GUARDRAIL:

A. Rail elements and backup plates: AASHTO M180, Type 1, Class A, W-Beam

B. Terminal, End and Return Sections, AASHTO M180, Type 1, Class A, W-Beam

C. Steel posts and blocks, ASTM A36 steel hot-dip zinc coated after fabrication in accordance with ASTM A123.

D. Bolts, nuts and miscellaneous hardware (fittings): AASHTO M180.

E. Concrete used for posts shall be in accordance with Division 3.

2.04 HEAVY DUTY GRATING PLANKS:

A. HEAVY-DUTY GRIP STRUT Plank Grating, Grip Strut 4-inch deep x 10 gauge steel grating as manufactured by Grating Pacific. www.gratingpacific.com, Phoenix, AZ 1-888-936-9201, or equal, with the following essential characteristics:

B. Capable of supporting a concentrated load of 1300 pounds with a deflection less than 0.35-inch at a clear span of 8 feet.

C. Width of planks shall be selected to cover the specified areas shown on the drawings using the minimum number of planks. Planks shall be a minimum of 23 inches wide and up to 36 inches wide.

D. Material shall have galvanized finish.

E. Slip resistant surface.

F. Provided with manufacturer's standard anchor and clamp assemblies or anchor clips.

2.05 TYPE 3 LADDERS

A. Refer to Drawing 40-D-6602

1. Fabricate safety ladders from 1-1/4-inch diameter schedule 40 pipe, ASTM A53 Grade B, Type S.

2. Safety steps shall be 3-hole traction tread, ladder rungs by GS Metals Corp. or equal.

3. Hot-dipped galvanized after fabrication

B. Ladder, location, lengths and quantities:

1. Downstream ladders, approximate Stations 4+25 (Rt) and 4+45 (Lt)as shown on Drawing Nos. 3704-D-5 and 6

a. Lengths: 8 feet (Varies from 40-D-6602 maximum distance from bottom landing shown on drawing)

b. Quantity: Two on vertical section of walls, install as directed by CO.

2.06 SAFETY LADDERS FOR CONCRETE LINED CANALS

A. Refer to Drawing 40-D-6460, except:

1. Fabricate safety ladders from ASTM A 36 bars and plates.

a. Hot-dipped galvanized after fabrication

2. Use adhesive anchors to install all ladder. Expansion anchors as shown on Drawing No. 40-D-6460.

B. Ladder, location, lengths and quantities:

1. Upstream ladders, approximate Stations 0+65 (Lt) and 0+73 (Rt) as shown on Drawing No. 3704-D-4

a. Length: 14 feet

b. Quantity: Two, one on each side slope

C. PVC sleeve and washers: Not required because ladders are not aluminum.

D. Paint for concrete lining at top of ladder: Not required.

2.07 SAFETY CABLES AND FLOATS

A. Refer to Drawing No.s 3704-D-4 and 6 and Drawing No. 3704-417-18.

B. Wire rope, clips, thimbles and floats are available from Rolyan Buoys, 1-888-269-2869, www.RolyanBuoys.com.

C. Wire rope:

1. Nylon -coated

2. 3/8-inch diameter bare cable, 7x17 Class Stand Core, Galvanized steel

3. 15/32-inch diameter coated cable

4. 14,400-pound minimum breaking strength.

5. Location and approximate lengths:
    a. Upstream cable, approximate Stations 0+65 and 0+73 as shown on Drawing No. 3704-D-4
        1) Approximate Length:
            a) Straight line distance: 70 feet
            b) Determine length prior to ordering and cutting
            c) Provide for sag at centerline of canal to be at El. 4997.4
    b. Downstream cable, approximate Station 4+25 and 4+45 as shown on Drawing No. 3704-D-5
        1) Approximate Length:
            a) Straight line distance: 30 feet
            b) Determine length prior to ordering and cutting
            c) Provide for sag at centerline of canal to be at El. 4997.4

D. Wire rope clips:
1. Federal Specification FF-C-450
2. Hot-dip galvanized
3. Size: 7/16-inch and ½-inch as shown on the drawings

E. Rope thimbles:
1. Rope thimbles shall conform to Federal Specification FF-T-276B
2. Hot-dip galvanized.

F. Floats:
1. Rolyan Buoys Model No. B618B0, or equal
2. Color: Orange
3. Shape: Cylinder
4. Diameter: 6-inches
5. Length: 18 inches
6. Construction:
    a. One-piece, ½-inch hole through horizontal axis
    b. Material: Molded of polyethylene
    c. Ultraviolet inhibitor incorporated into the polyethylene.
    d. Color pigment shall be incorporated into the polyethylene during manufacture.

2.08 FLAP GATE PARTS

A. Stabilizing cylinders:

1. Compressed length (minimum): 13.25 inches, Center to center of end connections
2. Extended length (minimum): 22.25 inches, Center to center of end connections
3. Travel distance: Greater than 9.00 inches and less than 9.88 inches
4. End connections: Eye or loop fitting for bolt connections
5. Bolts: 5/8-diameter, provide adequate shoulder length through end connection
6. Monroe part No. SC-2913, or equal

B. Flange-Mount bearings:

1. 2-inch shaft
2. Cast iron mount
3. Solid graphite with molten copper impregnated in bearing surface
4. Two bolt connection
5. Designed for dry and submerged conditions
6. McMaster Carr Catalog No. 7928K84, or equal

C. Collars:

1. Two-piece, clamp-on type
2. 2-inch bore
3. Zinc-plated steel
4. McMaster Carr Catalog No. 2380K44, or equal

D. Flap gate manufacturers

1. Gate manufacturers that may be capable of design and fabrication of the flap gates are:
    a. Fresno Valve and Casting Inc, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.
    b. Golden Harvest, Inc., 11944 Westar Lane, Burlington, WA 98233 Phone: (360) 757-4334, website: www.goldenharvestinc.com.

2.09 FABRICATION

A. Fabricate metalwork in accordance with AISC M016, AA ADM-1, and these specifications.

1. Perform welding and related work in accordance with AWS D1.1 and AWS D1.2.

2. Grind all welds on ladders, grab bars, pipe guardrails, wall rails, and handrails smooth.

B. If straightening is necessary, use methods that will not injure the metal.

C. After shop work completion and before galvanizing, if required, clean material of rust, loose scale, dirt, oil, grease, slag from welded areas, and other foreign substances.

D. Railings, fabricate from:

1. Standard weight pipe with diameter shown on drawings, or
2. Round HSS of the same outside diameter and minimum wall thickness of 0.132-inches.

E. Galvanizing:

1. Galvanize items of metalwork as specified or shown on drawings. Use hot-dip galvanizing, where required after fabrication, in accordance with ASTM A 123 and A 385.
2. Galvanize bolts, nuts, washers, and locknuts in accordance with ASTM A 153. Remove excess spelter by centrifugal spinning.
3. Galvanizing Repair:
   a. Redip material with damaged galvanizing unless damage is local and can be repaired by zinc primer.
   b. If the galvanized coating becomes damaged after being dipped twice, material will be rejected.
   c. Repair procedure where local paint repair is authorized:
      1) Clean damaged areas by wiping with clean rags saturated with mineral spirits or xylene, followed by wire brushing.
      2) Reclean areas with solvent to remove residue.
      3) Apply two or more coats of zinc primer:
         a) Total minimum dry-film thickness: 4 mils.
         b) Zinc primer: MIL-DTL-24441/19.

PART 3 EXECUTION

3.01 PREPARATION

A. Where locations and dimensions of miscellaneous metalwork shown on drawings are tentative or subject to change dependent upon equipment furnished, confirm locations and dimensions prior to fabrication of miscellaneous metalwork.

3.02 INSTALLATION

A. Blockouts:

1. Construct suitable blockouts in concrete where required for installation of metalwork.
2. After installation of metalwork, fill blockouts with concrete or grout as shown on drawings.

B. Embedded Metalwork:

1. Accurately locate metalwork to be embedded in concrete. Hold metalwork in correct position and alignment and protect metalwork from damage and displacement during placing and setting of concrete.
2. Install safety treads and risers in a rigid and substantial manner. After installation is completed, clean safety threads of foreign material.
3. Unless otherwise specified, use only metal braces, supports, and other items to position and align embedded metalwork, which will be embedded in concrete. Do not use wooden braces, supports, or other items to position and align embedded metalwork if they will also be embedded in concrete.
4. Clean surfaces of metalwork to be in contact with or embedded in concrete grouting mortar in accordance with NACE 3 / SSPC-SP6.

C. Adhesive Anchors:

1. Contractor may use suitable adhesive anchors meeting requirements of this section in lieu of embedded concrete inserts shown on drawings.
2. Drill holes for anchors straight and true and of diameter and depth recommended by anchor manufacturer.
3. Install anchors in accordance with manufacturer's recommendations.
4. Follow manufacturer’s recommendations when embedded steel or reinforcement is encountered during drilling for anchors.
5. When drilling water is used, clean surfaces of concrete to remain exposed immediately to prevent discoloration.

D. Galvanizing Repair:

1. Clean damaged areas by wiping with clean rags saturated with mineral spirits or xylene, followed by wire brushing.
2. Reclean areas with solvent to remove residue.
3. Apply two or more coats of zinc primer:
    a. Total minimum dry-film thickness: 4 mils.
    b. Zinc primer: MIL-DTL-24441/19.

E. Grout:

1. Where shown on drawings, fill spaces under metalwork completely as required with nonsettling grouting mortar in accordance with Section 03600 - Grouting Mortar for Equipment and Metalwork.

F. Holes in Metalwork:

1. Drill, or drill and tap as required, holes in metalwork required for installation.

G. Static Frames and Flap gates

1. Set static frames plumb in guides of gate structure.
2. Wedge frame in place with adjustment nuts.
3. Install flap gate assembly without counter weight shaft.
4. Install counterweight shaft with specified 1-inch thick counterweights.
5. Position half of the specified 1-inch counter weights inside each of vertical support tubing.
6. Bolt straps over counterweight shaft.
7. Install specified ¼-inch thick counterweights on ends counterweight shaft (outside of vertical support tubing).
8. Distribute counterweight evenly to each end.
9. Install collars on counterweight shaft.
10. Prior to end of contract, allow Contracting Officer to operate facility with water flowing over weir.
11. Provide labor and equipment to add or subtract counterweights, as directed by Contracting Officer, to maintain desired water surface.

END OF SECTION

SECTION 05612 – EXISTING TRASHRACK MODIFICATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Modifying Existing Trashrack:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials required for Modifying Existing Trashrack in accordance with the provisions of this section and referenced sections. The lump sum price shall include removal, modifications, preparing surfaces; application of coatings and reinstallation of the trashrack.

1.02 DELIVERY, STORAGE, AND HANDLING

A. The existing upper and lower trashrack panels are installed at the Hogback Diversion Dam Headworks trashrack structure, see specification Drawing No. 3704-417-21, 3704-D-13 and informational Drawing No. 809-D-5723.

B. Existing upper trashrack panels, see informational Drawing No.s 809-D-5723 and 809-D-5724:

1. Remove the five existing upper trashrack panels from their respective guides and store the upper trashrack panels at a location directed by the COR.
2. Approximate weight of each existing upper trashrack panel: 1820 pounds.
3. Provide timber blocking for elevating the upper trashrack panels above the ground during storage.
4. After the modified lower trashrack panels have been re-installed (see below), transport the upper trashrack panels from their storage area and re-install in the trashrack guides.

C. Existing lower trashrack panels, see informational Drawing No.s 809-D-5723 and 809-D-5724:

1. Remove the five existing lower trashrack panels from their respective guides.
2. Approximate weight of each existing lower trashrack panel: 3850 pounds.
3. Ship the lower trashrack panels to the Contractor’s shop for modification and coating.
4. After the panels have been modified and coated, ship the modified lower trashrack panels back to the Hogback Diversion Dam Headworks and re-install in the trashrack structure guides.
5. Ship, handle, and store in a manner to prevent permanent deflection, distortion, corrosion, or damage.

6. Any tie downs used during shipment to be positioned in a manner as not to deform the materials being shipped. Use of chains for hold down will not be permitted.

PART 2 PRODUCTS

2.01 MODIFICATION

A. Modify the five existing lower trashrack panels in accordance with specifications drawing 3704-D-13.

2.02 FINISHES

A. Remove the existing coating from the lower trashrack panels.

B. Prepare and coat the modified lower trashrack panels in accordance with Section 09908 - Coatings.

2.03 SOURCE QUALITY CONTROL

A. After modification, inspect the lower trashrack panels in the shop to ensure that the required dimensions have been obtained and surfaces repaired, prior to coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the five modified lower trashrack panels in the existing guides at the Hogback Diversion Dam Headworks trashrack structure (one modified lower trashrack panel per trashrack guide).

B. Remove the existing upper trashrack panels from storage.

C. Re-install the five existing upper trashrack panels in the existing guides (one existing upper trashrack panel per trashrack guide).

D. Repair any damage to the coatings prior to final installation.

END OF SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07921 Sponge Rubber Joint Filler
07925 Sealants

SECTION 07921 - SPONGE RUBBER JOINT FILLER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of sponge rubber filler in applicable prices offered in the schedule for concrete items for which sponge rubber joint filler is required.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM D 1752-84(1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

B. Federal Specifications (FS)

1. FS FF-N-105B Nails, Brads, Staples and Spikes: Wire, Cut and Wrought

1.03 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Store sponge rubber joint filler in as cool a place as practicable, preferably at 70 °F or less, and in no case store the joint filler in the open, exposed to the direct rays of the sun.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sponge Rubber Joint Fillers

1. Provide sponge rubber joint filler conforming to the requirements of ASTM D 1752 for type I joint filler: provided that the load required to compress the test specimen 50 percent of its thickness before testing is not less than 50 pounds per square inch nor greater than 100 pounds per square inch.

2. Where greater than 1-inch thick sponge rubber joint filler is required, the thickness may be obtained by cementing two or more sheets together. If multilayered joint filler is used, provide finished joint filler meeting the requirements specified above.

B. Copper Nails

1. Federal Specification FF-N-105B, type 2, style 10, common copper nails.

C. Adhesive

1. Provide a non-bituminous adhesive for securing the sponge rubber in place as recommended by the manufacturer of the joint filler.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cut the sponge rubber joint filler to the size and shape of the joint surface to receive the joint filler.

B. Secure the joint filler to the concrete in a manner approved by the Contracting Officer, with copper nails embedded at approximately 12-inch centers in the first-placed concrete in such a manner that the nails will protrude from the joint surfaces to be covered, or by adhesive applied between the filler and the first-placed concrete.

C. Provide joints between adjoining portions of the joint filler which are sufficiently tight to prevent mortar from seeping through such joints.

D. Where sealant is required, set back the joint filler from the edges to the joints to provide the proper recess for installation of the type sealant. The sealant is provided for in Section 07925 (Sealants). Elsewhere, unless otherwise shown on the drawings or directed, place the edges of the sponge rubber joint filler flush with the finished surface of the concrete or to the bottom edge of chamfers.

END OF SECTION

SECTION 07925 - SEALANTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of joint sealants in applicable prices offered in the schedule for concrete items for which joint sealant is required.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 920-05 Elastomeric Joint Sealants

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

B. Approval Data:

1. Manufacturer's product data for each sealant and backing material.
2. Manufacturer's instructions for storage, surface preparation, installation, and cleanup instructions for each sealant and primer material.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in accordance with manufacturer's instructions.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealant when ambient air temperature is below 40 degrees Fahrenheit or above 90 degrees Fahrenheit.

B. Comply with sealant manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 SEALANTS

A. Non-sag Polyurethane Sealant:

1. ASTM C 920, Type S, Grade NS, Class 25.
2. Single-component, non-sag polyurethane sealant.
3. Color: Concrete gray.
4. Sikaflex-1a, as manufactured by Sika or equal.

2.02 ACCESSORIES

A. Primers: As recommended by sealant manufacturer for joint surface materials.

B. Joint Cleaners: Noncorrosive and nonstaining products recommended by sealant manufacturer for application.

C. Joint Backing:

1. Closed-cell round polyethylene foam rod compatible with sealant.
2. Recommended by sealant manufacturer for application.

D. Bond Breaker: Self-adhesive, pressure-sensitive polyethylene tape recommended by sealant manufacturer for application.

PART 3 EXECUTION

3.01 PREPARATION

A. Allow concrete to cure for 28 days, minimum, before installation of sealant.

B. Preparation of Joint Surfaces:

1. Clean and prepare joint in accordance with sealant manufacturer's instructions.
2. Remove mortar, laitance, dust, coatings, curing compounds, petroleum products, corrosion, and other foreign material.
3. Allow joint to dry.
4. Prime joint surfaces as recommended by sealant manufacturer for joint materials.

C. Backing Installation:

1. Install backing materials in accordance with sealant manufacturer's instructions.
2. Use backing material to achieve required sealant depth.
3. Use backing rod with diameter 25 percent greater than joint width.
4. Use bond breaker in joints too shallow for backing rod.

D. Obtain approval of joint preparation and backing installation from COR before installation of sealant in joint.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place sealant to depth specified in Table 07925A - Depth of Sealant in Joints.

Table 07925A - Depth of Sealant in Joints

Type of Joint	Joint Width	Sealant Depth
Joints in porous materials (concrete masonry, stone, etc.) and between porous materials and nonporous materials	1/4 to 3/8 inch	Equal to joint width
	3/8 to 3/4 inch	3/8 inch
	3/4 inch or greater	1/2 inch
Other joints	All widths	50 percent of joint width or 1/4 inch, whichever is greater

C. Place and tool to smooth joints free of air pockets, embedded foreign material, ridges, and sags.

3.03 REPAIR

A. Remove defective or contaminated sealant. Reclean joint and replace sealant.

3.04 CLEANING

A. Remove excess sealant and soiling from adjacent surfaces.

END OF SECTION

DIVISION 8 - DOORS AND WINDOWS

08115 Bullet-Resistant Steel Doors and Frames

SECTION 08115 - BULLET-RESISTANT STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of bullet-resistant steel door and frame in the lump sum price offered in the schedule for Control Building.

1.02 REFERENCES

A. Building Hardware Manufacturers Association (BHMA)

1. BHMA A156.13-2002 Mortise Locks and Latches, Series 1000
2. BHMA A156.16-2002 Auxiliary Hardware

B. Underwriters Laboratories Inc. (UL)

1. UL 752-2000 Bullet-Resisting Equipment, Tenth Edition

1.03 PERFORMANCE REQUIREMENTS

A. Bullet-Resisting Rating: Provide door and frame assemblies capable of resisting Level 3 ballistics test when tested in accordance with UL 752.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Drawings:
   a. Submit shop drawings for approval.
   b. Show dimensions, material gauges, reinforcements, hardware preparation and locations, anchorage details, frame grouting access, and other fabrication and installation details.
2. Approval Data:
   a. Submit manufacturer's product data for approval.
   b. Include complete descriptions and specifications for materials, construction, finish, door hardware, lock cylinders, weatherstripping, and thresholds.
3. Instructions:
   a. Submit manufacturer's storage, handling, and installation instructions for doors and frames.

b. Submit manufacturer's installation instructions for door hardware, weatherstripping, and thresholds.

1.05 QUALITY ASSURANCE

A. Provide door and frame assemblies listed and labeled by UL for specified bullet-resisting rating. Label assembly with permanent UL label attesting to required rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and handle at jobsite in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

A. DR 3684 Door/Frame assembly, UL Level 3, manufactured by Chicago Bullet Proof Systems, 12 E. Old Mill Lane, Burr Ridge IL 60521; or equal, having following essential characteristics:

1. 1-3/4-inch-thick steel door.
2. Steel frame to be embedded in concrete wall opening with wall placement.
3. Welded door and frame construction.
4. Standard manufacturer’s paint and finish: Color as approved by CO.

2.02 ACCESSORIES

A. Frame Anchors: Embedded concrete anchor, pre-welded to frame with zinc-coated finish.

2.03 DOOR HARDWARE

A. Hinges: CBP #12252 manufactured by Chicago Bullet Proof Systems, 12 E. Old Mill Lane, Burr Ridge IL 60521; or equal, having following essential characteristics:

1. Continuous piano-type hinge.
2. Stainless steel material.
3. Factory drilled and tapped.
4. Satin finish.

B. Locksets: 8296 mortise lockset with LN rose and lever trim manufactured by Sargent, 100 Sargent Drive, New Haven CT 06536-0915; or equal, having following essential characteristics:

1. Meets requirements of BHMA A156.13, Grade 1 and Security Grade 1.

2. Lock function: F29.
3. Armored front.
4. 1-inch-throw solid stainless steel deadbolt with two enclosed hardened-steel roller pins.
5. Self-aligning trim installation secured with thru-bolts from inside trim.
6. Round rose and lever handle trim on inside and outside.
7. Round lever handle.
8. Solid stainless steel lever handles.
9. Stainless steel trim material.

C. Strikes and Accessories: Provide matching strikes and accessories required for installation or operation of hardware.

D. Fasteners: Matching fasteners suitable for application furnished by product manufacturer.

2.04 WEATHERSTRIPPING AND THRESHOLDS

A. Weatherstripping: S88D SiliconSeal manufactured by Pemko Mfg. Co., PO Box 3780, Ventura CA 93006; or equal, having following essential characteristics:

1. Compression bulb-type weatherstripping.
2. Silicone-rubber material.
3. Self-adhesive backing
4. Dark bronze color.

B. Thresholds: 2005AS Latching Panic Exit Saddle manufactured by Pemko Mfg. Co., PO Box 3780, Ventura CA 93006; or equal, having following essential characteristics:

1. Extruded aluminum threshold with fluted top.
2. Silicone-rubber bulb insert seal to match specified weatherstripping.
3. 1/2-inch height.
4. 5-inch width.
5. Mill finish.

C. Threshold Fasteners: Machine screws and adhesive anchors furnished by threshold manufacturer.

2.05 LOCK CYLINDERS AND KEYING

A. Provide locks with matching seven-pin, interchangeable-core, mortise lock cylinders.

B. Key locks alike.

C. Deliver all keys to Contracting Officer's Representative at jobsite after completion of work when directed by Government.

2.06 FABRICATION

A. Fabricate in accordance with approved shop drawings.

B. Grind exposed welds smooth.

C. Factory mortise, reinforce, drill, and tap for lockset.

D. Use hardware manufacturer's templates for hardware preparation.

2.07 FINISH

A. Clean, degrease, and factory paint with rust-inhibiting primer.

B. Use lead- and chromate-free priming paint compatible with finish paint to be shop applied at factory.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Install plumb, level, and in alignment with adjacent work.

C. Rake joint between frame and concrete to minimum depth of 1/4 inch and caulk joint.

D. Install surface-mounted hardware after doors and frames have been painted.

E. Use manufacturer's templates for field mounting of hardware.

F. Fit threshold to doorframe, set in full bed of grouting mortar, and attach to concrete with machine screws in adhesive anchors.

G. Install weatherstripping at head and jambs.

1. Install in full-length pieces without joints.
2. Butt corners tight.
3. Provide positive door seal.
4. Test and adjust door operation for proper operation.

END OF SECTION

DIVISION 9 - FINISHES

SECTION 09908 - COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of coating in the lump sum price offered in the schedule for Modifying Existing Trashrack

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 380-06	Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
2.	ASTM B 117-07a	Standard Practice for Operating Salt Spray (Fog) Apparatus
3.	ASTM D 522-93a(2001)	Mandrel Bend Test of Attached Organic Coatings
4.	ASTM D 870-02	Testing Water Resistance of Coatings Using Water Immersion
5.	ASTM D 1141-99(2003)	Preparation of Substitute Ocean Water
6.	ASTM D 2244-05	Calculation of Color Differences From Instrumentally Measured Color Coordinates
7.	ASTM D 2370-98(2002)	Test Method for Tensile Properties of Organic Coatings
8.	ASTM D 2794-93(2004)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
9.	ASTM D 3359-02	Measuring Adhesion by Tape Test
10.	ASTM D 3363-05	Film Hardness by Pencil Test
11.	ASTM D 4060-01	Abrasion Resistance of Organic Coatings by the Taber Abraser
12.	ASTM D 4285-83(2006)	Indicating Oil and Moisture in Compressed Air
13.	ASTM D 4541-02	Pull-Off Strength of Coating Using Portable Adhesion Testers
14.	ASTM D 4587-05	Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus

15.	ASTM G 8-96(2003)	Cathodic Disbonding of Pipeline Coatings
16.	ASTM G 14-04	Impact Resistance of Pipeline Coatings (Falling Weight Test)
17.	ASTM G 154-06	Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

B. Federal Standards (Fed Std)

1.	Fed Std 595B(1)-94	Colors Used in Government Procurement

C. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-AB1-04	Mineral and Slag Abrasives
2.	SSPC-AB2-04	Cleanliness of Recycled Ferrous Metallic Abrasives
3.	SSPC-AB3-04	Newly Manufactured or Re-Manufactured Steel Abrasives
4.	SSPC-PA2-04	Measurement of Dry Paint Thickness with Magnetic Gages
5.	SSPC-SP1-04	Solvent Cleaning
6.	SSPC-SP11-04	Power Tool Cleaning to Bare Metal
7.	SSPC-SP10/NACE 2-04	Near-White Blast Cleaning
8.	SSPC-SP12/NACE 5-02	Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
9.	SSPC-TR2/NACE 6G198-04	Wet Abrasive Blast Cleaning
10.	SSPC Guide 15-05	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates and Other Nonporous Substrates
11.	SSPC-VIS1-02	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
12.	SSPC-VIS3-04	Visual Standard for Power- and Hand-Tool Cleaned Steel
13.	SSPC-VIS4/NACE-VIS7-01	Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
14.	SSPC-VIS5/NACE-VIS9-01	Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blast Cleaning
15.	NACE SP 0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
16.	NACE RP 0287-02	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval data for each coating material:
    a. Manufacturer's product data and application sheets.
    b. Purchase orders. Include:
        1) Supplier's name, address, and phone number.
        2) Purchase order number and date.
        3) Manufacturer's designated product name.
        4) Batch number(s) for each material, except thinners.
        5) Quantities ordered for each material, except thinners.
2. Documentation:
    a. Written evidence of applicator's qualifications.
3. For coating materials proposed as "equal" products to specified brand name products in Coating Categories, submit following with specified approval data:
    a. List of projects (not less than three) where material has been successfully used in applications similar to this project. Include:
        1) Project name and location.
        2) Type of structure and service environment.
        3) Owner's name, address, and telephone number.
        4) Application dates.
    b. Manufacturer's certification substitute coating material meets specified requirements. Include:
        1) Manufacturer's name, address, and phone number.
        2) Batch number(s) for each material, except thinners.
        3) Signature of manufacturer's technical representative and date of signature.
    c. Certified test reports that demonstrates substitute material meets or exceeds specified coating category requirements for physical and performance characteristics from each of following:
        1) Coating manufacturer.
        2) Independent laboratory.

1.04 QUALITY ASSURANCE

A. Coating Applicators Qualifications:

1. Qualified to apply specified coating materials by one of following:

a. Successfully completed training in use of coating material on applications similar to those specified in these specifications.

b. Skilled and experienced in application of coating materials similar to materials specified in these specifications under conditions similar to conditions of this project.

B. Compliance Criteria for Coating Materials:

1. Material is of same composition and formulation to meet physical and performance test results for one of following:

a. Submitted batch or previously tested batch materials complies with these specifications.

b. Submitted batch materials are unchanged from previously tested batch materials that comply with manufacturer's quality control (QC) and quality assurance (QA) programs.

c. Submitted batch materials complies with manufacturer's quality control (QC) and quality assurance (QA) programs as listed on product data and application sheets.

1.05 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store materials in well ventilated area.

D. Do not expose to direct sunlight during storage.

E. Comply with manufacturer's storage instructions.

F. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with coating manufacturer's environmental restrictions. Comply with most restrictive requirements of coating manufacturer's restrictions and these specifications when coating manufacturer's restrictions conflict with these specifications.

B. Do not apply coatings under following environmental conditions:

1. Substrate surface temperature less than 5 degrees Fahrenheit above dewpoint.
2. Air and substrate surface temperature less than 50 degrees Fahrenheit and not to exceed manufacturer's recommended maximum temperature limit.
3. Humidity outside of manufacturer's recommended range.

C. Do not perform surface preparation or apply coatings when environmental conditions are not expected to meet specified requirements during surface preparation, coating application, and curing period.

D. Maintain environmental temperature and humidity conditions to meet specified requirements during, surface preparation, coating application, and curing period by use of indirect fired heat and dehumidification equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials required by these specifications and not listed in Coating Categories are subject to certification and testing in accordance with this section.
2. Provide compatible products of same manufacturer for coating system components.

B. Abrasives:

1. Mineral and slag abrasives: Meets SSPC-AB1 for type I (natural minerals) and type II (slags), class A, except following are not permitted:
   a. Flint minerals.
   b. Nickel slags.
2. Mineral abrasives: Meets SSPC-AB1 for type I, natural minerals, class A, except flint minerals are not permitted.
3. Ferrous metallic abrasives: Meets following requirements:
   a. SSPC-AB2 for recycled cleanliness.
   b. SSPC-AB3 class I (steel) or II (iron) for angular shaped grit.

4. Additive stabilizers for leachable toxic metal wastes are allowed, except elemental iron is not permitted.

5. Do not exceed toxicity threshold limit for hazardous materials.

C. Coatings:

1. Specified in Coating Categories.

2. Apply only one coating category per option in Coating Tabulations.

3. Volatile Organic Compounds (VOC):

a. Do not exceed maximum permitted by Federal, State, and local air pollution control regulations.

b. Do not exceed maximum permitted content as supplied in container or by addition of thinner material.

4. Factory color or tint. Do not color or tint at jobsite.

5. Use thinners recommended by manufacturer for each coating material.

6. Following chemical products are not permitted unless approved by Contracting Officer:

a. Accelerators.

b. Corrosion inhibitors.

PART 3 EXECUTION

3.01 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

A. Protect items or surfaces not to be coated and adjacent to surfaces to be cleaned and coated from contamination and damage during cleaning and coating operations.

1. Includes surfaces and equipment in physical contact with areas being cleaned or coated. Examples include: mechanical and electrical equipment (open or enclosed); instruction and similar plates; and wet and newly coated surfaces.

2. Protect from abrasive blast particles and airborne coating particles.

B. Do not move newly coated items until coating is thoroughly dry as determined by one of following:

1. Coating manufacturer’s instructions for handling.

2. Coating film cannot be distorted or removed by exerting substantial, but less than maximum, pressure with thumb and turning thumb through 90 degrees in plane of film.

3.02 REPAIR OF CONTRACTOR-DAMAGED SURFACES

A. Repair items, equipment, or surfaces which are damaged or contaminated as determined by Contracting Officer.

1. Repair damaged items or restore manufacturer-coated equipment to original condition and appearance.

2. Before coating any damaged coated surfaces, re-clean exposed surface and apply coating materials in accordance with these specifications.

3.03 SURFACE PREPARATION

A. Remove or repair weld spatter, slag burrs, porosity, sharp edges, pits, laminations, crevices, or other objectionable surface irregularities before specific surface preparation.

B. Specific surface preparation:

1. See Coating Tabulations.

a. Method A: SSPC-SP1.

b. Method C (steel): SSPC-SP10/NACE 2.

c. Method C-1 (steel): Repair of defective or damaged coated areas.

1) To metal substrate:

a) SSPC-SP10/NACE 2.

b) SSPC-SP11 where abrasive blasting is impractical.

2) To prime or intermediate coat:

a) Method A.

b) Feather abrupt edges and around repair area by hand or power tool with non-woven pad.

c) Roughen or abraded surface in accordance with manufacturer's recommendations.

d) Achieve matted or lusterless finish.

d. Method C-2 (steel): SSPC-SP10/NACE 2, wet abrasive blast cleaning.

1) Use one of wet abrasive blast methods described in SSPC-TR2/NACE 6G198.

2) Use potable water.

3) Use as needed - Concentration of soluble salt remover: Amount to meet allowable salt acceptance criteria listed below.

4) Cleanliness to meet following defined in SSPC-SP12/NACE 5:

a) Allowable flash rust: no flash rust

b) Nonvisible surface cleanliness: NV-2

e. Method J (water jetting): Meets following:

1) SSPC-SP12/NACE 5, WJ-2/no flash rust.

2) Nonvisible surface cleanliness: NV-2.

C. Surface profile:

1. Prepare in accordance with manufacturer's instructions for metallic or existing coating surfaces and service environment, unless specified in Coating Tabulations.

2. Where manufacturer's instruction do not specify a surface profile, prepare blasted surfaces to following profile:

a. Atmospheric service environments: 1 mil or greater angular profile and less than specified dry film thickness of first applied coat.

b. Burial and immersion service environments: Angular profile between 2 and 3-mils minimum and less than specified dry film thickness of first applied coat.

3. Perform tests in accordance with surface profile inspection procedures specified.

D. Soluble salt for surfaces field coated:

1. Test substrate surface after preparation to include corrosion pits.

2. Perform two tests per 1,000 square feet, minimum.

3. Perform tests in accordance with soluble salt inspection procedures specified.

E. Re-clean or perform additional surface preparation of completed metallic or coated surfaces that become contaminated before coating application.

F. Prepare surface free of moisture, frost, and ice. Heat substrate surface which is not thoroughly dry to remove moisture before coating application.

3.04 APPLICATION EQUIPMENT

A. Air compressor and spray application equipment:

1. Provide appropriate type equipment, adequately sized, and in proper operating order.

2. Equip with pressure gauges and pressure regulators.

3. Equip with air supply lines free from oil and moisture. Keep lines free of oil and moisture during work.

4. Perform tests in accordance with oil and moisture inspection procedures specified.

3.05 COATING APPLICATION

A. Apply in accordance with manufacturer's instructions.

B. Apply coatings so that surfaces exposed to public view display a uniform texture and color matched appearance.

C. Apply an even film of uniform thickness which tightly bonds to substrate or previous coat.

1. Fill crevices and cover irregularities.
2. Apply free of runs, pinholes, sags, laps, brush marks, voids, and other defects.

D. Primer Coats:

1. Cover peaks of surface profile by specified dry film thickness.
2. Apply stripe coats to edges, boltheads, welds seams, corners, and similar surfaces.

E. Intermediate and Topcoats:

1. Apply number of coats and coating thickness specified in Coating Tabulations.
2. Apply within re-coat window at referenced humidity and temperature recommended by manufacturer.
3. Tint intermediate coats with manufacturer's standard color to differentiate between coats.

3.06 FIELD QUALITY CONTROL

A. Equipment: Inspect air supply lines on air compressors for oil and moisture in accordance with ASTM D 4285. Remove oil or water before proceeding with work.

B. Surface Profile: Inspect surface profile in accordance with NACE RP 0287 for compliance with specified requirements.

1. Use replica tape suitable for surface profile depth range.

C. Visual Comparison of Prepared Surfaces:

1. Compare prepared steel surfaces to following visual reference photographs for allowable visible contaminants and stains:
    a. SSPC-VIS1 for abrasive blast cleaning.
    b. SSPC-VIS3 for power and hand tool cleaning.
    c. SSPC-VIS4/NACE-VIS7 for waterjetting.
    d. SSPC-VIS5/NACE-VIS9 for wet abrasive blast cleaning

D. Soluble Salt:

1. Measure chloride soluble salt ion or chloride specific ion on substrate surfaces by one of procedures in SSPC-Guide 15.
2. Procedure to have lower measurement threshold limit of 1 micrograms per square centimeter.
3. Acceptance Criteria for following service exposures:
    a. Atmospheric service exposure: Do not exceed 5 micrograms per square centimeter.
    b. Burial and immersion service exposure: Do not exceed 3 micrograms per square centimeter.

E. Completed Coating System:

1. Dry Film Thickness (DFT):
    a. Inspect hardened coating system before re-recoating interval has been exceeded for DFT compliance in accordance with SSPC-PA2 with following modifications:
        1) Section 4.3.1: Minimum thickness of 90 percent of specified minimum thickness.
        2) Section 4.3.2: Maximum thickness of 150 percent of specified maximum thickness.
    b. Acceptance Criteria: No single spot measurement in any 100 square foot area less than 90 percent of minimum specified thickness or greater than 150 percent of maximum specified thickness.
2. Discontinuity (Holiday) Testing:
    a. Burial and Immersion Exposure:
        1) Inspect nonconductive coating applied to conductive base metals in accordance with NACE SP 0188.
            a) Use maximum test voltage for any DFT as recommended by coating manufacturer to prevent coating damage.
            b) Use of detergent wetting solution is not permitted.
            c) Subtract thickness of zinc-rich primer from applied coating systems to determine test voltage.
        2) Perform test in presence of Contracting Officer.

3.07 REPAIR OF DEFECTIVE COATED SURFACES

A. Repair within minimum and maximum recoat window time in accordance with coating manufacturer's recommendations and applicable Coating Tabulation under which coating was applied.

B. Repair pinholes, holidays, laps, voids, and other defects.

C. Inspect repaired areas for compliance with specifications.

3.08 COATING TABULATIONS

Tabulation No. 01		
Items to be coated: a. Recoat modified trashracks.		
Coating materials – Option 1 Epoxy/polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-1A1 IE-1C IE-1D IE-1G	2 or more base coats. Apply at 8 to 10 mils DFT, per coat, plus stripe coats.	C, C-2, or J For uncoated surfaces C-1 For repair of damaged coated surfaces
Finish coats: Category options: AE-1AT over IE-1A1 AE-1CT over IE-1C AE-1DT over IE-1D AE-1GTV over IE-1G Color and gloss: Manufacturer's standard gray equivalent to FS 595B, 36463	1or more compatible manufacturer's finish coats. Apply at 3 to 4 mils DFT, per coat. Total system, excluding stripe coats: 19-mil DFT, minimum 24-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials – Option 2 100% Solids Epoxy	Number and thickness of coats	Surface preparation method

Tabulation No. 01		
For ferrous surfaces: Base coats: Category: IES-6D3(pw) Color and gloss: Manufacturer's standard light gray	1 or more base coats: Apply at 30 to 40 mils DFT, per coat, plus stripe coats. Total system, excluding stripe coats: 30-mil DFT, minimum 40-mil DFT, maximum	C, C-2, or J For uncoated surfaces C-1 For repair of damaged coated surfaces Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

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3.09 COATING CATEGORIES

Category AE-1AT

Amercoat 450HS; as manufactured by:

PPG Protective & Marine Coatings, One PPG Place, Pittsburgh, Pennsylvania 15272, 412-434-3131, www.ppgamercoatus.ppgmc.com

or equal, having following essential characteristics:

COMPOSITION:

Topcoat – Two-component, aliphatic polyurethane

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:	
Solids by volume:	63 percent, minimum
VOC, as supplied:	2.4 pounds per gallon (287.5 grams per liter), maximum
Mix ratio - resin:hardener:	4:1
Mixed usable pot life at 50 degrees F:	6 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	3 mils
Recoat time at 50 degrees F and 50 percent humidity:	12 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss

PERFORMANCE REQUIREMENTS:	
QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1A1

Amerlock 400 or Amerlock 2; as manufactured by:

PPG Protective & Marine Coatings, One PPG Place, Pittsburgh, Pennsylvania 15272, 412-434-3131, www.ppgamercoatus.ppgmc.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, polyamide epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	80 percent, minimum
VOC, as supplied:	Amerlock 400: 1.4 pounds per gallon (168 grams per liter), maximum Amerlock 2: 1.5 pounds per gallon (180 grams per liter), maximum
Mix ratio - resin:hardener:	1:1
Mixed usable pot life at 50 degrees F:	2 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	10 mils
Recoat time at 50 degrees F:	Amerlock 400: 3 months, maximum Amerlock 2: 1 month, maximum
Full cure time before immersion at 50 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/semigloss

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less

Category IE-1A1

Flexibility, ASTM D 522, 180 degree bend over ¼-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category AE-1CT

Endura-Shield II, Series 1074, gloss, or Series 1075, semigloss; as manufactured by:	
Tnemec Company, 6800 Corporate Drive, Kansas City MO 64141 800-863-6321, www.tnemec.com	
or equal, having following essential characteristics:	
COMPOSITION:	
Topcoat – Two-component, aliphatic acrylic, polyurethane	
Lead and chromate free.	
PHYSICAL CHARACTERISTICS, PRIMER:	
Solids by volume:	68 percent, minimum
VOC, as supplied:	2.11 pounds per gallon (253 grams per liter), maximum
Mix ratio - resin:hardener:	8:1
Mixed usable pot life at 77 degrees F:	2 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	5 mils
Recoat time at 75 degrees:	8 hours, minimum
Full cure time before immersion at 75 degrees F and 50 percent humidity:	7 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss or semigloss
PERFORMANCE REQUIREMENTS:	
QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1C

Hi-Build Epoxoline II, Series 69N; as manufactured by:

Tnemec Company, 6800 Corporate Drive, Kansas City MO 64141
800-863-6321, www.tnemec.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, polyamidoamine epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	67 percent, minimum
VOC, as supplied:	2.29 pounds per gallon (275 grams per liter), maximum
Mix ratio - resin:hardener:	1:1
Mixed usable pot life at 50 degrees F:	15 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	10 mils
Recoat time at 50 degrees F:	8 hours, minimum
Full cure time before immersion at 50 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Limited colors/semigloss

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes

Category IE-1C

Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category AE-1DT

Devthane 379 UVA as manufactured by:	
ICI Devoe Coatings, 4000 Dupont Circle, Louisville KY 40207 502-897-9861, www.devoecoatings.com	
or equal, having following essential characteristics:	
COMPOSITION:	
Topcoat – Two-component, aliphatic acrylic, urethane	
Lead and chromate free.	
PHYSICAL CHARACTERISTICS, Topcoat:	
Solids by volume:	63 percent, minimum
VOC, as supplied:	2.6 pounds per gallon (311 grams per liter), maximum
Mix ratio - resin:hardener:	4:1
Mixed usable pot life at 77 degrees F:	4 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	3 mils
Recoat time at 60 degrees F:	6 hours, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors, white/gloss
PERFORMANCE REQUIREMENTS:	
QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1D

Bar-Rust 235; as manufactured by:

ICI Devoe Coatings, 4000 Dupont Circle, Louisville KY 40207
502-897-9861, www.devoecoatings.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, modified polyamide-amine epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	68 percent, minimum
VOC, as supplied:	2.40 pounds per gallon (292 grams per liter), maximum
Mix ratio - resin:hardener:	4:1
Mixed usable pot life at 77 degrees F:	4.5 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	10 mils
Recoat time at 60 degrees F:	6 hours, minimum
Full cure time before immersion at 60 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors, off-white/semigloss

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes

Category IE-1D

Pencil hardness, ASTM D 3363:	3H, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category AE-1GTV

Carbothane 134 VOC; as manufactured by:	
Carboline, 350 Hanley Industrial Court, St. Louis, MO 63144-1599, 314/644-1000, www.carboline.com	
or equal, having following essential characteristics:	
COMPOSITION:	
Topcoat – Two-component, aliphatic acrylic polyurethane	
Lead and chromate free.	
PHYSICAL CHARACTERISTICS, PRIMER:	
Solids by volume:	70 percent, minimum
VOC, as supplied:	1.58 pounds per gallon (190 grams per liter), maximum
Mix ratio - resin:hardener:	4:1
Mixed usable pot life at 75 degrees F:	4 hours, maximum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	2 to 2.5 mils
Recoat time at 50 degrees F and 50 percent humidity:	16 hours, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss
PERFORMANCE REQUIREMENTS:	
QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	2500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1G

Carboguard 691; as manufactured by:

Carboline, 350 Hanley Industrial Court, St. Louis, MO 63144-1599, 314/644-1000, www.carboline.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, phenalkamine epoxy. Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	80 percent, minimum
VOC, as supplied:	1.42 pounds per gallon (170 grams per liter) mixed, maximum
Mix ratio - resin:hardener:	1:4
Mixed usable pot life at 75 degrees F:	1.5 hours, maximum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	8 to 20 mils
Recoat time at 60 degrees F:	14 days, maximum
Full cure time before immersion at 60 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Beige (0200), Red (0500) and Gray (0700) in a Semi-gloss.

PERFORMANCE REQUIREMENTS:

Immersion Test, NACE mod TM-01-74:	
75 degree F:	Grade: 99/100
130 degree F	Grade: 97/100
Salt Spray Test, ASTM B117	1400 hour test single coat, NE in plane, VSL undercutting @scribe, #2, MD blisters @scribe
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	249 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over ¼-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex	1700 psi or greater

Category IE-1G

A2, type II tester:	
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category IES-6D3(pw)

Plasite 4500 S; as manufactured by:

Carboline, 350 Hanley Industrial Court, St. Louis MO, 63144
314-644-1000, www.carboline.com

or equal, having following essential characteristics:

COMPOSITION:

Primer – Two-component, 100% solids, amine, epoxy

Intermediate coat and topcoat – Two-component, ultra high solids, amine, epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:

Solids by volume:	100 percent, minimum
Solids by weight:	100 percent, minimum
VOC, as supplied:	0.04 pounds per gallon (18 grams per liter), maximum
Mix ratio – resin:hardener:	4:1
Pot life at 75 degrees F	45 minutes
DFT per coat:	20-60 mils
Application methods:	Brush, roller, spray
Color:	Light gray, tile red, or white

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1/2-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	3H, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Cathodic disbondment, ASTM G 8:	Passes 90 day test

3.10 COLOR SCHEDULE

A. Colors and glosses of finished coats:

1. Meet requirements of tabulated coatings and specified color.
2. Meet accurate match of color and gloss of specified coated surfaces.

B. Color and gloss to meet one or more of following:

1. Fed Std. 595B.
2. Manufacturer’s standard color.

END OF SECTION

SECTION 09971 - METALLIZING

PART 1 GENERAL

1.01 COST

A. Cost of metallizing gates including all material, labor, inspection, testing and associated equipment, shall be included in the applicable lump sum price bid in the schedule for the type of gate.

1.02 GENERAL

A. The Contractor shall furnish all materials and perform all work required to complete the work as shown on the drawings and as specified herein.

1.03 NOMENCLATURES

A. Metallizing: The term "metallizing" as used herein refers to any of several application methods for depositing sprayed-metal coatings.

B. Wire Flame-Spray: The term "wire flame-spray" refers to a metallizing process in which metallic wire is melted in an oxygen and fuel gas flame and is dispersed with an airstream. Wire Flame-Spray **will not** be permitted on this project.

C. Arc-Spray: The term "arc-spray" refers to a metallizing process in which metallic wire is melted by an electric arc and is dispersed with an airstream.

D. Coating Inspector: An independent, third party inspection firm hired by the Contractor meeting the minimum qualifications of paragraph 1.08.D.

1.04 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI Z87.1-2003 Practice for Occupational and Educational Eye and Face Protection
2. ANSI Z89.1-2003 Requirements for Industrial Head Protection

B. American Society for Quality (ASQ)

1. ASQ Z1.4 -2003 Sampling Procedures and Tables for Inspection by Attributes

C. American Welding Society (AWS)

1. AWS A5.01 (1993; R 1999) Filler Metal Procurement Guidelines

2. AWS C2.25/C2.25M (2003) Specification for Thermal Spray -- Solid and Composite Wire and Ceramic Rods
3. AWS Z49.1 (1999) Safety in Welding, Cutting and Allied Processes

D. American Society for Testing and Materials (ASTM)

1. ASTM A 380-99 Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
2. ASTM D 1186-01 Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base
3. ASTM D 3951-98; R 2004 Commercial Packaging
4. ASTM D 4285-83; R 1999 Indicating Oil or Water in Compressed Air
5. ASTM D 4417-03 Field Measurement of Surface Profile of Blast Cleaned Steel
6. ASTM D 4541-02 Pull-Off Strength of Coatings Using Portable Adhesion Testers
7. ASTM E 337-02 Measuring Humidity with a Psychrometer (The Measurement of Wet- and Dry-Bulb Temperatures)

E. Compressed Gas Association (CGA)

1. CGA P-1 (2000) Safe Handling of Compressed Gases in Containers

F. National Fire Protection Association (NFPA)

1. NFPA 70 (2005) National Electrical Code

G. National Institute for Occupational Safety and Health (NIOSH)

1. NIOSH 98-119 (1998; 4th Ed) Supplement 2 to NIOSH Manual of Analytical Methods

H. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1. SSPC AB 1 (1991; R 2000) Mineral and Slag Abrasives
2. SSPC AB 2 (1996; R 2000) Cleanliness of Recycled Ferrous Metallic Abrasive
3. SSPC AB 3 (2003) Newly Manufactured or Re-Manufactured Steel Abrasives
4. SSPC SP 5 (2000) White Metal Blast Cleaning
5. SSPC-PA2-96 Measurement of Dry Paint Thickness with Magnetic Gages
6. SSPC-SP1-00 Solvent Cleaning
7. SSPC-SP3-00 Power Tool Cleaning

8.	SSPC-SP6/NACE 3-00	Commercial Blast Cleaning
9.	SSPC-SP7/NACE 4-00	Brush-Off Blast Cleaning
10.	SSPC-SP10/NACE 2-00	Near-White Blast Cleaning
11.	SSPC-SP11-00	Power Tool cleaning to Bare Metal
12.	SSPC-VIS1-02	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
13.	SSPC-VIS3-00	Visual Standard for Power- and Hand-Tool Cleaned Steel
14.	NACE RP 0188-99	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
15.	NACE RP 0287-02	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape

1.05 SUBMITTALS

A. Approval Data:

1. Documentation of the metallizing applicator’s qualifications and at least five years experience on similar projects.

1.06 DELIVERY, STORAGE, HANDLING

A. Metallizing wire shall be packaged, shipped, and stored in conformance with ASTM D 3951.

B. Commercial packaging shall protect items against physical and environmental damage during shipment, handling, and storage.

C. Wire spools shall be protected against corrosion, deterioration, and damage during shipment. Protection shall be that used for distribution directly to a using customer or subsequent redistribution as required.

D. Individual spool containers and shipping containers shall be clearly and durably labeled to indicate contract numbers, specification number, material type, lot number, net weight, date of manufacture (month and year), wire diameter, and manufacturer's and distributor's name.

E. Metallizing wire shall be delivered to the application site in unbroken containers.

F. All metallizing wire shall be stored under cover and protected from the elements.

PART 2 PRODUCTS

2.01 METALLIZING WIRE

A. The wire shall conform to the compositional requirements specified in AWS C2.25/C2.25M for 85/15 Zinc-Aluminum wire.

2.02 ABRASIVE MEDIA

A. The abrasive blast media shall be a hard angular type capable of producing the specified surface profile listed in paragraph Abrasive Blasting.

B. The blast media shall be steel grit, silicon carbide, aluminum oxide, garnet, coal slag, or iron oxide.

C. New steel grit shall conform to the requirements of SSPC AB 3 including the below subparagraph, Steel Grit.

D. Steel grit hardness shall be Rockwell C of 51 or greater.

E. Recycled steel grit shall conform to the requirements of SSPC AB 2 and shall at no time contain greater than 15 per cent round or half-round particles when viewed under a 10X microscope or magnifying glass.

F. Garnet abrasive shall conform to the requirements of SSPC AB 1, Type 1, Class A, and shall be an appropriate grade to produce the specified blast profile.

G. Iron oxide abrasive shall be a commercial specular hematite material.

H. Coal slag abrasive shall conform to the requirements of SSPC AB 1, Type 2, Class A, and shall be an appropriate grade to produce the specified blast profile.

I. Silicon carbide and aluminum oxide abrasives shall be commercially pure materials of the appropriate gradation to produce the specified blast profile.

PART 3 EXECUTION

3.01 PREPARATION

A. Pit, Edge, and Weld Preparation

1. Visibly rough flame-cut steel and weld metal shall be ground with a disk wheel grinder or other tool to produce a smooth contour prior to abrasive blasting.
2. Grinding of flame-cut edges and welds shall also be performed to the extent necessary to etch heat-hardened metal.

3. Pits with an aspect ratio of greater than unity (as deep as they are wide) shall be ground with an abrasive disk or other tool prior to blasting.

4. Pits with sharp edges, undercut pits, and pits with an irregular horizontal or vertical orientation shall also be ground smooth prior to abrasive blasting.

5. Grinding shall smooth all of the rough and irregular surfaces to the extent necessary to allow the entire surface of the pit to be blasted and coated.

6. Sharp edges shall be ground prior to abrasive blasting to a uniform minimum diameter of 1/8 inch.

B. Abrasive Blasting

1. Ferrous surfaces to be metallized shall be solvent and blast cleaned to a white metal grade in accordance with SSPC SP 5.

2. The compressed air used for abrasive blasting shall be clean and dry.

3. Abrasive blast media shall be dry and free of grease and oil.

4. The surface profile as measured in accordance with subparagraph Blast Profile, shall be between 3.0 and 4.0 mils.

5. Special care shall be taken to achieve the specified blast profile on welds and flame-cut edges. In some cases it may be necessary to either grind these surfaces with a disk wheel grinder or other tool prior to blasting or to use a harder abrasive blast media.

6. If recycled abrasives are used, the particle size distribution of the working mix shall be maintained such that a consistent blast profile is obtained.

7. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the surface shall be brought to the proper profile.

8. Surfaces shall be dry at the time of blasting.

9. Acceptable surfaces shall be free of all visible contaminants including grease, oil, soot, and dust prior to receiving the first coat of metallizing.

C. Protection

1. Cleaning and metallizing shall be so programmed that dust, dry spray, or other contaminants from the cleaning operations do not contaminate surfaces ready for metallization.

2. Surfaces not intended to be metallized shall be suitably protected from the effects of cleaning and metallizing operations.

3.02 METALLIZING APPLICATION

A. General

1. Metallizing equipment shall be set up and operated in the same manner as used to prepare the JRS.

2. Equipment set up and operation shall be validated using a bend test.

3. The bend test is acceptable if the coating shows no cracks or exhibits only minor cracking with no lifting of the coating from the substrate.

4. If the coating cracks and lifts from the substrate the results of the bend test are unacceptable.

5. Compressed air used to atomize the metallized coating shall be clean and dry.

B. Metallizing Application Technique

1. Arc spray application does not require preheating of the substrate.

2. Surfaces to be metallized shall be free of all visible contaminants including grease, oil, soot, and dust prior to receiving the first and subsequent coats of metallizing.

3. All metallizing coats shall be applied in such a manner as to produce an even, continuous film of uniform thickness.

4. Edges, corners, crevices, seams, joints, welds, rivets, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of metallic coating.

5. Metallizing equipment shall be operated by qualified applicators in accordance with the manufacturer's recommendations.

6. The sprayed metal shall overlap a minimum of 40 percent on each spray pass to ensure uniform coverage.

7. Manual spraying shall be done in a block pattern not exceeding 2 feet by 2 feet square.

8. Specified thickness of the coating shall be built up in multiple layers. Fewer than 2 spray coats (overlapping at right angles) shall not be accepted.

9. The application gun shall be held at such a distance from the work surface that the metal remains plastic until impact with the surface.

10. Metallizing shall not extend closer than 3/4 inch to surfaces that are to be welded.

C. Metallizing Appearance

1. The thermal-sprayed coating prior to sealing shall have a uniform appearance.

2. The coating shall not contain any of the following: blisters, cracks, chips or loosely adhering particles, oils or other internal contaminants, pits exposing the substrate, or nodules.

D. Metallizing Thickness

1. Surfaces shall be coated with the systems indicated in the metallizing schedule and/or as noted on the drawings in accordance with the following:

a. System No. 6-Z-A: This metallizing system shall be applied to a minimum average thickness of 16.0 mils for the completed system.

b. The thickness at any one spot shall not be less than 13.0 mils.

E. Metallizing Adhesion

1. The average adhesion of the metallized coating shall not be less than 1000 psi for 85-15 zinc-aluminum alloy.

2. No single adhesion measurement shall have a value of less than 80-percent of the specified minimum average adhesion.

F. Atmospheric and Surface Conditions

1. Metallic coatings shall be applied only to surfaces that are a minimum of 5 degrees F above the dew point and that are completely free of moisture as determined by sight and touch.

2. Metallic coatings shall not be applied to surfaces upon which there is detectable frost or ice.

3. Metallized coatings shall not be applied when ambient and surface temperatures are below, or expected to drop below the minimum application temperature prior to completion of metallizing.

4. The minimum application temperature shall be 35 degrees F.

5. During periods of inclement weather characterized by extremes of humidity and temperature, metallizing may be continued by enclosing the work area and providing conditioned air, provided the proscribed ambient, surface, and dew point temperatures are maintained.

G. Time Between Surface Preparation and Metallizing

1. Surfaces that have been prepared and approved for metallizing shall receive the first coat of metallic coating as soon as practicable after such preparation has been completed.

2. The first coat shall be applied prior to the appearance of flash rust or within 4 hours of abrasive blasting, whichever is sooner.

H. Approved Methods of Metallizing

1. Metallizing methods which employ metal wire feed stock with electric-arc spray that produce coatings in conformance with requirements of this specification are acceptable.

3.03 REPAIR OF DAMAGED SURFACES

A. Repair damaged metallized coatings in the field by methods approved by the Contracting Officer.

B. Inspect repaired areas for compliance with specifications.

END OF SECTION

DIVISION 11 - EQUIPMENT

11280 Radial Gates
11285 Slotted Baffles
11286 Dual Leaf Gates
11287 Canal Gates
11288 Slide Gates

SECTION 11280 - RADIAL GATES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Radial Gates:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for designing, furnishing and installing the Radial Gates in accordance with the provisions of this section and referenced sections.

B. Cost: The cost associated with furnishing and installing radial gate hoists shall be included in the lump sum price bid in the schedule for Radial Gate Hoists.

1.02 SUMMARY

A. This section includes requirements for designing, furnishing, installing, and functional testing for two (2) commercial 12-foot-wide by 5.25-foot-high, wire-rope operated radial gates, trunnion pin assemblies, seals, clamp bars, and the associated appurtenances for a completely operational system. See Drawing No.s 3704-D-3 and 5 and informational Drawing No.s 122-DC-341, 342 and 343.

B. Training of operating personnel covering operation and maintenance of the radial gate equipment.

1.03 REFERENCES

A. Materials shall meet or exceed the requirements of the following standards:

1. American Society for Testing and Materials (ASTM)

a.	ASTM A 36/A36M-03a	Carbon Structural Steel
b.	ASTM A 48/A48M-03	Gray Iron Castings
c.	ASTM A 108-03	Steel Bar, Carbon and Alloy, Cold-Finished
d.	ASTM A 126-95(2001)	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
e.	ASTM A 167-99	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
f.	ASTM A 240/A240M-04	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

g.	ASTM A 307-03	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
h.	ASTM A 380-99e1	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
i.	ASTM A 564/A564M-02a	Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
j.	ASTM A 663/A663M-89(2000)	Steel Bars, Carbon, Merchant Quality, Mechanical Properties
k.	ASTM B 21/B21M-01e1	Naval Brass Rod, Bar, and Shapes
l.	ASTM B22-02	Bronze Castings for Bridges and Turntables
m.	ASTM B 98/B98M-03	Copper-Silicon Alloy Rod, Bar and Shapes
n.	ASTM B 418-01	Cast and Wrought Galvanic Zinc Anodes
o.	ASTM D 395-03	Standard Test Methods for Rubber Property-Compression Set
p.	ASTM D 412-98a(2002)e1	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
q.	ASTM D 471-98e1	Standard Test Method for Rubber Property–Effect of Liquids
r.	ASTM D 572-99	Standard Test Method for Rubber-Deterioration by Heat and Oxygen
s.	ASTM D 2240-03	Standard Test Method for Rubber Property-Durometer Hardness
t.	ASTM F 593-02e1	Stainless Steel Bolts, Hex Cap Screws, and Studs
u.	ASTM F 594-02	Stainless Steel Nuts

2. American Institute of Steel Construction (AISC)

a.	AISC-M016–1989	Manual of Steel Construction, Ninth Edition, Specifications for Structural Steel Buildings, Allowable Stress Design and Plastic Design

3. American Welding Society (AWS)

a.	AWS D1.1/D1.1M-2004	Structural Welding Code – Steel

4. National Electrical Manufacturers' Association (NEMA)

a.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.04 DESIGN REQUIREMENTS

A. Review Drawing No.s 3704-D-3 and 5 and informational Drawing No.s 122-DC-341, 342 and 343 and submit immediate comments regarding:

1. Report immediately any incompatibilities with gate manufacturer's requirements for radial gate radius, trunnion pin centerline location and hoist locations.

B. Design, locate, specify, draw, and coordinate the requirements for the radial gate trunnion pin, including; the location, size, depth, and angle. Ensure the pin is compatible with the existing structure's walls.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and List of Submittals.

1. Approval Data: Submit all items listed for approval at least 30 days prior to gate fabrication.

a. Professionally-prepared drawings, checked and stamped by a registered professional engineer, showing installation, assembly, and details of the radial gates, including, but not limited to the following gate details:

1) Face plate assembly, arm assembly, and trunnion assembly.

2) Arm-to-faceplate connections, trunnion pin/bushing/trunnion embedment details.

3) List of materials with material specifications, structural member sizes, lengths, geometry, elevations, clearances, and list of parts.

4) Details of the side and bottom seal arrangements.

5) Gate assembly details and installation details.

b. Gate calculations:

1) Structural calculations, professionally-prepared and stamped by a registered professional engineer, for the radial gate structure, including, but not limited to the following supporting information and calculations:

2) Design loads and load diagrams, including all assumptions.

3) Stress analysis, and structural member sizing.

4) Allowable stresses and code references.

5) Referenced standards.

2. Final Data:

a. Operation and Maintenance Service Manuals:

1) Submit combined radial gate and hoist operation (Section 14611) and maintenance service manuals that include:

a) Final, as-built drawings of the installations, detailed as required in the approval drawings.

b) List of all components of the complete radial gate and hoist system.

c) Commercial product data for all radial gate components, including seals, bushings, trunnion pins, embedded metalwork, and fasteners.

d) Lubrication, maintenance, calibration, and adjustment data for the radial gate and hoist components.

b. Installation procedures: Submit manufacturer's complete radial gate and hoist installation procedures.

1.06 DELIVERY, STORAGE AND HANDLING

A. After completion of shop assembly and testing, the radial gates may be partially disassembled for shipment.

B. Protect all equipment from corrosion, deformation, and other types of damage during delivery, storage and handling.

PART 2 PRODUCTS

2.01 DESIGN PARAMETERS

A. Gates shall be designed to withstand a water surface level with the top of the gate in a closed position plus one extra foot of water head. Maximum face deflection shall not exceed 0.050 inch.

B. Faceplates of gates shall be one piece.

2.02 RADIAL GATE MANUFACTURERS

A. The radial gates and hoists (Section 14611) shall be a commercial product from an established manufacturer in the day to day business of designing and fabricating radial gates and designing the hoisting equipment to operate the radial gates.

B. Manufacturers shall have a minimum of 5 years experience.

C. Commercial manufacturers of radial gates include, but are not limited to the following:

1. Rodney Hunt Company, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.

2. Hydrogate Corporation, 6101 Dexter St., Commerce City, Colorado 80022 USA. 800-678-8228 / 303-288-7873 www.hydrogate.com

3. Waterman Industries, Inc., PO Box 458, Exeter CA 93221 USA. 800-331-0808 www.waterman.com

4. Fresno Valves and Castings, Inc., as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.

2.03 GATE FACE PLATE ASSEMBLY

A. Fabricate the skin plate of the face plate assembly as follows:

1. One piece construction.
2. Roll the skinplate to a constant radius.
3. Stiffen the skin plate with horizontal structural members (ribs).
4. Size and space the stiffening ribs to meet AISC requirements.
5. Attach the stiffening ribs to the skin plate with continuous, fillet welds.

2.04 RADIAL GATE ARMS

A. Design and fabricate radial gate arms as a beam/column in accordance with AISC, Chapter H, Combined-Stresses.

B. Design steel pin plate to transmit gate load from the radial arms to the trunnion pin.

2.05 TRUNNION PINS AND TRUNNION PIN BEARINGS

A. Self-lubricating bushings: Design and furnish a self-lubricating bushing with solid lubricant to support the trunnion pin with the following characteristics:

1. Composed of supporting metal and solid lubricant.
2. One-piece with a self-lubricating bearing surface on inside diameter.
3. Supporting metal manganese bronze, copper alloy UNS NO. C86300, ASTM B 22, Bronze Castings for Bridges and Turntables. Provide circular recesses for containment of the lubricant in each bearing surface of supporting metal.
4. Cast or machine recesses perpendicular to each bearing surface.
5. Make depth of recess a minimum of ¼-inch-deep.
6. Arrange recesses in an overlapping geometric pattern in the direction of motion.
7. Total pattern of recesses provide a net cross-sectional area that is not less than 30 percent of the total area of the bushing bearing surface.
8. Extent of lubricant is within 1/8-inch of the chamfered edges of bushing.
9. Prior to application of the solid lubricant, finish bearing surfaces of the supporting metal to a surface roughness of approximately 125 micro-inches.

10. Design and furnish a trunnion pin constructed of stainless steel.

B. Solid lubricant characteristics:

1. Dense combination of solids and binder having no-deteriorating characteristics as well as lubricant qualities and capable of withstanding effects of long-term atmospheric exposure and submersion in fresh water.

2. Does not contain graphite, molybdenum disulfide, and any other ingredient that tends to promote electrolytic or chemical action. Shellac, tars, resins, solvents, and other non-lubricating binder materials are not acceptable.

3. Integrally molded and compressed into circular recesses and cover all of the bearing surface area on the inside diameter of each bushing to the film thickness recommended by the bushing manufacturer for continuous duty at the design load capacity.

4. Shore A durometer hardness of at least 90 when tested in accordance with ASTM D 2240. During manufacture, finish the bearing surfaces of the solid lubricant film to a surface roughness not exceeding 125 micro-inches.

5. Bushing design loads: Design load capacity of at least 6,000 pounds per square inch of projected bearing area at surface speeds not exceeding 10 feet per minute. When subjected to loads between 2,000 pounds per square inch and 6,000 pounds per square inch, the static and the dynamic coefficients of friction shall not exceed 0.10.

2.06 SIDE AND BOTTOM SEALS

A. Design and provide music-note-type neoprene side seals for the radial gates.

B. Provide rectangular neoprene seals for the bottom of the radial gates.

C. Compound, cure, and test the neoprene seals in accordance with the procedures in the ASTM standards to provide the physical properties listed in the following table - Physical Properties of Seals.

Table – Physical Properties of Seals		
Property	ASTM Test Method	Neoprene
Shore A Durometer Hardness	ASTM D 2240	2500
Minimum Tensile Strength after accelerated aging (48 hrs in oxygen at 70 ºC)	ASTM D 572	80
Maximum Elongation at Break Point	ASTM D 412	450
Maximum Compression Set (Constant Deflection) percent of original deflection %	ASTM D 395, Method B	30
Maximum percent change in weight (48hrs in water at 70ºC)	ASTM D 471	5

2.07 WIRE ROPE ABRASION PROTECTOR

A. Design and fit strips under the wire ropes to protect the protective coating on the upstream skin plate from abrasion by the wire ropes.

B. Use a UHMW poly wear strip.

C. Install abrasion protector centered on the wire rope. Use stainless self-tapping bolts and washers.

2.08 FASTENERS

A. Size the fasteners for the radial gate for the specified design loadings and gate operation, including arm-to-skinplate bolts and trunnion assembly bolts.

B. Furnish stainless steel bolts, Type 304 and bronze nuts for the seal bolt clamps.

2.09 WELDING

A. Welding:

1. Perform the welding in accordance with AWS D1.1, including but not limited to surface preparation of base metal, qualifications of the welding procedure, preheat, fabrication, nondestructive weld testing, and weld inspection.
2. Perform welding to minimize structural member warpage and distortion due to welding heat input.

3. Purchase, store, and handle, atmospheric exposure time, and bake low hydrogen electrodes in accordance with Section 5.3 of AWS D1.1 and Table 5.1.

4. Ensure the quality of the workmanship of the welds in regards to base metal preparation, acceptable fillet weld profiles (Section 5.24 of AWS D1.1), use of peening (Section 5.27 of AWS D1.1), avoiding arc strikes (Section 5.29 of AWS D1.1), requirements of interpass slag removal and weld cleaning (Section 5.30 of AWS D1.1), control of distortion and shrinkage, and the proper termination of welds shall be in accordance with the requirements provided in Section 3 - Workmanship of AWS D1.1.

5. Minimum length of intermittent fillet weld shall not be less than 3 inches.

6. Visually inspect each fillet weld in accordance with the Visual Inspection Acceptance Criteria, Table 6.1, and Section 6.9 of AWS D1.1 with regards to cracks, fusion, craters, profiles, undercutting, and porosity.

7. Test fillet welds using liquid dye penetrant in accordance with Section 6.14.5 of AWS D1.1.

8. Repair defective welds or other defective work performed by the Contractor at Contractor's expense.

9. USBR reserves the right to examine the new construction welds by use of ultrasonic, liquid dye penetrant, or magnetic particle testing, and direct the Contractor to repair defective welds. Include time allowances in the welding schedule for this inspection, should it occur.

2.10 PROTECTIVE COATINGS

A. Galvanizing as a protective coating for the radial gate is not allowed.

B. Prepare the steel surfaces and coat the entire steel surfaces of the radial gates, including the gate face assembly, arms assemblies, trunnion assemblies, and hoisting equipment in accordance with Section 09971 (Metallizing).

C. In lieu of protective coatings, all components of the radial gates, excluding the trunnion bearings, can be constructed of stainless steel meeting the requirements of ASTM A 167, A 276 or A 240, Types 304, 304L, 316, 316L or ASTM A 240 Type 3RC12.

2.11 LUBRICANTS

A. Provide at least 10 ounces of each lubricant recommended by the manufacturer.

B. Lubricant shall be sealed and labeled stating intended use and application frequency.

C. Provide lubricants to COR prior to substantial completion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Non-shrink Grout for Blockouts:

1. Use non-shrink grout to fill the blockouts for the trunnion pin after the installation of the radial gate according to Section 03600 (Grouting Mortar for Equipment and Metalwork), with the approval of the Contracting Officer's Representative (COR).
2. Finish exposed surfaces of the blockout concrete smooth.
3. Grind smooth any protruding offsets at a slope no greater than 1 in 1.

B. Install Trunnion Pin Assembly:

1. Accurately locate and install trunnion pin assemblies so that the installed centerline of rotation of the gate is parallel to and within ± ¼ -inch of the theoretical design centerline (or axis) of gate rotation.

C. Install Radial Gate: Install radial gate in accordance with the manufacturer's recommendations and written installation procedures.

D. Install hoists, components, and accessories in accordance with 14611 (Radial Gate Hoists), the shop drawings, and the manufacturer's installation guidelines.

E. Before installation, clean the anchor bolts and other metalwork to be embedded in concrete. Support anchor bolts accurately in position during the placement of the concrete.

F. After installation, clean, lubricate, and service equipment in accordance with the manufacturer's instruction.

3.02 FIELD TESTING

A. Notify the COR a minimum of 7 days in advance of the scheduled testing. Perform field testing in the presence of the COR.

B. Arrange for the gate manufacturer representative to be onsite for the inspection and field testing. Field testing of radial gates to be as listed below and in conjunction with testing requirements of Section 14611 (Radial Gate Hoists).

C. Wire-rope Stretch: In accordance with requirements listed in Section 14611.

D. Limit Switch Test: Test in accordance with requirements listed in Section 14611.

E. Alignment Test: Test in accordance with requirements listed in Section 14611.

F. Performance Test: Test in accordance with requirements listed in Section 14611.

G. Adjustments:

1. Make the required and necessary adjustments, alignments, corrections of defects; and retest until operation of the gate, hoist, and all appurtenant equipment is satisfactory.

3.03 TRAINING

A. After the gates are fully operational and all testing and adjuxtments have been completed and in conjunction with the training requirements listed for the radial gate hoists (Section 14611), provide onsite training by the gate manufacturer to the water district operators.

B. Provide a minimum of four hours of training covering complete explanation, demonstration, operations and maintenance of the radial gates, trunnion pin, hoist, wire ropes, connections and drive mechanism.

3.04 ACCEPTANCE

A. Acceptance of the work will be based on visual inspection and measured or tested conformance.

SECTION 11285 – SLOTTED BAFFLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Type A Slotted Baffles:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for designing, furnishing and installing the Type A Slotted Baffle in accordance with the provisions of this section and referenced sections.

B. Type B Slotted Baffles:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for designing, furnishing and installing the Type B Slotted Baffle in accordance with the provisions of this section and referenced sections.

C. Cost: Cost of metalwork embedded in concrete shall be included in the lump sum price bid for Miscellaneous Metalwork.

1.02 SUMMARY

A. Design, furnish, and install two sets of slotted baffles (a total of four) in accordance with these specifications and as shown on Drawing No. 3704-D-6 and 3704-417-16.

B. Slotted baffles will be used downstream of the dual leaf gates to incrementally step the water surface down from the designed water surface at the weir wall to the normal flow depth of the sluice channel.

C. Due to floating debris and fish at various levels, the slotted baffles must allow the full column of water to pass through the baffles. Therefore, overshot and undershot gates are not considered acceptable devices.

D. The slotted baffles are envisioned, but not required, to be similar to a fabricated slide gate with a centered slot that permits flow to pass while the slide gate is in the normally closed position.

E. The slot widths of the baffles have been designed by Reclamation to accommodate flow ranges between 100 cfs and 225 cfs (per bay of the gate structure).

F. Slotted baffles will be used during normal operation of the Hogback Canal to return water, sediment, floating debris and fish back to the river via the sluice channel.

G. When sluicing is required to clean the upstream canal of sediment, the slotted baffles will be raised at least 4 feet above the concrete structure's invert with electric hoists to eliminate flow restrictions in the gate structure.

H. Design slotted baffles for a head differential of 3 feet (upstream to downstream).

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	ASTM A 36/A36M-03a	Carbon Structural Steel
2.	ASTM A 307-03	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
3.	ASTM F 593-02e1	Stainless Steel Bolts, Hex Cap Screws, and Studs
4.	ASTM F 594-02	Stainless Steel Nuts

B. American Institute of Steel Construction (AISC)

1.	AISC M016	Manual of Steel Construction - Allowable Stress Design - 9th Edition

C. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-2004	Structural Welding Code – Steel

D. National Electrical Manufacturers Association (NEMA)

1.	NEMA ICS 5-2000	Industrial Control and Systems: Control Circuit and Pilot Devices
2.	NEMA MG 1-2003	Motors and Generators
3.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.:

1. Slotted Baffle Approval Data: For Type A and Type B, the following data to be submitted and approved at least 30 days prior to fabrication:
   a. Professionally-prepared drawings showing installation, assembly, and fabrication details of the each type of slotted baffle, showing the following details:
      1) List of materials, structural member sizes, geometry, clearances, and list of parts.
      2) Assembly details and installation details.

3) Configuration and details of baffle lifting device.

4) Drawings shall be stamped by a registered professional engineer.

b. Structural Calculations:

1) Professionally-prepared and stamped by a registered professional engineer.

2) Design loads and assumptions.

3) Stress analysis, and structural member sizing.

4) Allowable stresses and code references.

5) Referenced standards.

c. Commercial product data for all equipment provided or used with the slotted baffle.

d. Commercial product data and proposed system for the lifting the baffles.

e. Electrical schematics and wiring diagrams.

2. Final Data:

a. Service manuals, including wiring diagrams for the motor-operated lifts.

b. Assembly/Outline drawings including final parts list.

1.05 DELIVERY, STORAGE AND HANDLING

A. After completion of shop assembly and testing, the baffles may be partially disassembled for shipment.

B. Protect all equipment from corrosion, deformation, and other types of damage during delivery, storage and handling.

PART 2 PRODUCTS

2.01 SLOTTED BAFFLE DESIGN AND PRODUCT REQUIREMENTS

A. Slotted baffles shall satisfy all requirements shown and called for on the drawings and per the requirements of this section.

B. Slotted baffles shall fit within the 8-foot wide bays of the gate structure.

C. Blockouts in the concrete walls shall be utilized for mounting the baffles. Blockouts shall be grouted flush once the gate is installed with non-shrink grout.

D. Water shall flow through the center of the baffles without restriction of structural members. A bottom cross member will not be permitted.

E. The slot widths of the baffles shall be:

1. Type A – 3 feet 9 inches.
2. Type B – 5 feet 2 inches.

F. The slot heights of the baffles shall be:

1. Type A - 8 feet 0 inches.
2. Type B – 6 feet 6 inches.

G. Slotted baffles shall be designed to handle and operate under a condition of 3 feet of differential head.

H. Slotted baffles shall be designed to handle flow velocities of 8.5 feet per second through the slot. Deflection limits of the baffles when operating shall be no more than 1/4-inch and shall be capable of being raised in the frames with the provided lifting devices.

I. Slotted baffles shall be designed to be raised at least 4 feet above the invert of the structure. There shall be no obstructions when raised.

J. Slotted baffles shall be capable of being raised individually.

K. Design baffles with frames to be fully self-contained for easy installation in the provided blockouts.

L. Bottom of frame (bottom sill), if necessary, shall be flush with the structure's concrete invert.

M. Frame provided shall have primary members or intermediate members to provide for fall protection as shown on the drawings.

N. To ensure structural integrity, the design of all parts of the baffle and frame, and mechanical components of the operator, shall comply with AISC specifications for the maximum hydraulic operating load.

O. Baffles and frame shall be fabricated with structural steel ASTM A36, high strength structural steel, stainless steel or aluminum.

P. All ferrous materials shall be galvanized in accordance with Section 0550 or metallized in accordance with Section 09971.

Q. All surfaces shall be smooth, and all joints flush with no rough edges, burrs, or sharp corners. Grind welds to a smooth contour and provide gradual slopes to all offsets.

2.02 STEM AND STEM GUIDES

A. If stems are used in the design to raise the slotted baffles, design and manufacture in accordance with AWWA C513, except:

1. No portion of stem shall have cross-sectional area smaller than root area of threaded portion of stem.
2. Stem may have upset end or stem block.
3. Stem block:
    a. Thread or screw onto bottom end of stem, or designed for an upset stem end.
    b. Rigidly pin or key to stem.

B. Stem guides: Fully adjustable, to prevent binding during full gate operation.

C. Stem cover: Steel.

2.03 ACTUATORS AND CONTROL PANEL

A. Refer to Section 14614 Gate Actuators and Control Panels for requirements.

2.04 SLOTTED BAFFLE MANUFACTURER

A. Slide gate manufacturers that may be capable of design and fabrication of the slotted baffles are:

1. Rodney Hunt Company, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175
2. Golden Harvest, Inc., 11944 Westar Lane, Burlington, WA 98233 Phone: (360) 757-4334, website: www.goldenharvestinc.com.

2.05 LUBRICANTS

A. Provide at least 10 ounces of each lubricant recommended by the manufacturer.

B. Lubricant shall be sealed and labeled stating intended use and application frequency.

C. Provide lubricants to COR prior to substantial completion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the slotted baffles as shown in the drawings and in accordance with the manufacturer’s recommendations.

3.02 FIELD QUALITY CONTROL

A. Site Test:

1. Operational Performance Tests: Test by opening and closing gate at least 6 times through its full range of operation. Carefully observe that all parts are in proper alignment. Make necessary adjustments as required.
2. Refer to Section 14614 for requirements of adjustment and calibration of the slotted baffle actuators.

END OF SECTION

SECTION 11286 - DUAL LEAF GATES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Dual Leaf Gates:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for designing, furnishing and installing the Dual Leaf Gates in accordance with the provisions of this section and referenced sections.

B. Cost: Cost of metalwork embedded in concrete shall be included in the lump sum price bid for Miscellaneous Metalwork.

1.02 SUMMARY

A. Design, furnish, and install two dual leaf gates in accordance with these specifications and as shown on Drawing No.s 3704-D-5 and 6.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	ASTM A 36/A36M-03a	Carbon Structural Steel
2.	ASTM A 307-03	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
3.	ASTM F 593-02e1	Stainless Steel Bolts, Hex Cap Screws, and Studs
4.	ASTM F 594-02	Stainless Steel Nuts

B. American Institute of Steel Construction (AISC)

1.	AISC M016	Manual of Steel Construction - Allowable Stress Design - 9th Edition

C. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-2004	Structural Welding Code – Steel

D. National Electrical Manufacturers Association (NEMA)

1.	NEMA ICS 5-2000	Industrial Control and Systems: Control Circuit and Pilot Devices
2.	NEMA MG 1-2003	Motors and Generators

3. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Data: The following data to be submitted and approved at least 30 days before fabrication:
    a. Professionally-prepared drawings showing installation, assembly, and fabrication details of the gate, showing the following gate details:
        1) List of materials, structural member sizes, geometry, clearances, and list of parts.
        2) Assembly details and installation details.
        3) Configuration and details of gate operator.
        4) Drawings shall be stamped by a registered professional engineer.
    b. Gate Structural Calculations:
        1) Professionally-prepared and stamped by a registered professional engineer.
        2) Design loads and assumptions.
        3) Stress analysis, and structural member sizing.
        4) Allowable stresses and code references.
        5) Referenced standards.
    c. Commercial product data for all equipment provided or used with the gate.
    d. Electrical schematics and wiring diagrams.
2. Final Data: Submitted not more than 15 days after installation.
    a. Operation and Maintenance Service Manuals:
        1) Submit combined Dual Leaf gate and operator/actuator operation (Section 14611) and maintenance service manuals that including final, as-built drawings of the installations, detailed as required in the approval drawings
        2) List of all components of the complete Dual Leaf gate and operator/actuator system.
        3) Commercial product data for all gate components, including seals, bushings, embedded metalwork, and fasteners.

4) Lubrication, maintenance, calibration, and adjustment data for the gate and operator/actuator components.

b. Installation procedures: Submit manufacturer's complete gate and operator/actuator installation procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. After completion of shop assembly and testing, the gate may be partially disassembled for shipment.

B. Protect all equipment from corrosion, deformation, and other types of damage during delivery, storage and handling.

PART 2 PRODUCTS

2.01 DESIGN AND PRODUCT REQUIREMENTS

A. Provided gate shall satisfy all requirements shown and called for on drawing and per the following specifications:

1. Gate leafs to have a structural height of 8.75 feet, above the concrete invert El. 4988.95.
2. Gates and operators to be designed to handle and operate under the full 8.75 feet of differential head.
3. Gates with frame to be fully self-contained for easy installation and removal in the provided gate slots.
4. To ensure structural integrity, the design of all parts of the gate and frame, and mechanical components of the operator, shall comply with AISC specifications for the maximum hydraulic operating load.
5. Leafs, frame, and torque tubes shall be fabricated with structural steel ASTM A36, high strength structural steel or stainless steel.
6. Normal operation of gate is from closed to a full unobstructed opening of 7 feet, minimum.
7. Operators to be equipped with limit switches for minimum and maximum travel.
8. Bottom of frame (bottom sill) shall not project more than ½ inch above concrete floor.
9. All exposed or submerged equipment shall be constructed of stainless steel or metalized.

10. If gates are operated with hydraulics, the hydraulic pump and controls shall be located in the Control Building.

    a. Hydraulic tubing shall be stainless or galvanized steel designed for the appropriate pressures.

    b. Use of hydraulic hoses shall be limited to connecting between equipment and pumps where flexible connections are required. When hydraulic hoses are used in exposed areas, they shall either have a metal braided exterior, enclosed in steel conduit, or enclosed in Schedule 40 steel pipe.

11. Two (2) redundant gate position sensors shall be provided by a 4 to 20 mA signal indicating the angle of the gate. The gate position sensors shall be designed so that no less than 75 percent of the 4 to 20 mA range is used from a full open to a full close gate position.

12. Operators shall be suitable for 24 V DC operation.

    a. Operators may be designed using geared transmissions, sprocket and roller chain configurations, hydraulics or any combination of the above. If hydraulic operators are used, the hydraulic pump shall be located in the Control Building and the hydraulic lines shall be installed from the Control Building to the dual leaf gates as shown on Drawing No. 3704-417-20.

    b. A method for mechanical operation shall be approved by COR.

    c. DC motor control shall include a DC softstart capable of current limiting to 1.5 times the full load amperes of the motor.

    d. Operator shall be capable of moving the gate from fully open to fully closed positions in 15 minutes and no faster than 10 minutes.

13. Operators shall be sized, or shear pins provided, to ensure that no over stressing of components will occur in the case of limit switch failure or operator error.

14. Torque tubes and all other hinge points and connections shall be provided with a suitable bearing or bushing.

15. Due to location of operators above the water surface, proper materials shall be used for all components to minimize corrosion damage.

16. Furnished gates shall include a spare hydraulic pump, spare pump motor, if hydraulics are used and a spare drive motor and spare gear box if geared operation is used.

17. Each gate furnished shall include a spare set of gate position sensors.

18. All surfaces are to be smooth, and all joints flush with no rough edges, burrs, or sharp corners. Grind welds to a smooth contour and provide gradual slopes to all offsets.

19. The Dual Leaf Gate operator panel shall be remotely located in the Control Building and shall be totally enclosed to provide NEMA type 4 rated enclosure.

    a. The panel shall be operable from the Central Control Panel. The Central Control Panel will include an Open, Close and Stop pushbuttons. The following components/features shall be included with the Dual Leaf Operator Panel:

        1) Reversing contactors (mechanically and electrically interlocked)

        2) Control and signal voltage shall be 24 VDC, externally supplied.

        3) Control by contact closure/discrete input signals via Open-Stop-Close signals 24 VDC.

        4) Contact closure terminals shall be provided adjacent to the output signal's terminal strip.

    b. Output signals for remote indication:

        1) The panel shall have a terminal strip on which each actuator shall be grouped together and each wire clearly labelled as to its function. Each of the six functions below shall be done with a different colored wire, with the same color performing the same function for each gate. Each gate shall have contacts to indicate:

            a) The Manual-Off-Remote selector switch is in the Remote position

            b) When the gate is at the open limit

            c) When the gate is at the closed limit

            d) When there is a general fault in the actuator

            e) Necessary connections for the gate position sensors. These terminals shall be clearly labeled and shall be labeled Gate Position terminals.

    c. From the Central Control Panel, when the Manual-Off-Remote selector switch is in the Remote position, it shall be possible to:

            a) A 24 VDC signal from the automation system or Central Control Panel shall cause the gate to open. The gate will open only while this signal is coming from the automation system or Central Control Panel. When the signal stops, gate movement will stop.

            b) A 24 VDC signal from the automation system shall cause the gate to close. The gate will close only while this signal is coming from the automation system or Central Control Panel. When the signal stops, gate movement will stop.

20. Security:

a. The gates and gate actuators shall be designed in a manner to protect the gate and its' operation from vandalism.

b. Position sensors, limit switches, hydraulic motors, gear boxes and any other part of the gate actuator shall be enclosed.

c. Connecting arms or drive shafts between leafs on a gate may be exposed with adequate shielding for protection of the operator.

d. If the motors for the gate actuators are mounted outside the control building, they shall have an enclosure meeting the requirements as outlined in Section 14614, subparagraph 2.03.A

2.02 DUAL LEAF GATE MANUFACTURERS

A. Gate manufacturers that may be capable of design and fabrication of the dual leaf gates are:

1. Aqua Systems 2000 Inc., 1606 Lakeside Road, Lethbridge, Alberta, Canada T1K3G8. 1-800-315-8997.

2. Rodney Hunt Company, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.

2.03 LUBRICANTS AND HYDRAULIC FLUID

A. Provide at least 10 ounces of each lubricant recommended by the manufacturer.

B. Provide at least two complete hydraulic fluid changes.

C. Lubricant and hydraulic fluid shall be sealed and labeled stating intended use and application frequency.

D. Provide lubricants and hydraulic fluid to COR prior to substantial completion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the gate as shown in the drawings and in accordance with the manufacturer's recommendations.

B. Make electrical connections in accordance with Division 16 – Electrical.

3.02 FIELD QUALITY CONTROL

A. Site Test:

1. Operational Performance Tests: Test by opening and closing gates at least 3 times through its full range of operation. Carefully observe that all parts are in proper alignment. Make necessary adjustments as required.
2. Completely purge air from hydraulic lines if applicable. Assure hydraulic oil reservoir is full after purging.

3. Adjust gate position sensors such that:
   a. 4 mA to 6 mA is observed at a fully closed position.
   b. 18 mA to 20 mA is observed at a fully opened position.

END OF SECTION

SECTION 11287 - CANAL GATES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. 12-inch Canal Gate:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment and materials required for furnishing and installing the 12-Inch Canal Gate in accordance with the provisions of this section and referenced sections. The unit price shall also include the cost of furnishing and installing 12-inch PVC drain pipe as shown on Drawing No.s 3704-D-6 and -8.

1.02 DEFINITIONS

A. Face and back pressure heads: Head at vertical distance from center of gate to maximum water surface.

PART 2 PRODUCTS

2.01 CANAL GATE

A. Design and manufacture:

1. Gate shall be manufactured to the standards of commercial equipment, and the Contractor shall assume responsibility for coordination and adequate design conforming to the best engineering practice for the requirements of the work under these specifications.

2. The canal gate shall be a Model C-10 as manufactured by Waterman Industries, Inc. or equal.

3. Seating head: 20-feet minimum

4. Frame: Flat back.

   a. The frame shall be an integral unit of extrusions and structural shapes, rigidly assembled to form the waterway opening.

   b. Holes shall be provided for mounting anchor bolts.

   c. Frames shall be ASTM A36/A36M-01 and galvanized in accordance with ASTM A123/A 123M-02.

5. Slide:

   a. Canal gate slide shall be cast iron ASTM A126, class B and galvanized in accordance with ASTM A123/A 123M-02.

2.02 CANAL GATE MANUFACTURES

A. Gate manufacturers that may be capable of design and fabrication of the canal gates are:

1. Fresno Valve and Casting Inc, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.
2. Waterman Industries, 1701 N. Nashville, Lubbock TX, Phone: (806) 763-5943, website: http://www.watermanusa.com.

2.03 STEM AND STEM GUIDES

A. Design and manufacture:

1. Gate stem diameter shall be adequate to withstand twice the force created by a 40 pound pull on the hand wheel.
2. The stem shall be supported by angle guides spaced to provide an l/r ratio of 200 or less.
3. Stems shall be stainless steel, AISI type 304.
4. Stem cover: Steel.

2.04 MANUALLY-OPERATED GATE LIFT

A. Design and manufacture:

1. Provide cast iron hand wheel with offsets, wall brackets, and stem guides as required.
2. Hand wheel shall be located approximately 36 inches above the top of the concrete wall.
3. Lift shall have thrust bearings, bronze lift nuts, and a bronze stop nut to limit the downward travel of the stem and slide.
4. Lift shall be rising stem type.
5. Provisions for lubrication.

2.05 PVC PRESSURE PIPE AND FITTINGS (4” TO 12”)

A. Pipe shall be Schedule 40, conform to ASTM D 1785.

B. Pipe fittings shall have solvent weld joints, shall be Schedule 40, conforming to ASTM D 2466.

2.06 GROUT

A. Grout for gate frame: Nonshrink grout in accordance with Section 03600 – Grouting Mortar for Equipment and Metalwork.

PART 3 EXECUTION

3.01 INSTALLATION

A. The PVC drain pipe shall be embedded in the walls and concrete placement as shown on Drawing Nos. 3704-D-6 and -8.

1. Pipe leaving the wall with the canal gate shall be cast in the wall during placement.
2. Pipe entering the wall downstream of the flap gates can be cast in the wall or placed through a blockout and grouted with non-shrink grout.
3. All pipe joints between canal gate and end of pipe shall be solvent weld joints. No gasketed joints rubber coupling devices will be accepted.
4. Support the pipe at spacing of not less than 5 feet.
5. Pipe penetrating walls shall have a clearance of 2 inches to nearest reinforcement steel.

B. Install slide gate as shown on drawings.

C. Install gates in manner to prevent leakage past seats.

D. Leakage between gate frame and concrete: None allowed.

E. During concrete placement, firmly support in accurate position pipe and other metalwork that will be embedded in concrete.

F. Lubricate stem and lift in accordance with Manufacturer's instructions.

G. Test after gates have been installed.

H. Test by opening and closing gate at least 3 times through its full range of operation.

I. Make required changes or adjustments until operation of gate and lift is approved by Contracting Officer.

END OF SECTION

SECTION 11288 - SLIDE GATES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. 72-inch by 72-inch Slide Gate:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment, and materials required for furnishing and installing the 72-inch by 72-inch Slide Gate in accordance with the provisions of this section and referenced sections.

B. 48-inch by 72-inch Slide Gates:

1. Measurement: Each.

2. Payment: Each unit price offered in the schedule. The unit price shall include the cost of all labor, equipment, and materials required for furnishing and installing the two 48-inch by 72-inch Slide Gates in accordance with the provisions of this section and referenced sections.

1.02 REFERENCES

A. American Water Works Association (AWWA)

1.	AWWA C513-97	Open-Channel Fabricated-Metal Slide Gates
2.	AWWA C540-02	Power-Actuating Devices For Valves And Slide Gates

B. National Electrical Manufacturers Association (NEMA)

1.	NEMA ICS 5-2000	Industrial Control and Systems: Control Circuit and Pilot Devices
2.	NEMA MG 1-2003	Motors and Generators
3.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 DEFINITIONS

A. Face and back pressure heads: Head at vertical distance from center of gate to maximum water surface.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval data: Submit at least 30 days prior to fabrication.

a. Drawings and data showing assembly, type, size, and detail dimensions of slide gate and lift installation. Include lift capacity.

2. Final data: Submit no later than 15 days after installation.

a. Service manuals.

b. Assembly/Outline drawings including final parts list.

1.05 PROJECT CONDITIONS

A. Supply power: 240 volts, single-phase, 60 hertz.

PART 2 PRODUCTS

2.01 SLIDE GATE

A. Design and manufacture in accordance with AWWA C513, except:

1. Gate frame and slide: stainless steel or aluminum.

2. Seating faces: UHMW polyethylene.

3. Capscrews, studs, assembly bolts, anchor bolts, and gate stem: Stainless steel conforming to any 300 series.

4. Nuts: Bronze.

B. Seating and unseating heads:

1. Seating head: 15-feet minimum

2. Unseating head: 10-feet minimum

C. Closure type: Flush-bottom

D. Flat-back type.

E. Frame and slide:

1. Slide: Square bottom type.

2. Frame: Self-Contained.

3. Raised surfaces: Only as necessary for attaching seats.

2.02 STEM AND STEM GUIDES

A. Design and manufacture:

1. Gate stem diameter shall be adequate to withstand twice the force created by a 40 pound pull on the hand wheel.
2. The stem shall be supported by angle guides spaced to provide an l/r ratio of 200 or less.
3. Stems shall be stainless steel, AISI type 304.
4. Stem cover: Steel.

B. Design and manufacture in accordance with AWWA C513, except:

1. No portion of stem shall have cross-sectional area smaller than root area of threaded portion of stem.
2. Stem block:
   a. Thread or screw onto bottom end of stem.
   b. Rigidly pin or key to stem.
3. Stem guides: Fully adjustable.

2.03 SLIDE GATE MANUFACTURERS

A. Slide gate manufacturers that may be capable of design and fabrication of the slide gates are:

1. Rodney Hunt Company, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.
2. Fresno Valve and Casting Inc, as supplied by Municipal Treatment Equipment, 17301 West Colfax Ave Suite #105, Golden, CO 80401 Phone (303) 231-9175.
3. Golden Harvest, Inc., 11944 Westar Lane, Burlington, WA 98233 Phone: (360) 757-4334, website: www.goldenharvestinc.com.

2.04 ACTUATORS AND CONTROL PANEL

A. Refer to Section 14614 Gate Actuators and Control Panels for requirements.

2.05 GROUT

A. Grout for frame: Nonshrick grout in accordance with Section 03622 – Grouting Mortar for Equipment and Metalwork.

2.06 LUBRICANTS

A. Provide at least 10 ounces of each lubricant recommended by the manufacturer.

B. Lubricant shall be sealed and labeled stating intended use and application frequency.

C. Provide lubricants to COR prior to substantial completion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install slide gate in accordance with AWWA C513 and as shown on drawings.

1. Install gates in manner to prevent leakage past seats.
2. Leakage between gate frame and concrete: None allowed.
3. During concrete placement, firmly support in accurate position anchor bolts and other metalwork that will be embedded in concrete.

B. Install stem and lift in accordance with AWWA C513 and as shown on drawings.

1. Handwheel, when furnished: Locate centerline of handwheel at elevation between 2 and 3 feet above ground or structure on which gate operator will stand; unless otherwise dimensioned or noted on drawings.
2. Crank, when furnished: Locate centerline of crank at elevation between 2.5 and 3.5 feet above ground or structure on which gate operator will stand; unless otherwise dimensioned or noted on drawings.

C. Lubricate stem and lift in accordance with Manufacturer's instructions.

D. Test after gate and have been installed.

1. Test by opening and closing gate at least 3 times through its full range of operation.
2. Make required changes or adjustments until operation of gate and lift is approved by Contracting Officer.

END OF SECTION

DIVISION 13 – SPECIAL CONSTRUCTION

134247 Water Level Sensors

SECTION 13427 – WATER LEVEL SENSORS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Water Level Sensors:

1. Payment: Lump sum price bid therefore in the schedule. The lump sum price shall include the cost of all labor, equipment and materials required for furnishing and installing the Water Level Sensors with stand pipes, enclosures, conduit and required mounting materials as shown on Drawing No.s 3704-417-19 and 20.

B. Cost: Cost of metalwork embedded in concrete shall be included in the lump sum price bid for Miscellaneous Metalwork.

1.02 SUMMARY

A. Furnish, and install ten water level sensors in accordance with these specifications and as shown on Drawing No.s 3704-417-19 and 20.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Data: The following data to be submitted and approved at least 30 days prior to fabrication:

a. Commercial product data for the water level sensors.

1) For the water level sensors, identify the installed cable length for each sensor.

PART 2 PRODUCTS

2.01 WATER LEVEL SENSORS

A. Ranged for maximum electrical output at 5 psig and minimum electrical output at 0.0 psig.

B. Stainless steel construction

C. Standard poly cable jacket ½" - 14 NPT male conduit fitting with molded cable seal

D. Provide 4-20 mA output, 0.25% full scale accuracy

E. No lightning protection

F. Open-face nose cap, labeling ft H2O units

G. Aneroid bellows

H. Sensor cables shall be factory furnished and extend from the sensor to the lockable connection box plus 2 feet of extra cable.

I. Polyurethane cable of adequate length to reach lockable box and extend the sensor to within one foot of the invert of the structure where mounted.

J. KPSI Pressure transducer Model 720 - Vented gage sensor or equal

1. Esterline Pressure Systems 34 Research Drive Hampton, VA 23666 (757) 865-1243

2.02 SECURITY FROM VANDALISM

A. Lockable boxes shall be Catalog No. A806CHNF, 16 gauge with lock kit by Hoffman Enclosures Inc. or equal.

2.03 MISCELLANIOUS METAL

A. See Section 05500, Metal Fabrications

2.04 CONDUIT

A. See Section 16130, Electrical Conduit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate water level sensors as shown on Drawing No. 3704-417-20.

B. Mount boxes to concrete with galvanized unistrut and adhesive anchors as shown on Drawing No. 3704-417-19 and as directed by COR.

C. Securely mount aneroid bellows and attach the bellows to the sensor vent tube in the lockable box. Do not impinge movement of the bellows.

D. Cable from the Control Building and the sensor wires shall connect in the lockable box on a terminal strip.

END OF SECTION

DIVISION 14 - CONVEYING SYSTEMS

14611 Radial Gate Hoists
14614 Gate Actuators and Control Panels

SECTION 14611 - RADIAL GATE HOISTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Radial Gate Hoists:

1. Payment: Lump-sum price offered in the schedule. The lump sum price shall include all costs of labor, equipment and materials required for furnishing and installing Radial Gate Hoists in accordance with the provisions of this section and referenced sections. The lump sum price shall also include either provisions to manually operate the gate operator or the cost of furnishing one identical spare gear box and motor.

B. Cost: Cost of removing the existing radial gate hoists shall be included in the lump sum price bid for Removing Existing Features.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA)

1.	AGMA 908-B89(1999)	Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth
2.	AGMA 2001-C95	Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
3.	AGMA 6010-F97	Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives
4.	AGMA 6019-E89	Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears (Replaced by AGMA 6109)
5.	AGMA 6109-A00	Gearmotor, Shaft Mounted and Screw Conveyor Drives
6.	AGMA 6034-B92	Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors

B. American Institute of Steel Construction (AISC)

1. AISC S335-89 Specifications for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary - 1989 (part of M016 - Manual of Steel Construction Allowable Strength Design Ninth Edition)

C. ASTM International (ASTM)

1. ASTM A 29/A 29M-99 Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for

2.	ASTM A 36/A 36M-02	Carbon Structural Steel
3.	ASTM A 148/A 148M-03	Steel Castings, High Strength, for Structural Purposes
4.	ASTM A 159-83(2001)	Automotive Gray Iron Castings
5.	ASTM A 290-02	Carbon and Alloy Steel Forgings for Ring for Reduction Gears
6.	ASTM A 291-03	Steel Forgings, Carbon and Alloy, for Pinions, Gears and Shafts for Reduction Gears
7.	ASTM A 380-99	Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
8.	ASTM A 513-00	Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
9.	ASTM A 519-96(2001)	Seamless Carbon and Alloy Steel Mechanical Tubing
10.	ASTM A 1011/A 1011M-03	Steel, Sheet and Strip, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
11.	ASTM B 22-02	Bronze Castings for Bridges and Turntables
12.	ASTM D 395-02	Rubber Property -Compression Set
13.	ASTM D 412-98a(2002)	Vulcanized Rubber and Thermoplastic Elastomers - Tension
14.	ASTM D 471-98	Rubber Property - Effect of Liquids
15.	ASTM D 572-99	Rubber - Deterioration by Heat and Oxygen
16.	ASTM D 2240-02b	Rubber Property - Durometer Hardness

D. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-2002	Structural Welding Code - Steel

E. Crane Manufacturers Association of America (CMAA)

1.	CMAA 70-2000	Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

F. Federal Specifications (FS)

1.	FS RR-W-410E	Wire Rope and Strand
2.	FS RR-S-550D (1)	Sockets, Wire Rope

G. National Electrical Manufactures Association (NEMA)

1. NEMA 250-97 Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA MG 1-98 Motors and Generators (with Revisions 1, 2, and 3)

H. Occupational Health and Safety Act (OSHA)

1.03 GENERAL REQUIREMENTS

A. Summary

1. Requirements within this Section include designing, furnishing, installing, and functional testing of the complete replacement of the hoist system for the two new 12-foot-wide by 5.25-foot-high radial gates. Upon completion of the installation, the two radial gates shall be mechanically tied together and operated from one gear box and one actuator.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Approval Data: Submitted at least 30 days prior to fabrication.
    a. Professionally-prepared drawing(s) showing installation, assembly, and details of gate hoists, including, but not limited to the following details:
        1) Hoist layout, drive train components, wire-rope data, wire-rope drum details, component pedestal details.
        2) Wire rope to gate connections, hoist to deck connections, wire-rope drum connections.
        3) Material specifications, equipment ratings and capacities.
        4) Hoist and actuator assembly and installation details.
    b. Calculations, stamped by a professional engineer registered in the state of the hoist, or actuator manufacturer, for sizing hoist components, including, but not limited to gearing, wire ropes, shafts, couplings, limit switches, and drums.
    c. Commercial Products Data: Includes complete identifying data giving the manufacturer's name, type, model, size, dimensions, ratings, and characteristics and features of all the commercially available components for the radial gate hoists and motor actuators.
    d. Installation Procedures:
        1) Submit five (5) sets of the manufacturer's complete installation procedures.
2. Final Data: Submitted no later than 15 days after installing hoist.

a. Operations and Maintenance Service Manuals:

1) Provide radial gate hoist operation and maintenance service manuals, including final, 11”x17” as-built drawings of the installations, detailed as required in the approval drawings.

b. Commercial products data for all actuator and hoist components.

c. Worm-gear speed reducer data, with manufacturer’s name, model, gear ratios, and maximum torque rating.

d. Gear motor and brake data, with manufacturer’s name and model, size, and torque rating.

e. Motor data sheet Drawing No. 40-D-6032, revised with as-built information.

f. Data for flexible couplings, pillow blocks, bearings, seals, and space heaters.

g. List of names, phone numbers, and addresses of all component manufacturers.

h. List of all parts of the complete radial gate hoist system.

i. Lubrication, maintenance, calibration, and adjustment data for the actuator and hoist components.

j. Operational instructions for the hoist and actuator.

k. Schematic wiring diagrams for the actuators.

l. The operation and maintenance service manuals to include schematic and wiring diagrams, maintenance and operating instructions, identifying parts list, and the list of recommended spare parts.

PART 2 PRODUCTS

2.01 ACTUATORS AND CONTROL PANEL

A. Refer to Section 14614 Gate Actucators and Control Panels for requirements.

2.02 DESIGN PARAMETERS

A. Radial Gate Hoist Components:

1. General:

a. Design hoist and actuator to mount on top of the walls and piers of the two gate bays, and to transfer the maximum hoist loads safely into the concrete structure’s walls and piers.

b. The hoist for the radial gate consist of the gear box, wire rope drums, drum shaft, wire ropes, bearing base, and all other required appurtenances to operate the radial gate. Design hoist components for a minimum factor of safety of 5:1.

c. The gear box shall be incorporated into the design of the hoist and actuator so that a provision is made to prevent back driving.

d. Gears shall be steel, and shall be the helical worm or spur type. Accurately machine gears with cut teeth, smooth running with suitable shafts of cold-rolled steel.

e. Machine housing to receive all shafting. All gearing and shafting shall be suitable for auxiliary motor operation. Gear box shall be a fully enclosed to contain the bath lubrication.

f. For each radial gate furnish cold-rolled steel drum shaft and two grooved machined drums with internal cable clamps. Size the drums for 2½ wraps of the wire ropes when the gates are in the fully closed position. Identically machine each drum to the same dimensions, and ensure the drums are interchangeable.

g. Completely shop-assemble and test-operate the hoists without load and dismantle only as required for shipment.

h. Design and size the wire ropes for a 5:1 factor of safety.

i. Provide epoxy anchor bolts and a double nut adjustment system to attach and align each hoist and bearing base to the concrete of the walls and piers. Install and align both ends of the drive shaft so that the shaft is level.

j. Gear box(es) shall be driven by one motor to left both radial gates.

B. Hoist Components:

1. Wire Ropes:

a. Federal Specifications RR-W-410E, Type 1, general purpose, Class 3, corrosion resistant steel, composition 302, preformed with corrosion resistant steel independent wire rope core (type 302 stainless steel, 6x37 classification, IWRC).

b. Length of hoist wire rope: Sufficient to lift gates to upper position and to lower gates to lowest position, including 2 ½ - 3 dead wraps on drum when gate is resting on invert of structure. Include ample length for anchoring rope to drum as per manufacturer's design.

2. Sockets:

a. Federal Specifications RR-S-550D, Spelter-type 6, galvanized. Provide one rope from each hoist with standard closed wire rope speltered socket. Provide the other rope from each hoist with a standard open wire rope speltered socket.

3. Socket Pins:

a. Dimensionally compatible with lugs on existing gates. Provide pins for disconnecting ropes from gate when necessary to remove gate for maintenance or to replace ropes.

4. Socketing - Zinc-type or resin-type:

a. Performed by a craftsman skilled in this work in accordance with current industry practice.

b. Zinc-poured socketing: Use procedures of the Wire Rope Technical Board, P.O. Box 849, Stevensville MD 21666.

c. Resin-type socketing: Required to have equivalent strength as zinc-type socket connection.

d. Socket connections: Tension tested to two-fifths of rope breaking strength.

5. Turnbuckles:

Provide turnbuckle for one rope from each hoist (the rope that has the open socket).

a. Standard galvanized, eye-and-eye turnbuckle, suitable for connecting to gate.

b. Maximum stresses that develop from normal loading of gates, lifting attachments, and weight of ropes: 20 percent of the ropes' ultimate breaking strength.

6. Wire Rope Connections:

   a. Connection between hoist ropes and gate: Wire rope socket that corresponds to type required by attachment lug on gate.

   b. Provide for disconnecting gate when necessary to remove gate for maintenance.

7. Wire Rope Drums:

   a. Cast steel, cast iron with heavy section, or welded steel.

   b. Reinforced to withstand concentrated load of rope pulls.

   c. If weldments option are used, submit for approval complete shop drawings of weldments showing configuration, dimensions, weld sizes, and materials.

   d. Pitch diameter: At least 20 times the diameter of the rope.

   e. Grooved length: Sufficient to take full length of ropes for specified lift plus three dead wraps, without overwinding.

   f. Helical grooves: Machined on drum surfaces to receive hoisting ropes to ensure that they spool and unspool in an orderly manner.

      1) Maximum surface texture: 125 micro inches.

      2) Minimum depth: Not less than 40 percent of rope diameter.

      3) Minimum groove pitch: Rope diameter plus 1/8-inch.

   g. Locate drums so that when the gate is in the highest raised position, the rope on the drum lies on the same vertical plane as the hoist connection on the gate.

   h. Maximum combined crushing and bending stress in the drum:

      1) Cast iron drum: 6000 lb/in^2.

      2) Cast steel drum: 12,000 lb/in^2.

      3) Welded-plate steel drums: 14,000 lb/in^2.

8. Wire Rope Drum Covers:

   a. Removable.

   b. Sheet metal: ASTM A 1011, 14 gauge.

   c. Surround entire length of drum.

   d. Cover as much of drum circumference as possible without interfering with motion of hoist ropes, shafts, bearings or couplings.

9. Lubricants:
    a. Suitable for year-round outside use in dusty or wet conditions, with air temperatures ranging from -15 ºF to 120 ºF.
    b. Gearbox oil: Readily biodegradable, provided grades exist that meets the manufacturer's recommendations.
    c. Wire rope lubricant: Specifically made for use with wire rope.
    d. Grease seals: Metallic or suitable nonmetallic material.
    e. Bearing lubrication: Oil lubrication for enclosed gear trains and motor sleeve bearings. High-pressure grease for other mechanical operating parts.
    f. Spur pinion and Spur gear: High pressure grease.
10. Bolts and Nuts:
    a. Except where closer tolerances are required, all bolts for mechanical equipment shall be semifinished and shall have hexagonal heads and nuts.
    b. On seats: Bolt heads and nuts bear at right angles to bolts.
    c. On castings: Seats on finished bosses or on spot-faced surfaces.
    d. Nuts subject to vibration and frequent changes in loading: Secured by effective locknuts.
    e. Double nuts: Standard thickness.
    f. Bolts in tension: base sizing on net section, at root of thread, 15 percent in excess of net section required in tension.
11. Shafts:
    a. Size: CMAA 70.
    b. Length of drum stub shafts and floating shafts:
        1) Depends upon length of worm gear reducer output shaft, drum lengths, and proper clearances (in accordance with the flexible coupling manufacturer's recommendations) between end faces of shafts.
    c. Horizontal distance between centerlines of the hoist connection lugs on the gate:
        1) Longitudinal movement of shafting:
            a) Set collars: Not allowed.
12. Bearings and Linings:
    a. Gear reducer unit bearings:

1) Roller-, spherical roller-, or ball-type.

2) Removable bronze linings.

b. Locate shaft bearings as close as possible to loading points.

c. Shafts are removable with pinion and gears in position without disturbing adjacent parts.

d. Base castings or weldments for support of bearings:

1) Ensure accurate alignment and spacing of shafting and gears.

2) Held securely in place by turned bolts and dowels.

3) Hold sleeve bearings against rotation or changing position under load.

13. Anti-friction bearings: Minimum life expectancy (L-10) of not less than 5000 hours at maximum loads and speeds to which they are subjected.

14. The pillow block bearings:

a. Spherical roller-type.

b. Manufacturer: Same for all pillow block bearings.

c. Size: Loads generated by normal hoist operation do not exceed 25% of basic bearing load rating.

d. Outdoor service.

e. Lubrication fittings.

1) Non-leaking seals.

15. Flexible couplings:

a. Floating shafts:

1) Single-engagement couplings.

2) Angular misalignment: 0.75 degree.

b. Other shafts:

1) Double-engagement couplings.

2) Angular misalignment: 0.75 degree per half coupling

3) Offset misalignment: 1.5 percent of maximum bore.

c. Metallic.

d. Gear-type.

e. Dustproof.

f. Fully enclosed.

g. Bore: Actual shaft diameter plus zero, minus 0.001 inch.

h. Fit accurately on shaft.

i. Rating:

1) For size shafts connected.

2) Torque rating: Suitable for loads transmitted.

j. Lubrication:

1) Grease.

2) Seals: Metallic or suitable nonmetallic material.

k. Keys, setscrews, bolts, nuts, and revolving surfaces:

1) Flush or guarded by a metal cover.

2) No hazard to personnel.

2.03 LUBRICANTS

A. Provide at least 10 ounces of each lubricant recommended by the manufacturer.

B. Lubricant shall be sealed and labeled stating intended use and application frequency.

C. Provide lubricants to COR prior to substantial completion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install radial gate hoist actuators and hoist components in accordance with manufacturers approved installation instructions.

3.02 FIELD TESTING

A. Field tests shall be performed in the presence of the COR. Notify the COR 7 days prior to testing.

B. Install and adjust wire ropes on both sides of gate for equal tension, to prevent racking of the gates.

C. Wire Rope Stretch:

1. Stretch wire rope only after the abrasion protector has been installed on the skin plate.

2. Induce and remove the inherent structural stretch of the radial gate wire ropes.

3. Operate each gate through five full opening and closing operations to cause wire ropes to stretch.

4. Re-tension each rope, to remove excess slack of the stretched wire rope.

5. In the closed gate position, do not over tension ropes. Ensure the weight of the gate rests on concrete invert.

D. Limit Switch Test:

1. After the wire ropes have been stretched, and that stretch has been removed, install, adjust and functionally test the operation of the limit switches to de-energize the actuator motor for each radial gate for the following gate positions:

a. When the gate is in the fully raised position, defined as the vertical height equivalent to the height of the gate.

b. When the gate is in the fully lowered position with the gate weight resting completely on the bottom seal.

E. Alignment Test:

1. Check the gate and hoist alignment by operating the gate from the fully open to the fully closed position

2. The gate should travel vertically without any apparent racking and/or binding.

3. Assure that the bottom edge of the gate is level (to within 1/8-inch) along its entire width for the full raising and lowering operations of the gate.

4. The wire ropes shall not contact the concrete surfaces at any point during the full gate travel.

F. Performance Test:

1. Using commercial power, operate each radial gate two times, and check to ensure that the gate, hoist, and actuator operate smoothly, quietly, and without observable vibration, excessive backlash, gate binding, and that the limit switches operate at the desired fully-open and fully-closed gate positions.

G. Adjustments:

1. Make the required and necessary adjustments, alignments, corrections of defects; and retest until operation of the gate, hoist, and all appurtenant equipment is satisfactory.

END OF SECTION

SECTION 14614 – GATE ACTUATORS AND CONTROL PANELS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include the cost of gate actuators in the applicable prices offered in the schedule for the device (slotted baffle or type of gate) for which the actuator will operate.
2. Include all applicable costs of designing, furnish and installing two control panels as described in this section in the lump sum price in the schedule for Control Panels. See Section 16444 for additional requirements.

1.02 DEFINITION

A. In this section, the term "Gate" shall include the following devices:

1. Slotted baffles: include gate actuator and components for the control panel
2. Dual leaf gates: include components for the control panel
3. Slide gates: include gate actuator and components for the control panel
4. Radial gates: include gate actuator and components for the control panel

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and List of Submittals.

1. Approval Data: Submit all items listed for approval at least 30 days prior to gate fabrication or fabrication of gate actuators and control panels.
    a. Wiring diagrams showing circuit connections for limit switches supplied with and as part of the motor-operated lift.
    b. Motor data:
        1) Locked-rotor torque: foot-pounds
        2) Full-load torque: foot-pounds
        3) Horsepower rating: horsepower
        4) Voltage rating: volts
        5) Locked-rotor current: amperes
        6) Full-load current: amperes
        7) Time rating: minutes
    c. Proposed wiring diagram of control panel(s)

2. Final data:
    a. Service manuals, including wiring diagrams for the motor-operated lifts.
    b. Assembly/Outline drawings including final parts list.
    c. Lubrication, maintenance, calibration, and adjustment data for the gate actuator components.
    d. Installation procedures: Submit manufacturer's installation procedures.
    e. As-built wiring diagram of control panel(s)

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment Requirements:

1. The actuators for the slide gates and slotted baffles shall be suitable for use on a 240 Volt single phase 60 Hz power supply and shall include motor, integral reversing starters, local controls and terminals for remote control and indication housed within a self contained, sealed enclosure.
2. Actuators for the radial gates shall be suitable for use on a 24 Volt direct current (DC) power supply and shall include motor, integral reversing starters, local controls and terminals for remote control and indication housed within a self contained, sealed enclosure.
3. All actuators, except for the dual leaf gates, on this project shall be the product of a single manufacturer.
4. A Central Control Panel shall be provided to remotely operate the above actuators as well as the dual leaf gates.

B. Actuator sizing:

1. The actuator shall be sized to guarantee gate closure at the specified torque and/or thrust requirement as indicated by the gate manufacturer or supplier.
2. The actuator must be adequately sized to provide the torque required to operate the gate at 90% of the nominal voltage. The operating speed shall be a minimum of 4 inches per minute and not greater than 9 inches per minute for all gate styles.

C. Environmental:

1. Actuators shall be suitable for outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -4°F to +158°F in open/close service.

D. Enclosures:

1. Actuators shall be 0-ring sealed, watertight to NEMA 6 (6 feet for 30 minutes).
2. All external fasteners shall be of stainless steel.
3. Gear cases shall be cast iron.

E. Motor:

1. The electric motors shall be Class F insulated, with a duty rating of at least 15 minutes, or one full gate open-close movement, whichever is greater, at 104°F (40°C).
2. Motor removal shall be possible without loss of lubricant.

F. Duty Rating:

1. All actuators shall be designed for on-off operation.
2. Maximum of 15 starts per hour.

G. Motor protection:

1. The following criteria shall be provided for motor protection:
   a. The motor shall be de-energized without damage in the event of a stall condition when attempting to move a jammed gate.
   b. The motor shall be de-energized in the event of an overtorque condition.
   c. Thermal devices imbedded in the motor windings shall be provided to de-energize the motor in case of overheating.

H. Gearing

1. The actuator gearing shall be totally enclosed in a cast iron gear case suitable for operation in any orientation.
2. Actuator gearing shall be hardened steel with alloy bronze worm wheel.
3. The design should permit the opening of the gear case for inspection or disassembly without releasing the stem thrust or taking the gate out of service.
4. Where required per application, electric actuators will be provided with worm gearboxes.
5. The worm gearboxes shall be supplied with full 360° bronze worm wheels and end-of-travel mechanical stops on the worm shaft.
6. Designs with segmented worm gears and end-of-travel stops in the gearbox housing will not be permitted.

I. Manual operation of gates, excluding dual leaf gates:

1. Manual operation shall be by a handwheel.
2. Handwheel shall be mechanically independent of the motor drive for emergency operation.
3. There shall be a shaft extension to permit gate operation with a portable drill.
4. Clockwise operation of the handwheel for all actuators shall cause the gates close or all shall open in the clockwise direction.
5. Return from manual to electric mode of operation will be automatic upon motor operation.
6. A seized or inoperable motor shall not prevent manual operation.
7. The hand wheel drive must be mechanically independent of the motor drive and any hand wheel gearing should be such as to permit emergency manual operation in a reasonable time.
8. Maximum rim pull for gate travel shall not exceed 60 pounds.

J. Drive nut and thrust base assembly:

1. Slide gates and slotted baffles:
   a. The drive nut shall be installed in a detachable thrust base.
   b. The design shall allow actuator removal from the thrust base, leaving the thrust base attached to the gate to retain gate position.
   c. Thrust bearings shall be lubricated by means of an easily accessible grease fitting.
2. Radial gates:
   a. The drive nut shall be a splined coupling designed to transmit the actuator’s torque to the radial gate’s drum drive shaft.

K. Gate position and torque calibration:

1. Limit switches shall be furnished at each end of travel.
2. Limit switch adjustment shall not be altered by manual operation.
3. One set of normally open and one set of normally closed contacts will be furnished at each end of travel where indicated.
4. Contacts shall be capable of reliably switching low voltage DC source from the control system furnished by others.
5. Mechanically operated torque switches shall be furnished at each end of travel.
6. Torque switches will trip when the actuator load exceeds the torque switch setting.

7. The torque switch adjustment device must be calibrated directly in engineering units of torque.

8. Each gate shall have a 4-20 mA position sensor. This includes both radial gates even though the radial gates are operated in tandem.

L. Integral starter and transformer:

1. The reversing starter, control transformer, and local controls shall be integral with the gate actuator, suitably housed to prevent breathing and condensation buildup.

2. This starter shall be an electro-mechanical type suitable for 10 starts per hour and of rating appropriate to motor size.

M. Wiring and terminals:

1. Internal wiring shall be tropical grade insulated stranded cable of appropriate size for the control and single phase power.

2. All external wiring shall terminate in a removable plug and socket head, which allows easy disconnection of all power and control voltages.

3. Actuators furnished without plug and socket terminal connections must have power and control disconnect switches for ease of maintenance and safety.

2.02 ELECTRIC ACTUATOR CONTROLS

A. Controls:

1. All actuators will be furnished with integral actuators / motor controls.

2. The integral controls shall be electrically connected to the actuator.

3. It shall be possible to re-position the integral controls at 90° increments, so that the push buttons and indication lights will face the operator.

B. Control components:

1. The following components/features shall be included with the integral controls:

a. Reversing contactors (mechanically and electrically interlocked).

b. Internal power supply / transformer for control power.

c. Control and signal voltage shall be 24V DC internally or externally supplied.

d. Control by contact closure / discrete input signals via OPEN-STOP-CLOSE signals (24 V DC) potentially separated from actuator controls by opto-isolators.

C. Local Controls:

1. Local controls with 'OPEN - STOP - CLOSE' pushbutton type controls and a lockable selector switch with 'LOCAL - OFF - REMOTE' function.

2. Local controls shall be supplied with indicating lights red for ‘OPEN’, yellow for ‘FAULT’ and green for ‘CLOSED’.

D. Output signals for remote indication:

1. The following output signals shall be furnished for remote indication on a terminal strip in the Central Control Panel:

a. Output signals from selector switch when switch is in LOCAL position shall be via potential-free contacts.

b. Output signals from selector switch when switch is in REMOTE position shall be via potential-free contacts.

c. Signals for end-of-travel positions OPEN and CLOSED shall be via potential-free contacts.

d. Monitor relay for collective fault signal (power failure, phase failure, thermal switch tripped and torque switch tripped in mid travel) shall be provided.

e. A 4-20 mA position feedback signal shall be provided.

2.03 SECURITY FROM VANDALISM:

A. General:

1. All actuators shall include a fabricated enclosure made from ¼”-thick steel.

2. The enclosure shall completely enclose the operator.

3. Openings in the enclosure shall permit a full range of movement of the actuator and gate but shall not permit access by tools or other devices which could damage the actuator.

4. They shall include lockable access to the actuator, which when opened or removed, shall permit access for calibration and servicing the actuator.

5. The lock shall be tamper proof and enclosed on all but one side by a steel cover. The enclosure shall be securely fastened to a concrete base or other structure components.

6. Fasteners that attach the enclosure to the structure shall only be accessible when the lockable cover is opened or removed.

7. It is not necessary for the enclosure to be provided by the manufacturer of the actuator nor is it necessary for the enclosure to be water tight.

8. Enclosures shall be hot dipped galvanized.

B. Remote mounted push buttons:

1. It shall be possible to operate all actuators from the Central Control Panel located in the Control Building.

2. When the Manual-Off-Remote selector switch on the actuator is in the Remote position, control shall be transferred from the actuator to a Central Control Panel located in the Control Building.

3. The actuators shall be configured so that Open and Closed operation shall require maintained contact.

2.04 CENTRAL CONTROL PANEL:

A. For the Central Control Panel, all gates shall mean all slide gates, slotted baffles, radial gates and dual leaf gates that have been furnished and installed. Gates that are not included are the existing radial gates located at the diversion dam headworks.

1. The Central Control Panel shall conform to the Specifications provided in Section 16444.

2. The Central Control Panel shall be installed in the Control Building.

3. There shall be indicator lights on the Central Control Panel for all gates indicating: that the selector switch is in the Remote position, Gate Open limit, Gate Closed Limit, and General Fault.

4. Push buttons on the Central Control Panel shall permit Opening, Closing and Stopping gate operation.

5. The pushbuttons shall be designed so that Open and Closed operation shall not require maintained contact.

6. The central panel shall also include a terminal strip to permit PLC interface with the Central Control Panel.

7. Each gate shall be grouped together on the terminal strip and each wire clearly labelled as to its function.

8. Each of the six functions below shall have a different colored wire, with the same color performing the same function for each gate. Each gate shall have contacts to indicate:

a. The Manual-Off-Remote selector switch is in the Remote position

b. When the gate is at the open limit

c. When the gate is at the closed limit

d. When there is a general fault in the actuator

e. And shall have contacts to cause the following to occur:

1) Upon a 24 VDC signal, cause the gate to open. Gate shall open only when the signal is present.

2) Upon a 24 VDC signal, cause the gate to close. Gate shall close only when the signal is present.

9. The gate position sensor wiring shall also terminate on the terminal strip.

10. There shall be an emergency STOP button located on the Central Control Panel door which stops gate movement for all gates. Button shall be labeled "E-STOP GATES ONLY"

11. To accommodate future automation hardware, the Central Control Panel shall include a blank space, 24-inches wide by 12-inches high on the back panel.

12. To accommodate future automation hardware, the door of the Central Control Panel shall include a blank space, 11-inches wide by 9-inches high.

2.05 DIVERSION DAM CONTROL PANEL AND PUSH BUTTON OPERATORS:

A. The Diversion Control Panel shall conform to the Specifications provided in Section 16444.

B. The Diversion Control Panel and push button operators shall be installed in the existing bullet-proof enclosure as shown on the Drawing No. 3714-417-21.

C. The Contractor shall weld unistrut to the back of the existing bullet-proof enclosure to accommodate mounting of panel DD1, Diversion Dam control panel and the push button operators.

D. The Contractor shall mount three Government furnished push button operators arranged horizontally in the Government furnished bullet-proof enclosure. The pushbuttons shall mounted no lower than three feet nor higher than five feet from the gound where the operator will be standing.

E. The Contractor shall connect the push button opertors to the existing gate actuators according to the manufacturer requirements. Control for the remote push operators is designed for 24 VDC operation.

F. The Diversion Dam Control panel will house a future PLC and a terminial strip which will serve as a junction box between the three existing radial gate actuators, push button operators and the PLC. For the Diversion dam control panel the Contractor shall mount a Hoffman CSD302408, or equal, NEMA Type 4 enclosure near the bottom of the bullet-proff box. The push button operators shall be mounted above the Hoffman box. The panel shall also include a terminal strip to permit PLC interface.

G. Each connection for each remote push button shall be grouped together on the terminal strip and each wire clearly labeled.

H. Each of the six functions below shall have a different colored wire, with the same color performing the same function for each actuator. The terminal strip shall include connections to indicate:

a. The Manual-Off-Remote selector switch on the gate operator is in the Remote position

b. When the gate is at the open limit

c. When the gate is at the closed limit

d. When there is a general fault in the actuator

e. A contact to Open the gate. Gate shall open only when the signal is present.

f. A contact to Close the gate. Gate shall close only when the signal is present.

g. Connections for the gate position sensor.

I. The Contractor shall install a 20A 120 VAC outlet inside the bullet proof box.

2.06 ELECTRIC ACTUATOR MANUFACTURERS:

A. Electrical actuator shall be manufactured by:

1. AUMA Actuators, Inc, Canonsburg, PA.
2. Flowserve Limitorque, Lynchberg, VA
3. Rotork Controls, Rochester, NY
4. Or other manufacturer approved by CO.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gate actuators in accordance with manufacturers approved installation instructions.

3.02 ELECTRIC ACTUATOR COMMISSIONING AND TEST REPORTS

A. Commissioning:

1. Each actuator shall be commissioned by a factory trained Field Service Technician.
2. Each actuator shall be provided with a commissioning kit consisting of a wiring diagram and installation and operation manual.
3. No special commissioning tools or parts will be required for start-up.

4. Commissioning shall include calibrating the actuator as recommended by the manufacturer.

5. The calibration shall also include setting the open and closed limit switches and setting and verifying torque settings.

6. The gate position sensor shall be calibrated so that a reading of 4.25 to 4.5 mA is given at the gate closed position and a reading of 19.25 to 19.75 mA is given at the fully open position.

7. For setting the gate position sensors, fully closed and fully open will be controlled by the physical limitations of the gate and not the limit switch settings.

B. Performance Test Documentation

1. Each actuator shall be performance tested in presence of COR.

2. Test documentation must be provided indicating the following:

a. Torque sensing tripping points in both the open and closed directions of travel

b. Current at the maximum torque tripping point

c. Actuator output speed

d. Position sensor reading with gate fully closed

e. Position sensor reading with gate fully open

f. Actual gate travel distance from fully open to closed position

3.03 TRAINING

A. Provide onsite training by the gate and/or actuator manufacturer to the Department of Water Resources (DNR) operators. Provide a minimum of four hours of training covering complete explanation, demonstration, set-up, calibration, operation (normal and manual) and maintenance of the all gates, electric actuators and drive mechanism, and the hoist components, including wire rope drums, limit switches, flexible couplings, shafts, gear reducers, motors, brakes, bearings, wire rope, wire rope sockets, wire ropes connections, terminations, and controls.

END OF SECTION

DIVISION 16 - ELECTRICAL

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 MEASUEMENT AND PAYMENT

A. Complete AC Electrical System:

1. Payment: Lump sum price bid therefor in the schedule. The lump sum price bid shall include the cost of the following:

   a. Furnishing and installing all materials so that the electrical features are complete and ready for operation.

   b. Coordinating with Navajo Tribal Utility Authority to extend the existing single phase overhead powerline from the existing power pole shown on Drawing No. 3704-417-2B to the new meter pole located near the headworks as shown on Drawing No.s 3704-417-2C and 21.

   c. Excavation and backfill for trenches for buried electrical and all types and sizes of communication conduits, including the HDPE conduit.

   d. Furnishing and installing conduits, blockouts, conductors and control cable.

   e. Transporting and storing equipment and materials.

   f. Furnishing and installing all brackets, fastenings, bolts, nuts, lock washers, and other accessories, and drilling holes as required for mounting or installing electrical equipment and materials.

   g. Furnishing and handling spare parts.

   h. Making all conduit, grounding, metering, and power connections, and furnishing all miscellaneous materials which are required for making these connections to electrical equipment. The cost of making these connections to equipment provided for in other divisions shall be included in the applicable unit or lump sum prices bid for the equipment.

   i. Assembling, adjusting, leveling, and installing equipment.

   j. Costs for furnishing drawings, documentation, and data for electrical installations will be included in the lump sum price bid in the schedule for a Complete AC Electrical System, and shall include the following:

      1) Coordinating and identifying "as-built" installation with designs provided by the Government.

1.02 COST

A. The costs associated with designing, furnishing and installing two control panels shall be in included the lump sum price in the schedule for Control Panels. See Section 16444 for additional requirements.

1.03 REQUIREMENT

A. Requirements for the electrical features being designed, furnished, and installed under these specifications for the Fish Barrier Weir at the Hogback Canal and Diversion Dam, shall be in accordance with the requirements of all Divisions as they apply to electrical equipment installation.

B. The electrical installation drawings included with these specifications show typical circuit connections and general locations of electrical equipment. The Contractor shall perform any additional electrical design and coordination as required; furnish all electrical materials and equipment not furnished by the Government; install and remove, modify, and reinstall electrical material and equipment as required; and make the electrical installation complete and ready for service, as shown on the Government drawings, on the Contractor's approved designs, drawings, and as described in these specifications. Provide at Contractor expense, design personnel to perform the design and prepare drawings as required under these specifications, including revisions of final drawings to show "As-Built" conditions at closeout.

1.04 REFERENCES

A. OSHA Occupational Safety and health Act Standards

B. American Society for Testing and Materials (ASTM)

1. ASTM A 123-1997 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A 153-1995 AASHTO No. M232 Zinc Coatings (Hot-Dip) on Iron and Steel hardware

C. National Fire Protection Association (NFPA)®

1. NFPA 70-2008 National Electrical Code (NEC)®

D. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-1997 National Electrical Safety Code

1.05 DESIGN REQUIREMENTS

A. Perform additional electrical design required.

B. Make required design changes when Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. Contracting Officer will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

C. Design, materials, and installation details not specifically covered in referenced standards or these specifications are subject to approval of Contracting Officer.

1.06 CONFLICTING REQUIREMENTS

A. In event of conflicting requirements, precedence is established by the following order:

1. These specifications or as directed by COR. Drawings included in these specifications Latest edition of NFPA 70 and adopted electrical code of State in which construction is located.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Manufacture, construct, and assemble electrical equipment in accordance with following:

1. NEMA, ASI, IEEE, ICEA, UL, and ASTM.
2. NFPA 70.

B. Test and label all electrical equipment and assemblies in accordance with a NRTL (Nationally Recognized Testing Laboratory) accredited by Federal Occupational Safety and Health Administration. If NRTL labeling is not provided, then provide evidence of a NRTL listing.

C. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment such as distribution panelboards and control switchboard assemblies in accordance with ASTM A 123 and A 153.

D. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.

E. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.

F. Provide additional tools and equipment as necessary to properly install, adjust, and check operation of electrical equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by Government.

B. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70 and IEEE C2.

C. Install and/or remove, modify, and reinstall electrical materials and equipment.

D. Make electrical installations complete and ready for service.

E. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books.

F. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.

G. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.

H. Installation of electrical equipment includes:

1. Drilling holes, furnishing hardware, and assembling components to each other.
2. Furnishing materials for and making connections in accordance with wiring diagrams.
3. Tagging wires and cables at each end.

3.02 REPAIR

A. Repair damaged painted surfaces of equipment to match original finish.

3.03 FIELD QUALITY CONTROL

A. Correct errors made during installation

B. Correct errors and discrepancies found during field testing. These corrections shall include making wiring changes, equipment replacements, drawing revisions, and adjustments to settings of electrical equipment.

C. Government will inspect electrical equipment during installation. Final acceptance will be made after equipment is installed and operational.

3.04 SPARE PARTS AND TOOLS

A. Provide spare parts required by these specifications. Deliver spare parts to Contracting Officer's Representative.

B. Provide at least five spare fuses for every size installed.

END OF SECTION

SECTION 16051 - ELECTRICAL DRAWINGS AND DATA

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. ASME Y14.1 - 95 Decimal Inch Drawing Sheet Size And Format

B. Institute of Electrical and Electronic Engineers (IEEE)

1. IEEE Y32.9-1972 Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction
2. IEEE C37.2-1996 Standard Electrical Power System Device Function Numbers and Contact Designations
3. IEEE 315 -1975 Graphic Symbols For Electrical And Electronics Diagrams (Including Reference Designation Class Designation Letters)

C. National Electrical Manufacturers Association (NEMA)

1. NEMA ICS 1-2000 Industrial Control and Systems: General Requirements

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Information Drawings and Data: Submit at least 30 days prior to procuring equipment.
    a. General: Furnish with manufacturer’s standard format.
    b. Equipment Layout Diagrams:
        1) Indicate dimensions of equipment.
        2) Indicate location of devices and items of equipment including nameplates, terminal blocks, wiring ducts, bus, conduit entries, and other features in their relative physical location.
        3) Indicate method of securing equipment to deck, floor, or wall.
        4) Identify each device and item of equipment with a bill of material reference number.

c. Bill of Material:

1) Provide information on manufacturer, style, type, rating, quantity, and other identifying information for each device or item of equipment.

2) Provide unique reference number for each device or item of equipment listed on bill of material.

d. Nameplate Lists: Provide information on type of material, size, and engraved lettering.

e. Schematic Diagrams:

1) Format:

a) Vertical ladder diagram form.

b) Label rungs with sequential numbers starting with number 1.

c) Locate rung numbers adjacent and to left of associated rung.

d) Provide unique rung numbers for each circuit.

2) Indicate functional operation.

3) Describe unusual or nonstandard operation.

4) Indicate ratings and/or values of all devices.

5) Indicate all contacts, including spare contacts, for each motor contactor coil, auxiliary relay, and timer.

6) Indicate a complete cross-reference between other schematic and wiring diagrams.

7) Indicate switch developments for each selector switch and limit switch.

8) Identify devices and items of equipment by reference to bill of materials item number and with appropriate device number in IEEE and NEMA standards.

f. Wiring Diagrams:

1) Indicate equipment as mounted on each back panel, side panel, and door. Each panel shall be indicated as viewed from wiring side of panel.

2) Identify each item of equipment with the device designation indicated on schematic diagrams.

3) Indicate point-to-point wiring in accordance with Standard Drawing 104-D-1165.

4) Indicate cables, cable and individual wire designations and connections to all external circuits.

g. Manufacturer's Technical Data:

1) Provide technical data for each device or item of equipment.

2) Include manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions.

3) Where several items are listed on same sheet, mark data being submitted for approval.

4) Demonstrate proposed device or item of equipment meets specifications requirements.

5) Include reference to RSN number.

2. As-built Drawings.

a. Mark prints of electrical specifications drawings to Indicate "as-built" changes made to equipment and systems during construction.

b. "As Built" Drawings:

1) Provide drawings for grounding, conduit, and lighting systems.

2) Indicate "as-built" changes, including revision dates, made to grounding, conduit, and lighting systems during construction.

3) Indicate dimensions of:

a) Location of grounding electrodes.

b) Embedded and direct buried grounding cables.

c) Embedded and direct buried conduit.

4) Include revision dates.

3. Final Drawings:

a. Indicate "As Built" condition of installed equipment at time of contract completion.

b. Provide original plot of schematic and wiring diagrams and equipment layout drawings.

c. Provide computer drawing files on compact disks in AutoCAD (*.dwg) or Drawing Transfer Format (DXF).

4. Operation and Maintenance Instructions Books:

a. Assemble each set of material into one or more books with enclosing covers.

b. Provide following items:

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) Manufacturer's operation and maintenance procedures; installation details, as necessary; and catalog data sheets for each device or item of equipment.

3) List of recommended spare parts and components.

4) Complete parts lists for all replacement parts.

5) Manufacturer's full-size circuit breaker and fuse time-current curves.

6) Copies of all drawings (in the form of half-size prints) and bills of material, both revised to reflect approval comments.

1.04 QUALITY ASSURANCE

A. Drawings:

1. Device designations and symbols:

   a. Conform to IEEE 315 and NEMA ICS-1.

   b. As indicated on Standard Drawing Nos. 104-D-757 and 104-D-1150.

2. Size: D-size prints as defined in ASME Y14.1 made from original drawings.

3. Indicate changes on revised drawings to distinguish them from previous submittals. Describe reasons for significant changes in submittal letters.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 16060 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM B 3-01 Soft or Annealed Copper Wire
2. ASTM B 8-99 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM B 228-02 Concentric-Lay-Stranded Copper-Clad Steel Conductors

B. Institute of Electrical and Electronic Engineers (IEEE)

1. IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. IEEE 837-1989 Qualifying Permanent Connections Used in Substation Grounding

C. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

D. Underwriters Laboratories (UL)

1. UL 467 - 1993 Safety Grounding and Bonding Equipment

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground Cable.

1. Annealed bare-copper cable.
2. Concentric stranded.
3. ASTM B 8, class B.
4. Solid wires used in forming the copper cable: ASTM B 3.

B. Ground Bus:

1. Bare copper.
2. Equal in size to largest riser, unless indicated otherwise on the drawings.

C. Ground Risers: No. 2 AWG, minimum.

D. Cable Connectors:

1. Welded, bolted solderless or compression type.
2. Current-carrying capacity: Equal to cable with which they are used.
3. Connectors for ground cables, including fittings, lugs, bolts, nuts, and washers: Copper alloy containing not more than 4 percent zinc.
4. Bolted solderless or compression type connectors: IEEE 837.

E. Ground Rods:

1. Length: 10-feet.
2. Diameter: 3/4-inch, nominal.
3. Bond 0.018 inch thick layer of copper inseparably to steel core.
4. In accordance with UL 467.

F. Ground Plates: Four-hole type, except where indicated on drawings.

G. Welding:

1. Use Cadweld, Thermoweld, or equivalent exothermic process.
2. Molds and weld metal:
   a. Use fresh stock from same manufacturer.
   b. Weld metal and starting material: No significant quantities of hazardous ingredients.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of all grounding components shall comply with NFPA 70-2008.

B. Connect equipment, metal conduit, steel structures, exposed metal surfaces, and other metal fabrications to grounding system as indicated on Standard Drawing Nos. 40-D-4334, 40-D-4335, and 40-D-4753. Ground equipment and/or miscellaneous metalwork that is required to be grounded, but is not indicated on drawings to grounding system with No. 4 AWG ground cable.

1. Ground risers.
    a. Connect grounding electrodes to ground bus embedded in concrete slab.
2. Ground rods:
    a. Installation of ground rods shall comply with the requirements of Article 250.53(G) of NFPA 70-2008.
    b. Drive ground rods vertically until tops of rods are flush or below ground level.
3. Connections:
    a. Make all ground connections between equipment and miscellaneous metalwork, and ground plates of grounding system whether or not such grounding connections are indicated on drawings.
    b. Number of grounding connections for equipment may be one, two, or more in some cases.
    c. Remove paint, enamel, scale, oil, grease, or other foreign nonconductive material from point of contact on metal surfaces before making ground connections.
    d. Repair damaged or removed paint or galvanizing material on metal finishes.
    e. Make ground connections that will be direct buried or embedded in concrete:
        1) Exothermic process.
        2) In accordance with manufacturer's instructions.

C. Excavate, place, and compact backfill in accordance with Sections 02221 (Excavation) and 02223 (Compacted Backfill).

END OF SECTION

SECTION 16075 - EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 COST

A. Equipment identification:

1. Cost: Include all costs for labor, material, and equipment required to perform the requirements of this section in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REQUIREMENT

A. Furnish and install equipment identification on electrical equipment, wire, cable, panelboards, and enclosures.

B. The first line on the nameplate shall indicate the function and equipment designations. The second line shall indicate the voltages found in the particular piece of equipment. Examples are shown below.

1. MAIN PANEL P1: 240/120 VOLT
2. GENERATOR PANEL P2; 240/120 VOLT

C. Wire/cable markers shall be cloth tape, split sleeve, or tubing type wire markers. Label with branch or feeder number.

D. Circuits on panelboards shall be labeled according to Drawing No. 3704-417-22.

1.03 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 70-08 National Electrical Code

PART 2 PRODUCTS

2.01 MATERIALS

A. Nameplates (Unless otherwise indicated):

1. Engraved three-layer laminated plastic, black letters on white background.
2. 1/4-inch lettering.
3. 3/32-inch thick.
4. Mounted with round or pan-head, self-tapping screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install nameplates on the exterior surface of each electrical panel, disconnect, and enclosure. Nameplates shall be located on front center of the enclosure.

B. Install all nameplates with machine screws. Use of adhesives for attaching nameplates is not acceptable.

C. Locate wire markers on each conductor in gutters, pull boxes, junction boxes, and panelboard/disconnect.

D. Comply with NFPA 70 requirements.

END OF SECTION

SECTION 16081 - WIRING CHECKOUT AND TESTS

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 SUMMARY

A. Perform field wiring checkout and tests on equipment specified in all Divisions in accordance with this section.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals.

1. Results of ground resistance test.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Notify Government in writing at least 10 days in advance of any wiring checkout or test. All testing shall be done at a time which is mutually agreeable to Contractor and Contracting Officer's Representative.

B. Perform internal wiring check of electrical equipment, cabinets, and enclosures

C. Perform operational checks.

D. Provide competent representative to perform wiring checkout and tests who has personal knowledge of electrical installation and equipment required by these specifications.

E. Furnish test equipment and materials required.

F. Provide electrical power required for operational testing.

G. Insure equipment conforms to these specifications.

H. Insure there are no discrepancies in drawings, equipment, or wiring.

I. Furnish at jobsite, for use by the Contracting Officer's Representative, wiring and schematic diagrams, instruction books, and manufacturer's data for electrical equipment being tested.

J. Retain full responsibility for removal and replacement of wiring connections required during field testing.

K. Testing will be witnessed by Government.

3.02 FIELD TESTING SEQUENCE:

A. Wiring Check:

1. Wire by wire, contact by contact, and terminal by terminal (point-to-point) check of circuit logic.
2. Check of contact configuration.

B. Continuity Check.

1. Check for proper wire tagging at ends of wires and cables.
2. Operational Check:
3. Check electrical controls for proper operation and proper sequence of operation.
4. Check protective devices for proper operation and setting.

C. Ground Resistance Test

1. Provide ground test and submit test report.
2. Utilize a ground resistance meggar.
3. Utilize the four-wire fall of potential method.

END OF SECTION

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	ASTM B 8-99	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-2002	National Electrical Safety Code (NESC)

C. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

D. National Electrical Manufacturers Association (NEMA)

1.	NEMA WC 57-1998	Control Cables

1.03 DEFINITIONS

A. Cable: Cable, cables, wire, or wires of one or more insulated conductors.

B. Power Cable: For power loads including receptacle outlets; motors; alternating- and direct-current distribution circuits; heating, ventilating, and air-conditioning and lighting circuits; and cable that is used for controlling heating, ventilating, air-conditioning, and lighting equipment.

C. Control Cable: For control, metering, indication, annunciation, and relaying circuits; and circuits not identified as power circuits.

PART 2 PRODUCTS

2.01 POWER CABLE

A. Manufactured no more than 24 months prior to Notice to Proceed.

B. Description: Single conductor insulated wire, solid or stranded.

C. Conductor: Use only copper conductors.

D. Insulation voltage rating: All conductors shall be rated 600 volts.

E. Insulation: Thermoplastic material rated 75 degrees C. Insulation shall be rated for installation in damp/wet locations as determined by NFPA 70 and suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70 article 300-19.

F. Use solid conductor for feeders and branch circuits 10 AWG and smaller. Use no conductor smaller than 12 AWG.

G. Cable color coding:

1. For 120/208-240 system Provide No. 6 AWG and smaller single-conductor cable used in branch lighting circuits with identified insulation or colored insulation:
    a. Phase A - Black
    b. Phase B - Red
    c. Phase C - Blue
    d. Neutral - White
2. 3-phase 277/480 power cable:
    a. Phase A - Brown.
    b. Phase B - Orange.
    c. Phase C - Yellow.
    d. Neutral- Gray

H. Conductor Sizes: As indicated on drawings.

2.02 CONTROL CABLE

A. Manufactured no more than 24 months prior to Notice to Proceed.

B. Description: Single or multi-conductor insulated wire, solid or stranded.

C. Conductor: Use only copper conductors.

D. Insulation voltage rating:

1. For circuits above 120 Volts nominal, conductors shall be rated 600 volts.
2. For circuits 120 Volts and below, conductors shall be rated 300 volts.

E. Insulation: Thermoplastic material rated 75 degrees C. Insulation shall be rated for installation in damp/wet locations as determined by NFPA 70 and suitable for installation

in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70 article 300-19.

F. Use stranded conductor for control/sensor circuits. Use no conductor smaller than 18 AWG

G. Cable color coding:

1. In accordance with NEMA WC 57.

2. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.

H. Conductor Sizes: As indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all cable in accordance with manufacturer's instructions, NFPA 70, NECA Standards, and requirements of these specifications. Sufficient length shall be left at the ends of the wires and cables to make connections conveniently to equipment and wiring devices.

B. Route wire and cable as required meeting project conditions. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Install cable without exceeding allowable pulling tensions and sidewall pressures recommended by cable manufacturer. Maximum cable run between pull boxes, termination point, cabinets shall not exceed 300 feet if the number of bends exceeds 180 degrees. If the number of bends is less than 180 degrees, the maximum cable runs between pull boxes, termination points, cabinets or equipment, cable runs of up to 500 feet will be permitted.

D. Where a lubricant is needed as an aid to pulling cables, use only soap-stone or other approved, non-hardening material, non-injurious to the insulation.

E. Make no splices unless authorized by the Contracting Officer's Representative. Where splices are authorized, they shall be permitted only at boxes, outlets, panelboards, and cabinets. Ensure all splices, taps, and terminations carry full ampacity of conductors with no perceptible temperature rise and with insulation equal to 150 percent of the insulation rating of the conductor. Do not splice multiconductor control cables.

F. Support cable installed in a vertical or inclined plane by cable grips (including hooks). Installed cable with slack spans between supports.

G. Clamp cable entering equipment with commercial type cable clamps.

H. Block cable opening in sleeves under equipment or passing through blockouts, with silicone-foam, fire-retardant type material in accordance with NFPA 70.

I. Provide spare conductors in accordance with Government-furnished information marked on Contractor's approval wiring diagram drawings. For multi-conductor cable, retain 25% of the single conductors as spare, keeping their length equal to longest single conductor of the multi-conductor cable. Ground spare conductors by wire jumpers from equipment terminal block points to equipment ground bus.

J. Install all cable in conduit:

1. Pull all conductors into same raceway at one time.
2. Do not pull cable into conduits until conduit runs have been cleaned and are free from obstructions and sharp corners.
3. Draw a clean, dry, tight-fitting rag through conduit immediately before installing cable.
4. Install cable to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.

K. Terminations of control wire:

1. Make with heavy-duty, preinsulated, pressure-crimp-type terminal connectors with ring tongues.
2. Connectors:
    a. Tin-plated copper.
    b. Serrated inner barrel.
    c. 600-volt-rated nylon insulation.
    d. Insulation support sleeve for vibration resistance.
    e. UL listed.
    f. Compatible with conductor size and type of cable for which it is used.

L. Tags:

1. Tag multiconductor cables at each end.
2. Suitable for outdoor use.
3. Shape: Rectangular.
4. Color: white.
5. Attach tags to cable by self-locking cable ties.
6. Mark tags with cable designation.
    a. Cable designations: As indicated on approved wiring diagrams.

b. Pre-printed or machine labels with permanent ink.

M. Marking:

1. Mark all conductors, whether single-conductor cables or individual conductors of multiconductor control, instrumentation, and power cables at each end with conductor designation on first line followed by cable designation on second line as indicated on approved wiring diagrams.

2. Markers:

   a. White.

   b. Self-laminating-vinyl type or heat-shrink type.

   c. Marked with conductor designation.

   d. Computer generated lettering.

3. Mark spare conductors of multi-conductor cables with cable designation and word "SPARE".

4. Numerically sequence markings (e.g., 2CSA-CSB-SPARE1).

END OF SECTION

SECTION 16130 - ELECTRICAL CONDUIT

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	ASTM A 123-01	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2.	ASTM A 153-01 AASHTO No. M232	Zinc Coatings (Hot-Dip) on Iron and Steel hardware
3.	ASTM F2160-08	Plastic Pipe Standards
4.	ASTM D3350-08	Plastic Standards

B. American National Standards Institute (ANSI)

1.	ANSI C 80.1-2005	Rigid Steel Conduit - Zinc Coated (GRC)
2.	ANSI C 80.6-2005	Intermediate Metal Conduit (IMC) and Couplings

C. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C2-2002	National Electrical Safety Code (NESC)

D. National Fire Protection Association, Inc (NFPA)

1.	NFPA 70 - 2008	National Electrical Code (NEC)

E. Underwriters Laboratories (UL)

1.	UL 360 (1996)	Liquid-tight Flexible Steel Conduit

F. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

1. NEMA TC 2-03, Electrical Polyvinyl Chloride (PVC) Conduit.

PART 2 PRODUCTS

2.01 CONDUIT

A. UL listed.

B. Rate for intended purposes or labeled by nationally recognized testing laboratory (NRTL) accredited by Federal Occupational Safety and Health Administration (OSHA) when applicable.

C. Galvanized Rigid Steel conduit (GRC), Zinc coated ANSI C80.1.

D. Flexible Liquidtight Metal Conduit for Outdoor Use:

1. Liquid tight type.
2. Ultra-violet resistant.

E. Nonmetallic conduit, PVC: NEMA TC 2.

F. Smoothwall 1 ½" HPDE conduit.

1. For communication between Pull Box A and the existing bullet-proof enclosure at the diversion dam.
2. HDPE, SDR 11.
3. Conduit is locally available from:

DB Technologies Inc
3601 1st St.
Bloomfield, NM 87413
(505) 632-7900

2.02 CONDUIT ACCESSORIES

A. Fittings required for completing the electrical conduit systems. Includes, caps, connectors, couplings, nipples, reducers, elbows, pipe plugs, locknuts, bondnuts, bushings, seals, and any other fittings.

B. Devices required for completing the electrical conduit systems and to fasten, clamp, attach, and support each conduit in place.

1. Includes threaded joint compound; protective sealant; materials for sealing ends of conduits terminating at outdoor boxes, panelboards or cabinets; supports and clamps.
2. Complete with bolts, washers, and nuts.

C. Conduit Sealing Bushings:

1. Non-Toxic.

2. Non-shrinking.
3. Fire-retardant type.
4. Seals against liquid, gas, and vapor seepage.

D. Protective Sealant:
1. Water repellant.
2. Resistant to peeling and cracking.

E. Sealing Materials:
1. General use:
a. Non-toxic.
b. Non-shrinking.
c. Fire retardant type.
d. Seal ends of conduit against liquid, gas, and vapor seepage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to NFPA 70 and IEEE C2.

B. Determine routing of exposed conduit when not indicated on drawings. Layout of exposed conduit shall not be placed to create a tripping hazard for operational staff. Coordinate location of all exposed conduit with the COR.

C. Determine exact locations of embedded conduit stub-ups based on equipment being furnished.

D. Install conduit with necessary fittings and supports.

E. Ensure that conduit runs and bends are free from kinks, indentations, or flattened surfaces.

F. Bends:
1. Install smooth, gradual bends to permit pulling insulated conductors without undue stress or damage to conductors or conduit.
2. Make metal conduit bends onsite with greater than minimum radii required by NFPA 70.
3. A conduit run shall not have more that the equivalent of four 90 degree bends (360 degrees total), between termination points at boxes, cabinets, or equipment enclosures.

G. Remove burrs and sharp corners at ends of metal conduit.

H. Coat male threads of rigid metal conduit joints with suitable graphite or zinc sealing material before making joints.

I. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.

J. Install bushings or Chase-type nipples on ends of conduit to protect insulation of insulated conductors from abrasion.

K. Install locknuts and bondnuts to provide tight ground connections between conduit and boxes, panelboards, and cabinets.

L. Seal ends of conduits that terminate at boxes, panelboards, or cabinets with sealing material or sealing bushings to prevent air circulation through conduits into boxes, panelboards, or cabinets. Install seals in accordance with manufacturer's instructions.

M. Stub conduit that terminates at horizontal surfaces 4 inches above finished floor level and terminate with coupling and plug. Replace plug with bushing or Chase-type nipple before installing insulated conductors.

N. Tighten conduit to electrical equipment mounted on tubular metal structures securely and support rigidly in place by conduit clamps, hex head nuts, and threaded 3/8-inch stud fasteners driven by powder-actuated tools.

O. Except for the buried conduit from pull box A to the diversion dam, conduit embedded in concrete or buried in earth:

1. PVC Schedule 80 except for elbows which shall be GRC.
2. Conduit for motor neutral grounding leads: Nonmetallic type.
3. Hold conduit, conduit fittings, and conduit boxes securely in position while concrete is being placed.
4. Protect ends of conduit to prevent entrance of concrete, sand, or other foreign material.
5. Terminate ends of conduit that do not terminate at boxes with couplings and pipe plugs or insulating bushings and caps.
6. Clean concrete from inside of conduit boxes immediately after forms are removed.
7. Clean threads for attaching devices and covers to boxes.
8. Swab conduit within 24-hours after removal of forms with clean dry rags until conduit is thoroughly cleaned and dried.
9. Grease threads of removed plugs and reinstall plugs to prevent entrance of water or foreign material.

10. Seal conduit boxes with rubber gasketed blank cover.

P. Buried communication conduit as shown on Drawing No.s 3704-417-20 and 21 from Pull Box A to the bullet-proof enclosure at the diversion dam:

1. Buried 3 feet below existing ground level except at location of existing 48" culvert (approximately 600 feet upstream of Pull Box A). At this location the conduit can go over the top of the existing culvert. Notify COR if the resulting cover on the conduit is less than 18 inches.

2. Provide intermediate pull boxes as shown on Drawing No.s 3704-417-20 and 21.

Q. Install expansion couplings where exposed or embedded conduits cross expansion or contraction joints. Install expansion couplings and expansion-deflection couplings in accordance with manufacturer's instructions.

R. Install conduit seals where conduits enter electrical enclosures in a Class I, Division 1 or 2 locations; and where conduit runs pass from a Class I, Division 1 or 2 locations into an unclassified location.

S. Exposed conduit runs:

1. All runs outside of the control building shall be GRC, except for motor/equipment connections which shall be flexible liquid tight metal conduit.

2. Runs inside the control building can be GRC or IMC.

3. Straight and parallel with each other and with centerlines of room or structure.

4. Support conduit rigidly from wall or ceiling within 3 feet of each outlet box, junction box, cabinet, or fitting; and at intervals of not more than 5 feet.

5. Installation includes, where required, drilling holes in bottom, side, or top of enclosures or plates of other electrical equipment.

6. Tighten conduit securely.

7. Support conduit rigidly in place.

8. Make connections to outdoor boxes watertight.

T. Buried conduit:

1. Depth: 24 inches, unless marked otherwise on the drawings.

2. Install 2 inches of sand around each conduit.

3. Backfill and compact remaining portions of trench in accordance with Section 02224 (Backfill, Compacted Backfill, Foundation Backfill and Compacted Embankment).

4. As indicated on Standard Drawing 40-D-6576.

U. Use flexible conduit for conduit connections to lighting fixtures.

V. Install poly rope capable of withstanding 700 pounds tensile strength in all empty conduits for future pulls. Extend rope 6 feet at each end of the conduit.

END OF SECTION

SECTION 16135 – ENCLOSURES AND BOXES

PART 1 GENERAL

1.01 COST

A. Enclosures and Boxes:

B. Cost: Include all costs for labor, material, and equipment required to perform the requirements of this section in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REQUIREMENT

A. Furnish and install enclosures, outlet boxes, pull boxes, junction boxes, equipment, and appliances as shown on the drawings or as required to provide a Complete AC Electrical System. Furnish and install mounting brackets, hangers, extension rings, and device covers as required.

1.03 SECTION INCLUDES

A. Receptacle boxes.

B. Hinged cover enclosures.

C. Terminal blocks.

D. Accessories.

1.04 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-03	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA ICS 4-05	Terminal Blocks

B. National Fire Protection Association (NFPA)

1.	NFPA 70-08	National Electrical Code

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

A. Furnish five of each key type.

PART 2 PRODUCTS

2.01 MATERIALS

A. Boxes and enclosures:

1. Standard NEMA enclosures including NEMA 3R weather-tight boxes designed for moist/exterior use and NEMA 1 designed for dry/interior use. Ensure proper application of equipment/boxes, complying with all applicable codes and standards.
2. Provide weather gaskets and covers as required to prevent gasses, moisture, and dust infiltration in accordance with NEMA and NFPA 70.
3. Dimensions as dictated by the project documentation and NFPA 70.
4. Boxes and enclosures containing electrical controls or protection devices: Capable of accepting pad-locks in addition to any cylinder-type locking device present.
5. Finish: Manufacturer's standard enamel.
6. Lock cylinders: Keyed alike where possible.

B. Hinged cover enclosures:

1. Covers: Continuous hinge that exposes only the hinge roll to view when the door is closed. Each door shall have a three point latch having a knob with T-handle, and a cylinder lock.
2. Each door outside of the control building shall include a cylinder lock.
3. Key all locks with same key.

C. Terminal blocks:

1. Terminal blocks: NEMA ICS 4.
2. Power terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
3. Signal and control terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 600 volts.
4. Provide ground bus terminal block, with each connector bonded to enclosure.

D. Accessories:

1. Plastic raceway: Plastic channel with snap-on cover.

2. Provide interior metal panel in controller enclosure for mounting terminal blocks and electrical components; finish with white enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install boxes and enclosures at the locations as shown on the design drawings.

B. Install enclosures plumb. Anchor each enclosure securely to structure in accordance with manufacturer's recommendations.

C. Fit conduits terminating in boxes and enclosures not provided with threaded hubs with locknuts, bondnuts, and bushings or suitable connector. Install fittings to provide a tight continuous ground connection between the conduit and the box or enclosure.

3.02 CLEANING

A. Clean electrical parts to remove conductive and harmful materials.

B. Remove dirt and debris from enclosure.

C. Clean finishes and touch-up any damage to finish in accordance with manufacturer's recommendation.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. NEMA WD 1-1989 General Requirements for Wiring Devices
2. NEMA WD 6 -1997 Wiring Devices - Dimensional Specifications

B. National Fire Protection Association, Inc. (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

PART 2 PRODUCTS

2.01 SNAP SWITCHES

A. Type: Specification grade, Quiet type a.c. switches.

B. NRTL Listed and labeled to comply with UL standard 20.

C. Voltage: 120/277 volts, 60 hertz.

D. Current: 20 amperes.

E. Device Body: Ivory, impact resistant plastic.

F. Terminals: Screw type for line wiring and grounding.

2.02 GFCI RECEPTACLES

A. Type: Specification grade, heavy duty, duplex plug with integral ground fault circuit interrupter.

B. NEMA Configuration: 5-20R.

C. Voltage: 120 volts, 60 hertz.

D. Current: 20 amperes

E. Body: Ivory, impact resistant plastic.

F. Terminals: Screw type for line wiring and grounding.

G. Pushbuttons: Test and reset.

H. Conform to NEMA WD 1 and NEMA WD 6.

2.03 COVER PLATES

A. Weatherproof Receptacle Coverplates:

1. Type: Die cast with heavy rubber gasket.
2. Material: Copper free aluminum.
3. Self closing spring door.
4. Suitable for mounting on type FS cast box.
5. Manufacturers: Same as associated receptacle.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NEC and the Drawings.

B. Install weatherproof cover plates as required by site conditions, NEC, and as shown on Drawings. Others shall be standard type.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on bottom.

E. Install fork pressure-crimp-type connectors for terminations. Do not place bare stranded conductors directly under screws. Do not use push-in terminals for wiring connections.

F. Bond wiring devices to equipment grounding conductor.

G. GFCI breakers meeting the same requirements for GFCI receptacles may be used in place of GFCI receptacles.

END OF SECTION

SECTION 16210 - ELECTRICAL UTILITY SERVICE

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REQUIREMENTS

A. Coordinate with local electric utility provider, NTUA, for meter base/electrical service requirements at the Control Building and at the existing headworks as shown on the drawings.

B. Coordinate with local electric utility provider, NTUA, for extending the single phase power from the existing power pole shown on Drawing No. 3704-417-2B to the proposed location of the meter pole shown on Drawing No.s 3714-417-2C and 21.

C. Install conduit from the utility-owned poles to the meter bases in accordance with project documents and local utility provider's requirements.

D. Coordinate with the local utility provider for inspection of all utility conduits prior to any backfill to ensure compliance with all requirements.

E. Purchase and install metering equipment, including any required CT cabinets, in accordance with utility requirements.

F. Coordinate with local utility provider to connect service conductors to metering equipment.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)
    a. ANSI C2 National Electric Safety Code
2. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
    a. NFPA 70-08 National Electrical Code (NEC)
3. BUREAU OF RECLAMATION (RECLAMATION)
    a. RECLAMATION RSHS Reclamation Safety and Health Standards (revised 2001)

1.04 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purposes specified and shown.

B. Conform to requirements of applicable codes and standards as referenced in project documentation.

PART 2 PRODUCTS

2.01 UTILITY METERING EQUIPMENT/METER BASE

A. Metering equipment must meet the local utility provider's minimum requirements.

B. Meter base shall be single phase with an approved manual link bypass and rated for the intended load.

PART 3 EXECUTION

3.01 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. The Contractor shall minimize interference with other energized systems while performing work associated with this contract. The Contractor shall provide for and maintain all temporary connections, structures, and services necessary, in a manner satisfactory to the owners and operators of the other energized systems and to the Contracting Officer. Make any necessary repairs, replacements, or similar operations once temporary connections, structures, and services are no longer needed.

3.02 CLEARANCES

A. Where an existing overhead power line or communication line crosses a feature of the work to be constructed under this contract, clearances shall be in accordance with the most restrictive requirements of ANSI C2, RECLAMATION RSHS, and local utility provider's requirements.

END OF SECTION

SECTION 16212 - METER SOCKET

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. American National Standard Institute (ANSI).

1. ANSI C12.7-1993 Watthour Meter Sockets

B. National Electrical Manufacturers Association (NEMA)

1. NEMA 250-1991 Enclosures For Electrical Equipment (1000 Volts Maximum)

1.03 MATERIALS AND EQUIPMENT

A. Meter base:

1. In accordance with Electric Utility Providers requirements and ANSI C12.7.
2. Outdoor, 1-phase, 3-wire.
3. 240/120-volt.
4. Type 3R enclosure in accordance with NEMA 250.
5. Sealing ring.
6. Seven self-contained sockets.

PART 2 EXECUTION

2.01 INSTALLATION

A. In accordance with manufacturer’s recommendations and as indicated on drawings.

END OF SECTION

SECTION 16240 - BATTERY EQUIPMENT

PART 1 GENERAL

1.01 MEASUEMENT AND PAYMENT

A. Complete 24 Volt DC Battery System:

1. Payment: Lump sum price bid therefor in the schedule. The lump sum price bid shall include the cost of the following:

   a. Furnishing and installing all materials so that the 24 Volt DC Battery System is complete and ready for operation.

   b. Transporting and storing equipment and materials.

   c. Furnishing and installing all brackets, fastenings, bolts, nuts, lock washers, and other accessories, and drilling holes as required for mounting or installing the 24 volt DC battery system equipment and materials.

   d. Furnishing and handling spare parts.

   e. Making all conduit, grounding, metering, and power connections, and furnishing all miscellaneous materials which are required for making these connections to the 24 Volt DC Battery equipment**.** The cost of making these connections to equipment provided for in other divisions shall be included in the applicable unit or lump sum prices bid for the equipment.

   f. Assembling, adjusting, leveling, and installing equipment.

   g. Costs for furnishing drawings, documentation, and data for electrical installations will be included in the lump sum price bid in the schedule for furnishing and installing materials for the complete electrical system, and include the following:

      1) Coordinating and identifying "as-built" installation with designs provided by the Government.

1.02 COST

A. The costs associated with designing, furnishing and installing two control panels shall be in included the lump sum price in the schedule for Control Panels. See Section 16444 for additional requirements.

1.03 REQUIREMENT

A. Designed, furnished, and installed one 24 Volt DC Battery System including battery charger and battery rack for the Fish Barrier Weir at the Hogback Canal in accordance with this Section and the requirements of all Divisions as they apply to electrical equipment installation.

1.04 REFERENCES

A. National Fire Protection Association (NFPA)®

1. NFPA 70-2008 National Electrical Code (NEC)®

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-1997 National Electrical Safety Code

1.05 DESIGN REQUIREMENTS

A. Perform all required design necessary for a complete 24 volt DC system with the following design criteria:

1. Capable of operating all DC loads for a 72 hour period without AC input into the battery charger.
2. Capable of recharging the battery cells to a fully charged state in 48 hours.
3. DC motor operation is based on a 24 hour period and 7 days per week with the follows load characteristics:
    a. One ¼ Hp high torque motor starting every 5 minutes and operating for 1 minute.
    b. One ½ Hp high torque motor starting every 12 hours and operating for 20 minutes.
    c. Continuous operation of the future PLC and remote loop powered sensors.
    d. Assume continuous load of 75 watts for PLC and sensors.

B. Make required design changes when Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. Contracting Officer will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

C. Provide venting as recommended by manufacturer for an occupied working space.

D. Design, materials, and installation details not specifically covered in referenced standards or these specifications are subject to approval of Contracting Officer.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and List of Submittals.

1. Approval Data: Submit all items listed for approval at least 30 days prior to gate fabrication.
    a. Design and layout of system
    b. Summary of salient design assumptions and design approach.

c. Calculations and assumptions for sizing batteries.

d. Operational stratagies.

2. Final Data:

a. Operation and Maintenance Service Manuals.

b. List of components and commercial product data for the components.

1.07 QUALITY ASSURANCE

A. Manufacturer of the battery cells and charger shall have documented 5 year experience in the manufacturing of 24 volt cells and chargers. Charger and cells shall be supplied as a complete system from the same source to ensure system compatibility.

1.08 CONFLICTING REQUIREMENTS

A. In event of conflicting requirements, precedence is established by following order:

1. These specifications or as directed by COR (Contracting Officer's Representative). Drawings included in these specifications Latest edition of NFPA 70 and adopted electrical code of State in which construction is located.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Battery Cells

1. Provide battery cells/modules with the following characteristics:

a. VRLA battery technology designed for critical applications.

b. Cell voltage: 2 volts.

c. Be rated to function at temperatures of 0 to 40 °C and at an elevation of 5,000 feet above sea level.

d. Post seal: Dual primary and secondary barrier seal.

e. Terminal Post: Heavy-duty ½" square post with tin-plated copper insert.

f. Plates: Thick, pasted construction for both positive and negative plates using a lead/calcium/tin alloy.

g. Separators: High-quality double "C" wrapped absorbent micro-porous glass fibers. Separator shall have low resistance and high density.

h. Electrolyte: High-purity sulfuric acid absorbed in the separator, requiring no watering. Supply cells filled and charged.

i. Safety Valve: Self sealing one-way valve operating between 2.5±1 psi.

j. Flame Arrestor: Built-in and located above the safety valve.

k. Container and Cover: Flame-retardant polypropylene to UL94 V-0 & 28% LOI. Enclosed in an individual steel jacket to maintain consistent cell compression and act as a heat sink. Design must allow for air circulation for optimum service life.

l. Inter-cell Connectors: Dual heavy-duty tin plated copper connectors that do not require torque maintenance or grease.

m. NEBS III Certified.

n. Cells shall be supplied in modular form with multiple cells per modular.

o. UBC Seismic Zone 4 and IBC-2000 to 300%g.

p. Modules shall be stackable to minimize overall system footprint to approximately 24-inches wide and 12-inches deep.

B. Battery Charger

1. Provide battery charger with the following characteristics:

a. DC System Voltage: 24 volts.

b. Float Charge: 2.25±VPC at 77ºF (25ºC).

c. Battery charger shall be provided with means to momentarily discharge the filter capacitor within 3 minutes after the charger has been de-energized. Use of a suitable bleeding resistor in series with a momentary contact of a switch will be satisfactory.

d. Full-wave silicon or silicon controlled rectifier.

e. Fully automatic, voltage-regulating type.

f. Be equipped with:

1) Disconnecting device for the alternating-current input.

2) Overload and fault-protective devices in input circuitry.

3) 2-pole output overload protective device to protect charger components during overload or short-circuit conditions on the direct-current system.

4) Two voltage set points, float and equalize, each independently and continuously adjustable.

C. Efficiency of not less than 85 percent.

D. Nominal input supply voltage: 240 volts, 1 phase, 60 hertz.

E. Continuous operation with rated load and voltage regulation accuracy from 5 to 40 ºC at an elevation of 5000 feet.

F. Total output ripple of 30 millivolts, rms, or less under steady-state conditions with the charger connected to a battery having an 8-hour rating at least four times the full-load current rating of the charger.

G. Be capable of building up and maintaining normal output voltage with battery completely disconnected.

H. Be such that the battery cannot discharge through charger components during an alternating-current failure. Current through voltmeter or alarm devices will not be considered sufficient to discharge battery.

I. Shall resume charging up to full-current limit after failure and re-energization of alternating-current supply, without operation of protective devices.

J. Shall have current-limiting characteristic to continuously deliver rated current to a discharged battery without operation of protective devices, and without exceeding electrical or thermal ratings of charger components.

K. A short circuit on output terminals shall not damage charger components.

L. Shall damp out, in less than 10 seconds, any oscillations which develop upon energization of the charger or during surges in alternating-current supply voltage.

M. Solid-state components shall be selected from manufacturer's pretested quality controlled lots to equal or exceed requirements necessary to achieve reliable hardware systems performance, optimum packaging densities, and long life expectancy. Components shall be selected from industrial grade product utilization classes to suit intended application.

N. Charger shall have a timer to automatically return the charger from equalize to float charge rate after a preset time interval has elapsed. Timing range shall allow setting time intervals up to 72 hours. Manual reset of timer circuit, to allow the charger to return to float charge rate before preset time interval has elapsed, shall be provided. Manual selection of equalize charging rate shall be provided. Lamp indication shall be provided on front of the charger cabinet to indicate when charger is operating at equalize charging rate.

O. Charger shall sense loss of alternating-current power input for periods in excess of 5 seconds. If alternating-current power is lost for more than 5 seconds, the charger shall automatically switch to equalize (high rate) charge when power is restored. Length of time charger remains at high rate after power is restored shall be controlled by an automatic timer. The timer shall have an adjustable range of 0 to 72 hours.

P. Terminal blocks for external control wiring shall be rated at least 600 volts and 25 amperes, shall be one-piece, molded-block type to accommodate ring lugs ½ inch wide in diameter at terminal screw, shall be furnished with binding-head or washer-head screws having serrated or grooved contact surfaces or having lockwashers, and shall be furnished

with molded-insulating barriers between terminals. Each terminal block shall have a marking strip.

Q. Wiring shall be performed with switchboard-type AVB, SIS, or PVC, 600-volt copper wire. Hinge wiring shall be extra flexible, class K, stranded. Terminations of wire shall be made with crimp-type terminal connectors. Exposed wiring shall be kept to a minimum and, where used, shall be formed into compact groups, bound together, firmly supported, and run straight, horizontally, or vertically with short- radius, right-angle bends. Hinge wiring shall twist around the longitudinal axis of wire, wherever practicable, instead of being bent laterally. Each wire shall be protected from abrasion. Wiring shall not be spliced; connections shall be at device studs or terminal blocks. No more than two wires shall be terminated at each terminal point. Wiring of No. 8 AWG or smaller shall be terminated at terminal blocks with ring tongues. Wiring larger than No. 8 AWG shall be connected directly to terminal studs. Wiring between devices shall be performed by the most direct method.

R. The charger shall be furnished with a current shunt installed between direct-current output protective device and filter circuit.

S. The charger shall be equipped with a direct-current ammeter and voltmeter. Each meter shall be a minimum 3.5-inch case and 2-percent accuracy.

T. A low-voltage alarm relay shall be actuated when charger output voltage falls below the preset alarm voltage level. The relay shall have one contact closing on alarm, wired to terminal blocks for use in remote annunciation.

U. A high-voltage alarm relay shall be actuated when charger output voltage exceeds the preset alarm voltage level. The relay shall have one contact closing on alarm, wired to terminal blocks for use in remote annunciation.

V. An alternating-current power loss alarm relay shall be activated when charger input voltage falls below the preset alarm voltage level. The relay shall have one contact closing on alarm, wired to terminal blocks for use in remote annunciation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not procure DC battery system until approval design, drawings, and data for associated system have been approved by Government.

B. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70 and IEEE C2.

C. Make the system installation complete and ready for service.

D. Install DC system equipment in accordance with directions furnished by manufacturer's instruction books.

E. Tighten nuts used in equipment or system assembly with torque wrenches to torque values recommended by equipment manufacturers.

F. Drill holes in bolted steel structures and provide fastenings required for mounting or installing the DC system equipment and materials.

G. Installation of DC system includes:

1. Drilling holes, furnishing hardware, and assembling components to each other.
2. Furnishing materials for and making connections in accordance with manufacturer's recommendations and system wiring diagrams.
3. Tagging wires and cables at each end.

H. Do not install the battery cells until ambient conditions meet the battery manufacturer's recommendations unless approved by the COR.

3.02 REPAIR

A. Repair damaged painted surfaces of equipment to match original finish.

3.03 FIELD QUALITY CONTROL

A. Correct errors made during installation

B. Correct errors and discrepancies found during field testing. These corrections shall include making wiring changes, equipment replacements, drawing revisions, and adjustments to settings of system equipment.

C. Government will inspect the system equipment during installation. Final acceptance will be made after equipment is installed and operational.

END OF SECTION

SECTION 16411 - ENCLOSED SAFETY SWITCHES

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section shall be included in the lump sum price bid in the schedule for a Complete AC Electrical System.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. NEMA KS 1 - 2001 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

B. National Fire Protection Association, Inc. (NFPA)®

1. NFPA 70 – 2008 National Electrical Code (NEC)®

PART 2 PRODUCTS

2.01 ENCLOSED SAFETY SWITCH

A. Type: Heavy-duty.

B. Enclosure: NEMA type 3R.

C. Voltage Rating: as required.

D. Current Rating: as required.

E. Switch Mechanism/Handle.

1. Switch Operating Mechanism: Made from steel, with no plastic parts.
2. Switch Operating handle:
   a. Integral part of the switch enclosure. Use of cover as disconnect device is not acceptable.
   b. Made from steel, with no plastic parts other than handle grip.
   c. Have provisions for padlocking in the ON and OFF positions.

F. Switch Cover Interlock:

1. Prevent unintentional opening of switch cover when switch is ON.
2. Prevent closing switch with switch cover open.

3. Have externally operated interlock override. Override shall not permanently disable interlock mechanism.

G. Current Carrying Parts: Plated to resist corrosion.

H. Engraved Nameplates:

1. Conform to Drawing 40-D-6234 using type A material and ½ inch lettering.

2. Follow naming convention used on Drawing No.'s 3704-417-22 and 23 for circuit descriptions.

3. Engraving examples:

a. Slotted Baffle A, Left.

b. Slotted Baffle A, Right

c. Slotted Baffle B, Left.

d. Slotted Baffle B, Right

e. Etc.

I. Coatings: Manufacturer's standard coating for outdoor service.

J. Conform to NEMA KS 1.

K. Underwriters' Laboratories, Inc. (UL) listed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install switches plumb and in locations as required by code.

B. Mounting Height: 3 to 5 feet to operating handle.

C. Install grounding and bonding connections in accordance with Section 16060 and requirements of NEC Article 250.

D. Install engraved nameplates with cadmium-plated, slotted, pan-head self-tapping screws.

E. Conduit shall enter bottom of switch enclosure.

END OF SECTION

SECTION 16441 - DISTRIBUTION PANELBOARDS

PART 1 GENERAL

1.01 COST

A. All costs for labor, material, and equipment necessary to perform the requirements of this section for two AC panelboards and one DC panleboard shall be included in the applicable lump sum price bid in the schedule for a Complete AC Electrical System or Complete 24 Volt DC Battery System.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. NEMA 250-1997 Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA PB 1-1995 Panelboards

B. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL)

1. UL 50-1995 Safety S Enclosures for Electrical Equipment
2. UL 67-1993 Safety Panelboards
3. UL 489-2002 Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 – Submittals and Section 16051 - Electrical Drawings and Data.

1. Information Drawings and Data: Manufacturer’s technical data and equipment layout drawing.

PART 2 PRODUCTS

2.01 DISTRIBUTION PANELBOARDS

A. Panelboards:

1. Circuit-breaker type suitable for the voltage and service required.

2. Furnished complete with main circuit breaker and neutral lugs, equipment grounding bar, circuit breakers, and a minimum of 6 spare circuit breakers of each size.

3. Panelboard layout: As shown on panel schedule provided on drawings.

4. Dead-front construction.

5. Panelboard components:

   a. Panelboard enclosure:

      1) One-piece type fabricated of sheet steel having a standard factory finish in accordance with Section 16135 - Enclosures and Boxes.

      2) Steel sheet in boxes: Minimum thickness of No. 14 United States Standard gauge.

      3) Provide mounting bolt-holes of 9/16-inch diameter through back surfaces of boxes.

      4) Rated NEMA 1 as a minimum.

      5) Each door shall have on its inside surface a circuit directory frame with a clear plastic cover. The circuit directory frame shall be such that the circuit directory need not be folded when placed in the frame and all information on the circuit directory is clearly visible and legible.

   b. Bus bar connections to the circuit breakers: Distributed-phase of phase-sequence bolted type. Busing shall be such that adjacent single-pole breakers are individually connected to each of the two different poles in such a manner that two-pole breakers can be installed in any location.

   c. Main buses: Copper and have ampacities as shown on the panel schedule.

   d. Connections between branch circuit buses and circuit breaker terminal main buses: Copper and be the bolted type. Riveted or "plug-on" bus connections will not be allowed.

   e. Provide a solid neutral bus insulated from the panelboard enclosure. The neutral bus shall be copper, 200% rated, and have two solderless-type terminal lugs of the proper size and type for each branch circuit breaker and for each future space.

   f. Furnish panelboards with a solid copper equipment grounding bar bonded to the panelboard enclosure. The equipment grounding bar shall have one bolted, solderless-type terminal lug, for each branch circuit, suitable for terminating a copper conductor. Install neutral/ground bonding bar in accordance with NFPA 70.

   g. Panelboards shall have bolted solderless-type main circuit breaker and neutral terminal lugs suitable for terminating copper feeder cables. Size

all panel feeder cables for maximum panel ampacity. Aluminum lugs using aluminum screws will not be allowed.

6. Provide panelboards with nameplates bearing the designations shown on the drawings/panel schedule and in accordance with Section 16075 - Equipment Identification. Locate nameplates on the exterior front above the door over the circuit breaker section.

PART 3 EXECUTION

3.01 INSTALLATION

A. All panelboard installations shall comply with requirements of NFPA 70.

B. Install panelboards at the locations indicated on the design drawings.

C. Drill all holes in the panelboard enclosures necessary for terminating conduits; and make all conduit, cable and wiring, and grounding connections required to put the panelboards into normal operation.

D. Maintain all NEMA ratings required.

E. The panelboards shall be leveled, plumbed, and securely anchored to panelboard structure.

END OF SECTION

SECTION 16444 - CONTROL PANELS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Control Panels:

1. Payment: Lump sum price bid offered in the schedule. The lump sum price shall include all cost of labor, equipment and materials required for designing, furnishing and installing two control panels as described in this section and Section 14614.

1.02 REFERENCES

A. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-1997	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA FU 1-1986	Low Voltage Cartridge Fuses
3.	NEMA ICS 1-2000	Industrial Control and Systems: General Requirements
4.	NEMA ICS 2-2000	Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
5.	NEMA ICS 5-1996	Industrial Control and Systems: Control Circuit and Pilot Devices
6.	NEMA ICS 6-1993	Industrial Control and Systems: Enclosures
7.	NEMA KS 1-2001	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
8.	NEMA WC 70-1999	Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

B. National Fire Protection Association, Inc. (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL)

1.	UL 489-2002	Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
2.	UL Standard 1565	Positioning Devices

D. International Electrical Commission (IEC)

1. IEC 60947-1 Motor Contactors and Starters

1.03 DESIGN REQUIREMENTS

A. Design layout of control panels in accordance with NEMA ICS and NEC, including:

1. Size of control circuit transformer.
2. Selector switches, pushbuttons, and indicating lights.
3. Select correct fuses for control circuit transformers.

B. See Section 14614 for requirements of Gate Actuators and Control Panels.

1.04 PERFORMANCE REQUIREMENTS

A. Ambient temperature: -10°C (14˚F) to +50˚C (122˚F).

B. Altitude: 4580 feet above mean sea level.

1.05 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and List of Submittals and 16051 - Electrical Drawings and Data.

1. Information Drawings and Data:
   a. Manufacturer's Technical Data.
   b. Schematic diagram, wiring diagram, equipment layout, nameplate list, and bill of materials.
2. Operation and Maintenance Instruction Book:
   a. As-built drawings with schematics and wiring diagrams (1/2-size prints).
   b. Operating limits.
   c. Routine preventive maintenance schedule

1.06 EXTRA MATERIALS

A. Furnish following extra materials:

1. Six fuses of each size and type used.
2. Six indicating lamps of each size and type used.

PART 2 PRODUCTS

2.01 ENCLOSURE

A. Provide enclosures and cabinets suitable for the installation environment in accordance with Section 16135 - Enclosures and Boxes and NEMA 250.

B. Constructed from sheet steel no lighter than 14 MSG (Manufacturer's Standard Gage).

C. Seams continuously welded and ground smooth.

D. Continuous door hinge.

E. Oil-resistant gasket attached with oil-resistant adhesive and held in place with steel retaining strips.

F. Lockable handle.

G. Furnish with swing panel.

H. Nameplate:

1. Conform to Standard Drawing No. 40-D-6234.
2. Engraving: As indicated on Drawings.

2.02 SELECTOR SWITCHES

A. Type: Heavy-duty, watertight, oiltight.

B. Q600 contact rating in accordance with NEMA ICS 5.

C. Knob or wing lever.

D. 22 or 30.5 millimeter mounting holes.

E. Conform to NEMA ICS.

F. Provide with contact arrangements indicated on drawings.

G. Legend Plate: Engrave with legend indicated on drawings.

2.03 PUSHBUTTONS

A. Type: Momentary, heavy-duty, watertight, oiltight.

B. Contact Rating: NEMA ICS 5 Q600.

C. Mounting: 22 or 30.5 millimeter hole.

D. Pushbutton color and head type:

1. STOP pushbutton: Red with extended head.
2. Emergency Stop pushbutton: Illuminated Red mushroom style.
3. All other pushbuttons: Black with flush head.

E. Conform to NEMA ICS.

F. Legend Plate: Equipment manufacturer's standard or custom legend plate engraved with legend shown on Drawings.

2.04 INDICATING LIGHT ASSEMBLIES

A. Type: Full-voltage, push-to-test, heavy-duty, watertight, oiltight.

B. Voltage: as required.

C. Color: As indicated on Drawings.

D. Lamp: High visibility LED (Light Emitting Diode).

E. Legend Plate: Equipment manufacturer's standard or custom legend plate engraved with legend shown on drawings.

F. Conform to NEMA ICS.

2.05 AUXILIARY RELAYS

A. Type: Self-resetting, heavy-duty, machine-tool. Do not provide general purpose relays.

B. Contacts: Convertible with NEMA ICS 5 Q600 rating.

C. Furnish two spare contacts on each relay, minimum.

D. Conform to NEMA ICS.

2.06 TERMINAL BLOCKS

A. Type: Molded-block with molded-insulating barrier between terminals.

B. Rating: 600 volts, 30 amperes, minimum.

C. Terminals: Binding-head or washer-head screws with serrated or grooved contact surfaces.

D. Full-size marking strips.

2.07 TERMINAL CONNECTORS

A. Pressure-Crimp-Type Connectors:

B. Connector: Tin-plated copper, serrated inner barrel.

C. Insulation: 600 volts, nylon or vinyl.

2.08 OPEN SLOT WIRE DUCT

A. Type: lead free rigid polyvinyl chloride with covers.

B. Color: Grey or white.

2.09 FABRICATION

A. All control panels shall be assembled and tested prior to shipping to the site.

B. Wiring and Wiring Connections:

1. Make connections at device terminals or terminal blocks. Maximum two wires at terminations.
2. Form wiring into compact groups bound together and firmly supported. Run wiring groups straight, horizontally, or vertically with short-radius, right-angle bends.
3. Support and secure wire bundles with cable tie mounting bases. Secure cable tie mounting base with two No. 8 screws. Mounting cable tie bases with only adhesive will not be allowed.
4. Group wires at terminal blocks to minimize number of external cables.
5. Install ring tongue pressure-crimp-type connectors for terminations at terminal blocks and electrical devices.
6. Install pin pressure-crimp-type connectors for terminations where the use of ring tongue is not practical such as terminations at selector switches, pushbuttons, indicating lamps, or auxiliary relays.
7. Do not terminate wire without terminal connector.
8. All wires longer than 8 inches shall be contained in wire ducting.

C. Wire Markers:

1. Install wire markers on each end of each conductor.
2. Print conductor designation on first line.
3. Print conductor destination and terminal number on second line.
4. Nameplates: Attach nameplate to control panel enclosure in accordance with Section 16075 – Equipment Identification.

2.10 FINISHES

A. Control Panel Enclosure: Manufacturer's standard finish.

2.11 SOURCE QUALITY ASSURANCE

A. Test at factory for correct operation and mechanical adjustment.

PART 3 EXECUTION

3.01 INSTALLATION

A. All control panel installations shall comply with requirements of NFPA 70.

B. Install control panels at the locations indicated on the design drawings.

C. Drill all holes in the control panel enclosures necessary for terminating conduits; and make all conduit, cable and wiring, and grounding connections required to put the control panel into normal operation.

D. Maintain all NEMA ratings required.

E. The control panels shall be leveled, plumbed, and securely anchored to the control panel support structure.

END OF SECTION