



Solicitation No. 00-SI-30-0023
Invitation for Bids

Penstock Tunnel Repairs

Hoover Dam & Powerplants

Boulder Canyon Project

Arizona - Nevada

Volume 2 of 2

Lower Colorado Regional Office
Boulder City, Nevada

2000

United States Department of the Interior
Bureau of Reclamation



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SECTION C - STATEMENT OF WORK/SPECIFICATIONS

SUBSECTION C.1 - GENERAL REQUIREMENTS

C.1.1. The Requirement

The work to be performed under this solicitation includes repair and partial replacement of the existing drainage systems and replacement of miscellaneous metalwork in four (4) penstock tunnels and sixteen (16) penstock laterals. The work shall be in accordance with these contract provisions and clauses, these specifications, and the drawings listed in Paragraph C.11.2. (List of Drawings) hereof, Penstock Tunnel Repairs, Hoover Dam and Powerplants, Boulder Canyon Project, Arizona-Nevada.

The work is located at Hoover Dam, on the Colorado River, approximately 8 miles northeast of Boulder City, Nevada, and 32 miles from Las Vegas, Nevada, in Clark County, Nevada and Mohave County, Arizona.

C.1.2. Description of the Work

The principal items of work to be performed include the following:

- a. Removing and disposing of miscellaneous materials including, but not limited to, the following: (1) Abandoned overhead light fixtures, mounting brackets, and fittings in the Lower Arizona and Lower Nevada penstock tunnels; (2) Abandoned working platform in the Lower Nevada penstock tunnel; (3) Miscellaneous items such as sheet metal trough sections, rusted walkway grating, and other items as required from the penstock tunnels and the penstock laterals; and (4) Damaged angle iron supports, redwood stiffeners, and cracked or broken fiberglass sheeting from the overhead drainage collection system.
- b. Repair work and partial replacement of existing drainage collection systems in the Lower Arizona and Lower Nevada penstock tunnels, 50-foot inside diameter. The existing overhead collection systems consists of interconnected corrugated fiberglass panels, angle iron supports, redwood stiffeners, gutters, downspouts and discharge tubing to collect drainage flows. Repair work shall include: (1) Removing and reinstalling entire sections of the overhead drainage collection system. NOTE: Undamaged full sheets (12' x 53") and partial sheets of fiberglass panels shall be salvaged and reused; (2) Removing and replacing individual damaged components of the overhead drainage collection system; and (3) Removing and replacing damaged portions of the drainage collection (gutters), downspouts, and drain pipes.

Additional work in the Lower Arizona and Lower Nevada penstock tunnels includes repair of existing drainage weep holes located on the tunnel side walls between the raised walkways and the underside of the overhead drainage collection system. This shall include removing and replacing existing plumbing fixtures and drainage tubes for the weep holes.

- c. Replacement of existing drainage collection systems in the Upper Arizona and Upper Nevada penstock tunnels, 37-foot inside diameter. Work in the Upper Arizona and Upper

Nevada penstock tunnels includes repair of existing drainage weep holes located on the overhead portion of the tunnel and the side walls above the raised walkways. This shall include removing and replacing existing plumbing fixtures and drainage tubes for the weep holes.

d. Replacement of existing drainage systems in approximately 4,800 linear feet of the 16 penstock lateral tunnels (8 horizontal; 8 inclined at 45 degrees), 18-foot inside diameter. Work in the penstock lateral tunnels includes repair of existing drainage weep holes located on the overhead portion of the tunnel and the side walls above the walkways. This shall include removing and replacing existing plumbing fixtures and drainage tubes for the weep holes. The condition of some existing weep holes and existing plumbing fixtures in the penstock laterals may be so poor that drilling new weep holes may be required.

e. Removing and replacing miscellaneous metalwork including, but not limited to, the following: (1) 230 sections of grating; (2) 80 individual stair steps; (3) 200 linear feet of handrail sections; and (4) 1 large staircase and landing area, including structural steel (approx. 20 stairs).

C.1.3. Submittal Requirements

a. General.--The Contractor shall furnish all materials and perform all work required for furnishing submittals to the Government, in accordance with this paragraph, Table 1A (List of Submittals), and the requirements in the provisions, clauses, and paragraphs of this contract.

The word "submittals" shall be interpreted to include drawings, data, manuals, certifications, test reports, curves, samples, color chips or charts, brochures, and other items furnished by the Contractor for approval, informational, or other purposes.

b. List of submittals.--Table 1A (List of Submittals) lists the submittals required by this contract except those submittals which are required conditionally, required by entities other than the Bureau of Reclamation, or which are periodic in nature. Any submittal required to be submitted by the Contractor, but which is not listed in the table, shall be submitted in accordance with the applicable requirements of this contract. In case of a conflict between the requirements of this paragraph and the requirements included elsewhere in this contract, the requirements elsewhere shall take precedence over the requirements contained in this paragraph.

c. Submittals.--Each item in Table 1A has been assigned an RSN (Required Submittal Number). The "Submittals required" column of the table specifies the material to be submitted for each RSN. All of the material specified for an RSN will be considered a complete set; and where the material required for an RSN is specified as separate or distinguishable parts, a complete set shall include all parts. Only complete sets shall be submitted.

The number of complete sets to be submitted, and the location to which they are to be sent, shall be in accordance with the "No. of sets to be sent to:" column of the table, except as provided below for sets of original material.

When an RSN involves submittal of original (non-copied) material, all original material, or as much thereof as is necessary to form a complete set, shall be included in just one complete set. This "originals" set shall be sent to the proper address, given in subparagraph e. below, as determined by the "Responsible code" column of the table and the following:

- (1) CO indicates Contracting Officer.
- (2) RE indicates Regional Engineer.

The "originals" set shall be counted as one of the complete sets required to be submitted under the "No. of sets to be sent to:" column of the table.

For each RSN, the Contractor shall submit complete sets of required submittal material under the cover of a transmittal letter. At the Contractor's option, complete sets for more than one RSN may be submitted under cover of the same transmittal letter, provided they have the same responsible code designation as shown in the table. The Contractor's transmittal letter shall include:

- (1) Reference to Bureau of Reclamation contract number and title.
- (2) Identification of responsible code as shown in the table.
- (3) Complete list of RSN(s) for which material is being submitted.
- (4) For each RSN, number of complete sets and list of materials included.
- (5) For each RSN, identification of the submittal as an initial submittal or a resubmittal.

Each drawing submitted by the Contractor shall have the Contractor's or supplier's title and drawing number on it. Drawings and data shall be labeled with the Bureau of Reclamation contract number and the bidding schedule item number.

Manufacturer's data for commercial products or equipment, such as catalog cut sheets, shall be clearly marked to indicate the item(s) to be furnished. The data shall be sufficiently comprehensive to identify the manufacturer's name, type, model, size, and characteristics of the product or equipment, as well as to fully demonstrate that the product or equipment meets the requirements of these specifications.

Submittals requiring certification by a registered professional shall be signed and sealed.

d. Review of submittals furnished for approval.--The time required for review of each submittal or resubmittal furnished under an RSN for approval will not begin until the Government receives complete sets of all the submittal materials required for that particular RSN. The number of calendar days required for review of drawings or data submitted or resubmitted for approval will include the date the drawings or data are received by the Government, and will extend through the date of return mailing to the Contractor.

Except as otherwise provided in the specifications for specific submittals, the Government will require 20 calendar days for review of each submittal or resubmittal furnished by the Contractor for approval, and this review time will apply to each separate submittal or resubmittal whether the submittals are approved, not approved, or returned for revision.

If the Government uses time in excess of the specified number of calendar days for review of any submittal or resubmittal, additional time, not to exceed the excess time, will be added to the time allowed the Contractor for delivery of the materials or equipment affected by such excess time, to the extent it is demonstrated that the excess time caused delay. If the Government's review of two or more separate submittals or resubmittals is late and results in concurrent days of excess time, such days will be counted only once in computing an extension of the delivery date. Further, if the Contractor fails to make complete approval submittals in the sequence and within the time periods specified in this contract, and thus precludes the Government from approving or considering for approval such submittals within the specified calendar day period, then the Contractor shall not be entitled to an extension of time allowed for delivery of the materials or equipment.

Unless otherwise specified, one set of the submittals required for approval will be returned to the Contractor either approved, not approved, or conditionally approved, and will be marked to indicate changes, if required. Submittals that are not approved or that require changes or revisions shall be revised and resubmitted for approval, and shall show changes and revisions with revision date. All requirements specified for the initial submittal shall apply to any resubmittals required. Unless otherwise specified, all submittals which are to be resubmitted shall be resubmitted by the Contractor within 20 calendar days after the Contractor has received the Government's comments.

e. Addresses.--The Contractor shall send the submittals to the applicable addresses listed below as required by Table 1A.

The Contractor shall also send a copy of the transmittal letter to each of the addresses listed below that are not sent the submittal.

Submittals shall be sent as required by Table 1A to:

- (1) Bureau of Reclamation
Attn: Contracting Officer (LC-3130)
Lower Colorado Regional Office
P.O. Box 61470
Boulder City NV 89006-1470
- (2) Bureau of Reclamation
Attn: Regional Engineer (LC-6000)
P.O. Box 61470
Boulder City NV 89006-1470

f. Cost.--Unless otherwise specified, no separate payment will be made for preparing and furnishing submittals to the Government, and the cost thereof shall be included in the prices bid in the schedules for the applicable items of work requiring the submittals or other items of work.

Table 1A--List of Submittals

RSN	Item	Reference clause or paragraph	Responsible code	Submittals required	No. of sets to be sent to:*		Due date or delivery time
					CO	RE	
001	Bonds	52.228-15	CO	Performance and payment bonds.	1	0	Within 15 calendar days of contract award.
002	Safety and Health	WBR 1452.223-81	RE	Safety Program.	0	2	Submitted and accepted before commencing onsite work.
003	Safety data	WBR 1452.223-900	CO	(1) Experience Modification Rate for Worker's Compensation Insurance.	1	0	Within 20 calendar days of contract award.
				(2) Log and Summary of Occupational Injuries and Illnesses.	1	0	
				(3) Death and lost workday severity incidence rate.	1	0	
004	Insurance - Work on a Government installation	52.228-5	CO	(1) Written certification that the required insurance has been obtained.	1	0	Prior to commencement of work under this contract.
				(2) Current certification of insurance for each subcontractor.	1	0	At least 5 days before entry of subcontractor's personnel on the Government installation.
005	Liability Insurance	DOI 1452.228-70	CO	Acceptable evidence showing that insurance has been obtained.	1	0	Prior to commencement of work under this contract.
006	Accident prevention	52.236-13	CO	Accident exposure data.	1	0	Prior to commencement of onsite work under this contract.
007	Payment (electronic funds transfer)	52.232-34	CO	Payment information (ACH form).	1	0	After award, but not less than 14 days before an invoice or contract financing request is submitted.
008	Subcontracts (Labor Standards)	52.222-11	CO	(1) List of subcontracts.	1	1	Within 14 days after award of contract and within 14 days after award of any subcontracts.
				(2) Statement and Acknowledgment Form (SF 1413) for each subcontract.	1	1	
009	Hazardous Materials	C.4.1.	RE	Material Safety Data Sheets and updated List of Hazardous Materials.	1	2	Not less than 30 days prior to jobsite delivery of each hazardous material.
010	Air Abatement	C.5.2.	RE	Air Quality Permits.	1	1	Submitted and accepted before commencing onsite work.

RSN	Item	Reference clause or paragraph	Responsible code	Submittals required	No. of sets to be sent to:*		Due date or delivery time
					CO	RE	
011	Scaffolding	C.6.1.h.	RE	Drawings, pamphlets, manufacturer's literature, and general information about the scaffolding or work platforms.	1	2	Submitted and accepted before commencing onsite work.
012	Paint and coating materials	C.9.1.	RE	Purchase orders, certifications, and paint manufacturer's composition data.	0	3	No later than 30 days after contract award.
013	Warranties of workmanship, paint and coating materials	C.9.1.a.	CO	Standard Warranties.	1	2	Prior to submission of final invoice.
014	Release of Claims	DOI 1452.204-70	CO	Release of Claims (DI-137) against the United States.	1	1	After completion of the work and prior to final payment.

* CO indicates Contracting Officer and RE indicates Regional Engineer. For mailing addresses, see subparagraph C.1.3.e.

SUBSECTION C.2 - MATERIALS

C.2.1. Materials to be Furnished by the Contractor

a. General.--The Contractor shall furnish all materials required for completion of the work.

The words "material" or "materials" as used in these specifications to denote items furnished by the Contractor shall be construed to mean equipment, machinery, product, component, or any other item required to be incorporated in the work.

When a separate item which includes the furnishing of any material is provided in the schedule, the cost of furnishing, hauling, storing, and handling shall be included in the price bid for that item. When a separate item is not provided in the schedule for furnishing any material required to be furnished by the Contractor, the cost of furnishing, hauling, storing, and handling shall be included in the price bid for the work for which the material is required.

Materials furnished by the Contractor shall be of the type and quality described in these specifications. The Contractor shall make diligent effort to procure the specified materials from any and all sources, but where because of Government priorities or other causes, materials required by these specifications become unavailable, substitute materials may be used: Provided, That no substitute materials shall be used without prior written approval of the Contracting Officer, said written approval to state the amount of the adjustment, if any, to be made in favor of the Government. The Contracting Officer's determination as to whether substitution shall be permitted and as to what substitute materials may be used shall be final and conclusive. If the substitute materials approved are of less value to the Government or involve less cost to the Contractor than the materials specified, an adjustment shall be made in favor of the Government, and where the amount involved or the importance of the substitution warrants, a deductive modification to the contract will be issued. No payments in excess of prices bid in the schedule will be made because of substitution of one material for another or because of the use of one alternate material in place of another.

b. Inspection of materials.--Materials furnished by the Contractor which will become a part of the completed service work shall be subject to inspection at any one or more of the following locations, as determined by the Contracting Officer: at the place of production or manufacture, at the shipping point, or at the site of the work. To allow sufficient time to provide for inspection, the Contractor shall submit to the Contracting Officer, at the time of issuance, one copy of the purchase order, including drawings and other pertinent information, covering materials on which inspection will be made as advised by the Contracting Officer, or shall submit other evidence in the event such purchase orders are issued verbally or by letter.

The inspection of materials at any of the locations specified above or the waiving of the inspection thereof shall not be construed as being conclusive as to whether the materials and equipment conform to the contract requirements, nor shall the Contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications. Acceptance of all materials will be made only at the site of the work.

C.2.2. Materials and Workmanship

a. Materials.--All materials furnished by the Contractor shall be new and of the most suitable grade for the purpose intended considering strength, ductility, durability, and best engineering practice.

Materials shall conform to Federal specifications or standards; or to specifications or standards of ANSI (American National Standards Institute), ASTM (American Society for Testing and Materials), ASME (American Society of Mechanical Engineers), SAE (Society of Automotive Engineers), IEEE (Institute of Electrical and Electronic Engineers), NFPA (National Fire Protection Association), or other nationally recognized standards organization. If the Contractor proposes to deviate from, or to use materials not covered by, the aforementioned specifications and standards, the Contractor shall submit, for approval, the justification for and exact nature of the deviation, and complete specifications for the materials proposed for use.

b. Workmanship.--The Contractor shall be responsible for the accurate manufacture and fabrication of materials in accordance with best modern practice and the requirements of these specifications, notwithstanding minor errors or omissions therein.

Liberal factors of safety and adequate shock-absorbing features shall be used throughout designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock. Shock-absorbing features and parts subject to vibration shall include provisions which prevent components from loosening.

C.2.3. Reference Specifications and Standards

Materials, Contractor design, construction work, and other requirements which are specified by reference to Federal Specifications, Federal Standards, or other standard specifications or codes shall comply with the editions or revisions listed. In the event of conflicting requirements between a referenced specification, standard, or code and these specifications, these specifications shall govern.

In the event that materials are not covered by Federal or other specifications, the materials furnished shall be of standard commercial quality.

Copies of many of the Federal Specifications and Standards may be examined at the Bureau of Reclamation Denver Office Library, building 67, Denver Federal Center, West 6th Avenue and Kipling Street, Denver, Colorado.

The Contractor shall maintain onsite, a copy of referenced specifications and standards related to work proceeding at the jobsite while the work is being performed. These shall be available for use by the Government.

SUBSECTION C.3 - LOCAL CONDITIONS

C.3.1. Access to the Work and Haul Routes

- a. General.--The Contractor shall make its own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect transportation and ingress and egress at the jobsites. Subject to the clause at FAR 52.249-10, Default (Fixed-Price Construction), the unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.
- b. Existing roads.--Existing roads are available for the Contractor's use subject to existing restrictions. The Contractor shall meet all conditions properly imposed upon the use of existing roads by those having jurisdiction thereover, including seasonal or other limitations or restrictions.
- c. Haul routes.--The hauling of construction materials or waste materials over public highways, roads, or bridges shall be in compliance with the applicable local regulations and shall be such as to minimize interference with or congestion of local traffic.
- d. Parking.--Parking is extremely limited in the construction area, and the Contractor may be restricted as to the number and the type of vehicles that may be parked there. The Contractor shall use parking areas adjacent to the construction site as approved by the Contracting Officer, and shall not block traffic with parked vehicles, equipment, and/or materials. Additional area for the Contractor's employee parking will be provided at an area near the Government warehouse on U.S. Highway 93.

The Contractor shall place an identification label, with the Contractor's name, on the windshield of vehicles parked at the construction area. This will not be required if the Contractor's name is prominently displayed at some other location on the vehicle.

- e. Cost.--The cost of all work described in this paragraph shall be included in the prices bid in the schedule for other items of work.

C.3.2. Security and Identification of Employees

The operation of Hoover Dam and Powerplant requires continuous and effective security measures. Such security is carried out by a Federal guard system, and the security regulations provide for controlled access to certain restricted areas including switchyards, powerplants, and other critical areas. These restricted areas are designated and may be modified or changed by the Contracting Officer. All necessary security measures required by this contract including provisions for security police and/or guards shall be subject to the approval by the Contracting Officer. The Contractor shall be responsible for initiating necessary measures to insure that its employees comply with all established security rules and regulations, including but not restricted to the following:

(1) Construction work areas.--All areas where work is required under this contract are designated as construction work areas. The Contracting Officer will designate suitable accessways to construction work areas for use of construction personnel. Unless specifically authorized, construction personnel shall be restricted to these areas. It shall be the Contractor's responsibility to insure by appropriate and effective means that its personnel remain in these areas while on the jobsite.

(2) Restricted areas.--Construction personnel will not be permitted to enter established or designated restricted areas unless so authorized by the Contracting Officer. Such entry shall be in accordance with and subject to the security regulations established in the area. It shall be the Contractor's responsibility to insure by appropriate and effective means that its personnel shall not enter these areas unless authorized as set forth above.

(3) Identification of Contractor employees.--All Contractor personnel who will require access to secured areas of the Hoover Dam facilities shall be issued a numbered identification badge clearly identifying the employee and its employer. Such identification shall be required for all employees on the jobsite and shall be worn at all times. If special badges holding the employee's photograph are required for restricted areas, such badges will be furnished by the Government.

(4) Access cards and keys. - The contractor shall be limited to a total of three access cards for use by the Project Manager, Project Superintendent and a runner/escort when access is required for subcontractors, deliveries and/or vendors visit the contractor's worksite. The Project Superintendent shall maintain a log which shows who uses the runner/escort card, the time and duration of use, and the purpose used for. This log shall be available for review by Government personnel upon request.

The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

C.3.3. Use of Land for Service Purposes

a. General.--The Contractor will be permitted to use Government land, controlled by the Bureau of Reclamation, for field offices, plants and buildings, storage yards, shops, and other service facilities required for service purposes.

b. Government land.--The Contractor's use of Government land for service purposes shall be subject to SUBSECTION C.5 (ENVIRONMENTAL QUALITY PROTECTION) of these specifications, and to the requirements of this paragraph. Such use shall not interfere with any part of the work under this contract, nor with the work of other contractors or the Government in the vicinity, nor with reservations made, or as may be made, by the Government for the use of such land.

c. Cost.--No charge will be made to the Contractor for the use of Government land for service purposes.

C.3.4. Protection of Existing Installations

a. General.--In performing work in the existing facility, the Contractor shall take all necessary precautions to safeguard existing installations.

The Contractor shall furnish, install, and maintain adequate protection as needed to safeguard personnel and existing facilities from harm due to its operations. Such protection shall be subject to approval by the Contracting Officer.

All protective installations shall be arranged so as to permit operation of the existing equipment and facilities by the Government while work under these specifications is in progress. The Contractor shall remove all protective installations provided by them after they have served its purpose. The materials furnished by the Contractor to provide protection shall remain the property of the Contractor and, after removal, shall be transported from the worksite.

Drawings included in these specifications show the items of existing materials and equipment but do not purport to show all equipment and materials existing at the worksite.

b. Enclosures.--Enclosures shall be constructed by the Contractor to prevent weld spatter, dust, spalls, chips, grit, and other foreign material from endangering personnel and contaminating or damaging equipment during service operations.

Enclosures shall be subject to approval of the Contracting Officer. Enclosures shall be sufficient to confine the Contractor's operations to the immediate work area, and to prevent contaminating and damaging mechanical and electrical installations.

c. Damages.--The Contractor shall repair, at its expense, any damage to the existing installations due to the Contractor's operation or its failure to provide proper protection; or at the option of the Contracting Officer, any such damage may be repaired by the Government and the Contractor will be backcharged for the cost thereof.

d. Cost.--The cost of protection of existing installations in accordance with this paragraph shall be included in the prices bid in the schedule for other items of work.

C.3.5. Government and Contractor Furnished Facilities

The following Government facilities will be available to the Contractor at no charge for use in the performance of work under these specifications:

- a. Water at approximately 80 pounds per square inch pressure.
- b. Sanitary facilities.--Existing restrooms will be made available.
- c. Electrical power.--Single phase, 60-hertz, alternating current at approximately 120/240 volts

- d. Compressed air.--Pressurized air lines at various locations within the penstock tunnel and access adit will be made available to the Contractor upon request.

The location of these facilities will be shown during the prebid site visit or after award of the contract. Facilities are provided on an as-is, where-found basis. The Contractor is responsible for being cognizant of the location of the utilities.

The Contractor shall provide all necessary distribution circuits, transformers, and other electrical equipment required for distributing the power to the place or places of use by the Contractor and shall dismantle and remove from the site of the work all such distribution circuits and equipment at the termination of the contract.

Likewise, the Contractor shall provide all means of conveying water and/or compressed air to points of use and shall remove from the site all Contractor equipment at the termination of the contract.

The cost of providing necessary materials and labor for conveying water and power to points of use shall be included in the prices bid in the schedule for other items of work.

SUBSECTION C.4 - SAFETY

C.4.1. Submission of Material Safety Data Sheets for Hazardous Materials

The Contractor shall comply with the Reclamation Safety and Health Standards. After award of contract, the Contractor shall submit updated List of Hazardous Materials (LHM) and Material Safety Data Sheets (MSDS) in accordance with the requirements of paragraph (e) of the clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data.

The Contractor shall submit the updated LHM and completed MSDS and identification and certification for each material to the Responsible Code in Table 1A (List of Submittals), in accordance with Paragraph C.1.3. (Submittal Requirements). The Contractor shall not deliver any hazardous material to the jobsite which was not included on the original LHM prior to acceptance of the Contractor's MSDS by the Regional Engineer, Boulder City, Nevada.

The cost of complying with this paragraph shall be included in the applicable prices bid in the schedule for the items of work for which the hazardous materials are required.

SUBSECTION C.5 - ENVIRONMENTAL QUALITY PROTECTION

C.5.1. Prevention of Water Pollution

a. General.--The Contractor shall control pollutants by use of wastewater management controls, service site management practices, and other controls, including State and local control requirements.

(1) Service site management.--The Contractor shall perform service 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. Such 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) Service safety standards.--The Contractor shall comply with the sanitation and potable water requirements of section 7 of Reclamation's publication entitled "Reclamation Safety and Health Standards" (RSHS).

(3) Laws and regulations.--The Contractor shall perform service operations in such a manner as to comply, and ensure all subcontractors to comply, with all applicable Federal, state, and local laws, orders, regulations, and Water Quality Standards concerning the control and abatement of water pollution. In the event there is a conflict between Federal, state, and local laws, regulations, and requirements, the most stringent shall apply.

b. Cost.--The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

C.5.2. Abatement of Air Pollution

a. General.--The Contractor shall comply with applicable Federal, state, and local laws and regulations and with the requirements of this paragraph concerning the prevention and control of air pollution. Should a conflict exist in the requirements for abatement of air pollution, the most stringent requirement shall apply. The Contractor shall utilize such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

Burning of combustible service materials and rubbish will not be permitted. In lieu of burning, such combustible materials shall be disposed of in accordance with Paragraph C.5.3. (Cleanup and Disposal of Waste Materials).

Storage and handling of flammable and combustible materials, provisions for fire prevention, and control of dust resulting from service operations shall be in accordance with the applicable provisions of the RSHS.

b. Submittals.--Submittals shall be in accordance with this paragraph and Paragraph C.1.3. (Submittal Requirements).

Prior to commencing any activity for which an Air Quality Permit is required, the Contractor shall submit, for informational purposes, a copy of the applicable Air Quality Permit. Air Quality Permits are required for certain service-related activities including, but not limited to, earthmoving, sandblasting, aggregate processing, welding, spray-coating operations, or other processes which discharge pollutants into the open air.

Air Quality Permits, and information concerning the requirements, can be obtained from the appropriate state agencies.

c. Cost.--The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

C.5.3. Cleanup and Disposal of Waste Materials

a. General.--The Contractor shall be responsible for the cleanup and disposal of waste materials and rubbish. Contractor removed piping and appurtenances to be disposed of shall be considered waste material. The disposal of waste materials and rubbish shall be in accordance with applicable Federal, state, and local laws and regulations, with applicable requirements of the RSHS, and with the requirements of this paragraph. Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement shall apply.

The Contractor shall keep records of the types and amounts of waste materials produced, and of the disposal of all waste materials on or off the jobsite.

In the event of the Contractor's failure to perform the work required by this paragraph, the work may be performed by the Government, and the Contractor will be backcharged for the cost of such work. The Contractor's surety or sureties shall be liable for such payment until received by the Government.

b. Cleanup.--The Contractor shall keep work and storage areas free from accumulations of waste materials and rubbish, and before completing the work, shall remove all plant facilities, buildings, enclosures, including concrete footings and slabs, rubbish, unused materials, concrete forms, and other like materials, which are not a part of the permanent work.

In addition, the Contractor shall conduct an environmental site assessment at the following Contractor use locations:

(1) All hazardous waste accumulation areas.

(2) All hazardous material storage areas where the aggregate storage of hazardous materials at the site is or has been over 110 gallons.

This site assessment shall be performed by an industrial hygienist, an environmental specialist, or equivalent, and shall document through appropriate analytical sampling that the site is free of the effects of contamination (i.e., contaminant concentrations less than state action cleanup levels).

c. Disposal of hazardous waste and materials.--Materials or wastes, defined as hazardous by 40 CFR 261.3; Federal Standard 313, as amended; or by other Federal, state, or local laws or regulations, used by the Contractor or discovered in work or storage areas, shall be disposed of in accordance with these specifications and applicable Federal, state, and local laws and regulations. Unknown waste materials that may be hazardous shall be tested, and the test results shall be submitted to the Contracting Officer for review.

Waste materials known or found to be hazardous shall be disposed of in approved treatment or disposal facilities. Hazardous wastes shall be recycled whenever possible. A copy of all hazardous waste manifests shall be sent to the Contracting Officer.

Waste materials discovered at the service site shall immediately be reported to the Contracting Officer. If the waste may be hazardous, 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.

d. Disposal of other nonhazardous waste materials.--

(1) General.--Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the Contractor. Disposal of combustible materials shall be by removal from the service area. Disposal of combustible materials by burning will not be permitted.

(2) Disposal by removal.--Waste materials to be disposed of by removal from the service area shall be removed prior to completion of the work under these specifications. All materials removed shall become the property of the Contractor.

Waste material shall be dumped only at an approved sanitary landfill. The Contractor shall make any necessary arrangements with private parties and county officials pertinent to locations and regulations of such landfills, and shall pay any fees or charges required for such dumping.

e. Cost.--Except as provided above, the cost of cleanup and disposal of waste materials in accordance with this paragraph shall be included in the prices bid in the schedule for other items of work.

SUBSECTION C.6 - SCAFFOLDING

C.6.1. Scaffolding Requirements

a. General.--Scaffolds, ladders, stairways, ramps, platforms, or temporary floors shall be provided for employees engaged in work that cannot be performed safely from the ground or from solid construction.

Scaffolding shall be erected, dismantled, or altered under the supervision of a competent person and in compliance with the requirements of this section and ANSI A10.8-1988, "Construction and Demolition Operations - Safety Requirements for Scaffolding," with the more stringent standards prevailing. Ladders or makeshift devices shall not be used to increase height of scaffolding. Scaffolding working surfaces shall be essentially level.

Scaffolds and their components shall be capable of supporting at least four times the maximum intended load. Scaffolds shall not be loaded in excess of the working load for which they are designed. Materials shall not be stored on scaffolds in excess of supplies needed for immediate operations. Manufactured scaffolds shall be used in accordance with manufacturer's recommendations.

Employees working on suspended or movable scaffolding or scaffolding without standard guardrails, shall be protected by nets, lifelines, lanyards, and belts as set forth in the RSHS.

Work platforms and scaffolds more than 6 feet above the ground or floor level shall be provided with standard guardrails, midrails, and toeboards on the open sides and ends except for floats, needle beam, and ladder-supported scaffolds. Guardrails are not required during the erection and dismantling of scaffolds. However, fall protection meeting the requirements above shall be used.

The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Poles, legs, and uprights shall be plumb and securely and rigidly braced to prevent swaying and displacement.

Scaffolds shall not be altered or moved horizontally while being occupied except when specifically designed for such use. Freestanding scaffolds with a height to base ratio of more than 4 to 1 shall be guyed, braced, or otherwise restrained from tipping.

Scaffolding that utilizes structural members and/or working surfaces different from those specified herein and in referenced standards shall be designed by a competent registered engineer and accepted by the COR or office head prior to onsite erection.

Scaffolding or working platforms will be required to gain access to all portions of the penstock tunnels, including the main portion of the 50-foot diameter lower penstocks and the 37-foot diameter upper penstocks.

b. Scaffolding load requirements.--Materials selected for scaffold working surfaces shall be designed to produce a platform that will safely support the specified load. The load rating for scaffold decking units shall be based on the greater of the person loading requirements or the uniformly distributed load requirement.

The width of all scaffolds, ramps, runways, and platforms shall be sufficient to prevent congestion of persons, materials, or equipment, and in no case shall they be less than 18 inches wide.

(1) Person loading requirements.--The design working load for scaffold decking units shall be calculated on the basis of one or more 200-pound persons with 50 pounds of equipment each. Scaffold decking units designed for one person shall be designed and constructed to carry 250 pounds placed in the center of the span. Scaffold decking units designed to support two people shall be designed to carry 500 pounds with 250 pounds placed 18 inches each side of the center of the span. Scaffold decking units designed to support three people shall be designed to support 250 pounds in the center of the span and 250 pounds 18 inches each side of the span.

(2) Uniformly distributed load requirements.--Each scaffold decking unit, where applicable, shall be designed to carry a uniformly distributed load as an alternate to the person loading requirement.

- (a) Heavy duty: 75 pounds per square foot
- (b) Special duty: greater than 75 pounds per square foot

Wood scaffold planks shall be designed so that the deflection, at the center of the span at the design load does not exceed the span divided by 60. Permissible spans that comply with the above requirement are shown below:

- One person: 8 ft
- Two people or heavy duty: 7 ft
- Three people or special duty: 5 ft

c. Standard guardrails.--A standard guardrail shall consist of a toprail, intermediate rail, toeboard, and posts. The vertical height of the guardrail shall be 42 inches. Posts, toprails, and intermediate rails shall either be a minimum 1.5-inch diameter steel pipe or 2- by 2-3/8-inch angle iron with posts spaced not to exceed 8 feet on centers. Wire rope or cable having equivalent strength of pipe guardrails may be used for top and intermediate rails provided deflection is less than 12 inches under a 200-pound loading at center span. Regardless of material used, the guardrail shall be capable of withstanding a minimum loading of 200 pounds supplied in any direction at any point on the toprail with a minimum of deflection. Railings required to withstand greater stress due to the nature of use shall be designed with a minimum safety factor of four.

d. Metal scaffolds and towers.-- All metal scaffolds and towers shall be listed by Underwriters Laboratories, Inc., or Factory Mutual Engineering. Such scaffolds and towers shall be erected in accordance with the manufacturer's specifications and the design load limits shall not be exceeded.

Sections of metal scaffolds shall be set plumb and securely connected together. All braces shall be installed prior to scaffold use. The entire scaffold shall be secured and braced to the building or structure at intervals not exceeding 30 feet horizontally and 26 feet vertically. Freestanding scaffold working platform heights shall not exceed three times the smallest base dimension.

e. Tube and coupler scaffolds.--Tube and coupler scaffolds shall be designed and constructed in accordance with industry standards and the requirements of this paragraph.

The components of tube and coupler scaffolds shall be constructed of steel tubing not less than the respective minimum diameters and spacing indicated in the following table:

Posts, runners, and bracing diameter: 2-in o.d.

Bearer diameter: 2.5-in o.d.

Maximum post spacing (length): 6.5 ft

Maximum post spacing (width): 6 ft

Bearers shall be at least 4 inches, but not more than 12 inches longer than the post or runner spacing. Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler.

Diagonal bracing shall be installed across the scaffold at least every third set of posts horizontally and every fourth runner vertically. Longitudinal diagonal bracing shall be installed on the inner and outer rows of poles at an angle of 45 degrees from the base of the scaffold to the top. All diagonal bracing shall be attached to each pole that it crosses.

f. Tubular welded frame scaffolds.--Metal tubular frame scaffolds, including all load-bearing components, shall be designed and constructed to safely support four times the maximum rated load. The frames shall be placed one directly over the other using coupling or stacking pins to provide vertical alignment of the posts.

When uplift may occur, frame members shall be locked together vertically by pins or equivalent means.

Metal tubular frame scaffold shall be properly braced by cross bracing or diagonal braces, or both for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and aline vertical members. All brace connections shall be made secure.

g. Mobile scaffolds.--The height of free-standing mobile scaffolds shall not exceed four times the minimum base dimension.

Wheels and casters shall be equipped with a positive locking device to prevent accidental movement of the scaffold.

The force necessary to move mobile scaffolds shall be applied as close to the base of the scaffold as possible. Provisions shall be made to stabilize the scaffold during movement. The scaffolds shall be used only on firm, level, and broom-clean surfaces.

No persons shall be permitted to ride on a manually propelled mobile scaffold unless the following conditions exist:

- (1) The floor or surface is within 1.5 degrees of level and free of pits, holes, or obstructions.
- (2) The minimum dimensions of the scaffold base when ready to move is at least one-half the height.
- (3) Outriggers, if used, shall be installed on both sides of staging.
- (4) The wheels or coasters are equipped with rubber or similar resilient tires.
- (5) Tools and materials are removed from the platform or secured prior to movement.

h. Submittals.--The Contractor shall submit drawings, pamphlets, manufacturer's literature, and general information about the scaffolding or work platforms that will be used in the penstock. Separate submittals shall be required for each size and type of scaffolding that is to be used. The submittals must include design load calculations that meet the requirements of subparagraph b. above.

Safety of the workforce and of Government inspectors is a critical element of the submittals. Submittals shall include safety information about guardrails, toe boards, and location of tie-offs for safety harnesses. Submittals shall be in accordance with Paragraph C.1.3. (Submittal Requirements) and Table 1A (List of Submittals).

C.6.2. Payment

Payment for furnishing, erecting, and relocating scaffolding system for the 37-foot and 50-foot diameter penstock tunnel sections will be made at the respective lump sum price bid therefor in the schedule, which price shall include the cost of all labor, equipment, and materials.

The cost of designs, drawings, submittals, and final dismantling and removal of the scaffolding systems upon completion of the work shall be included in the applicable lump sum prices bid in the schedule for furnishing, erecting, and relocating scaffolding systems.

SUBSECTION C.7 - SITEWORK

C.7.1. Removing Miscellaneous Materials

Existing features to be removed by the Contractor include the following:

- (1) Removing and disposing of damaged components of the existing overhead fiberglass canopy:
 - a. Rusted angle iron support braces; approximately 900 individual pieces with lengths ranging from 12 to 14 feet.
 - b. Damaged 1" x 2" and/or 2" x 2" redwood support stiffeners; approximately 1800 individual pieces, nominal length of 4 feet.
 - c. Broken or missing sections of fiberglass panels; approximately 150 panels, nominal dimensions of full size panel are 53-inches wide x 12 feet in length. Note: Partially damaged fiberglass panels shall be cut and the salvageable portion shall be saved for make-up pieces.
 - d. Broken or missing sections of vinyl drainage collection trough (vinyl rain gutter); approximately 300 linear feet.
- (2) Removing, salvaging, and temporary storage of reusable fiberglass panel pieces; approximately 600 panels, nominal dimensions of full size panel are 53-inches wide x 12 feet in length.
- (3) Removing and disposing of approximately 750 linear feet of ceiling mounted electrical conduit and wiring from the abandoned overhead lighting system in the Lower Arizona and Lower Nevada Penstocks. Included are approximately 40 light fixtures and mounting brackets. Removing abandoned lights, conduit, and wiring shall only be required in areas that the entire canopy section is being removed and reinstalled with a combination of new and salvageable materials.
- (4) Removing and disposing of all plumbing and piping from existing drainage (weep) holes located above the grating walkways. For the lower penstocks, it shall only include drainage holes above the walkway but below the overhead fiberglass canopy drainage collection system. For the upper penstocks and the penstock laterals, it shall include all drainage holes above the walkway or stairs, including those on the ceiling directly above the penstock and lateral pipes. The majority of drainage holes in the upper and lower penstocks are 2-inch diameter holes with a short piece of PVC pipe with a 90 degree elbow epoxied into the opening. A small number of drainage holes in the primary penstock tunnels are 1-inch diameter with rusted black iron pipe. There is no salvage value to these materials and disposal shall be in accordance with Paragraph C.5.3. (Cleanup and Disposal of Waste Materials).
- (5) Removing defective grating, stair steps and handrail sections. These items shall be replaced in accordance with Paragraph C.9.1. (Miscellaneous Metalwork).

(6) Removing and disposing existing structural steel members, stair steps, pipe handrails and steel grating as required for complete replacement of the stairway and landing area adjacent to the northeast doorway of the Arizona Viewing Platform. Replacement of structural steel, stairway, handrails, and steel grating shall be in accordance with Paragraph C.9.1. (Miscellaneous Metalwork).

(7) Dismantling, removing, and disposing of abandoned working platform, Lower Nevada penstock tunnel. Platform was last used in or around 1959 and was left at the furthest end of the tunnel upon completion of the work. The majority of the framing is light weight structural aluminum which appears to be in good condition. Mild steel bracing, ladder rungs, and bolts are badly rusted. For safety reasons, it has been deemed as unsafe and nonrepairable.

(8) Removing and disposing of miscellaneous items located on or below the existing walkways in the penstock tunnels, such as PVC pipe and PVC fittings, nylon tubing that has broken away from existing drainage holes, and miscellaneous debris (unsalvageable fiberglass panels, redwood stiffeners, rusted angle iron pieces) that has fallen from the overhead fiberglass canopy. This shall be an ongoing requirement to maintain a safe and clean working environment. Final inspection for cleanliness of the areas below the walkways will be performed by the Government at the conclusion of all repair work in the applicable penstock tunnels.

Most of the items listed above are not shown on the drawings. The Contractor shall be required to remove these items and other minor items which, in the opinion of the Contracting Officer, need to be removed for performance of the work. In removing the existing facilities, any damages to existing features, which are to remain in place, caused by the Contractor shall be repaired at no cost to the Government and in a manner satisfactory to the Contracting Officer. For safety reasons and to minimize damage to existing facilities, the Contractor will not be permitted to drop or throw debris into the tunnel invert.

All removal operations which might endanger the new construction shall be performed prior to the construction of new facilities. No equipment or devices shall be used in removal operations which might damage existing structures, utilities or facilities which are to remain in place.

All waste materials removed by the Contractor shall become the property of the Contractor and shall be disposed of in accordance with Paragraph C.5.3. (Cleanup and Disposal of Waste Materials).

Payment for dismantling, removing, and disposing of the abandoned working platform, Lower Nevada Penstock tunnel, will be made at the lump sum price bid therefor in Schedule No. 1, which price shall include the cost of all labor, equipment and incidentals required for performing the work described in this paragraph.

Payment for removing and disposing of abandoned overhead light fixtures from the applicable penstock tunnels will be made at the applicable unit price bid therefor in Schedule Nos. 1 and 2, which price shall include the cost of all labor, equipment and incidentals required for

performing the work described in this paragraph. The cost of removing the electrical conduit, wiring, and brackets associated with the abandoned overhead lighting shall be included in the applicable unit prices.

Payment for removing and disposing of miscellaneous plumbing fixtures on existing drainage (weep) holes will be made at the lump sum price bid therefor in the schedules, which price shall include the cost of all labor, equipment and incidentals required for performing the work described in this paragraph.

The cost of removing and disposing of damaged components of the existing overhead fiberglass canopy, which includes the following: rusted angle iron support braces, redwood support stiffeners, broken or missing fiberglass panels, broken or missing sections of the collection trough shall be included in the applicable unit prices bid therefor in Schedule Nos. 1 and 2 for items requiring the performance of this work.

The cost of removing, salvaging, and temporary storage of reusable fiberglass panel pieces shall be included in the applicable unit prices bid in Schedule Nos. 1 and 2 for removing, modifying, and reinstalling damaged sections of overhead fiberglass canopy drainage collection system.

The cost of removing and disposing of defective grating, individual stair steps, handrail sections shall be included in the applicable unit prices bid in the schedules for which the work is required.

The cost of removing and disposing of structural steel, stair steps, handrails, and steel grating as required for complete replacement of the stairway and landing area adjacent to the northeast doorway of the Arizona Viewing Platform shall be included in the unit prices bid in Schedule No. 2 for removing and replacing stairway, handrailing, landing, and structural steel support members, Arizona Viewing Platform.

The cost of removing and disposing of damaged components of the existing overhead fiberglass canopy, which includes the following: rusted angle iron support braces, redwood support stiffeners, broken or missing fiberglass panels, broken or missing sections of the collection trough shall be included in the applicable unit prices bid therefor in Schedule Nos. 1 and 2 for items requiring the performance of this work.

SUBSECTION C.8 - REPAIR WORK TO EXISTING DRAINAGE SYSTEMS FOR PENSTOCK TUNNELS SECTION

C.8.1. Repair Work, Collection System for Lower Penstock Tunnels

a. General.--The existing overhead fiberglass canopy drainage collection system consists of interconnected corrugated fiberglass panels, angle iron supports, redwood stiffeners, vinyl rain gutters, downspouts and discharge tubing to collect natural seepage that flows through cracks, joints, and numerous drainage (weep) holes in the concrete lining of the penstock tunnels. Drawing Nos. 45-300-831, -832, and -833 are included as "information only" drawings. Due to minor field modifications during the initial construction in 1986, there are isolated areas that do not exactly match the "information drawings". Examples may include the dimensioning and spacing of the angle iron support braces which standardly is 48 inches but varies slightly due to existing obstacles at the Visitor Viewing Platforms, vent pipes, and concrete thrust block anchors. Additional deviations from the original design are Section A-A, Detail 4, and the NOTES on Drawing No. 45-300-831. Section A-A shows a No. 14 self-tapping stainless steel screw attaching the fiberglass to the angle iron support brace from top to bottom. Actual direction of the screw is opposite that which is shown on the drawing. Detail 4 which shows the interconnection of adjacent fiberglass panels was attempted briefly using the self-threading screw going from bottom to top (as opposed to top to bottom), but this was soon deleted as a requirement. Similarly, a requirement that was stated in the NOTES to connect the fiberglass panels to the redwood stiffeners with a self-tapping screw was deleted due to accessibility limitations.

For repair of the existing overhead fiberglass canopy drainage collection system, the lower penstocks will be considered as two sections. For the Lower Nevada Penstock, Section 21 through 42, and the Lower Arizona Penstock, Section 19 through 32, corrosion damage to the angle iron support braces is significant and none are considered as salvageable or reusable. It has also been determined that the redwood stiffeners are not salvageable or reusable. Existing 1/2-inch diameter stainless steel threaded rod anchors and the majority of the fiberglass panels are reusable.

For the Lower Nevada Penstock, Section 43 through 86, and the Lower Arizona Penstock, Section 33 through 86, corrosion damage to the angle iron support braces is random. It has also been determined that the majority of the redwood stiffeners do not show signs of rot or water damage. For these sections of the existing overhead fiberglass canopy drainage collection system, repairs shall be treated as isolated sites. Repair work shall be performed such that only the angle iron support braces that have corrosion shall be removed and replaced. Redwood stiffeners that require removal for installation of the new support braces, redwood stiffeners that are missing, or redwood stiffeners that show signs of rot or water damage shall be removed and replaced. Every effort shall be made to leave the existing fiberglass panels intact and undisturbed while installing the new support braces and new stiffeners.

The Contractor shall furnish and install all materials specified herein, reuse the existing 1/2-inch diameter stainless steel threaded rod anchors which are embedded in the concrete

ceiling and reuse the majority of the existing fiberglass panels. Upon completion, the corrugated fiberglass panels suspended from the tunnel ceiling shall collect drainage flow from leaks in the upper portions of the tunnels and drain into the existing vinyl rain gutters that are mounted on the concrete sidewall of the tunnels.

b. Materials.--

(1) Fiberglass panels.--Contractor shall salvage and reuse existing fiberglass panels. Missing or damaged fiberglass panels shall be replaced using new materials that match the existing corrugated fiberglass panels.

New fiberglass panels shall have a standard nominal width of 53 inches with a finished installed width of 48 inches when panels are overlapped. Panels shall be an off-white or ivory color that closely matches the color of the existing canopy. Full-size corrugated panels shall be 53 inches wide by 12 feet long, type 2-1/2 by 1/2. Fiberglass panels shall meet the requirements of ASTM D3841-(1997), *Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels*.

(2) Rain gutter.--Replacement of damaged or missing sections of existing rain gutters shall include vinyl troughs, 5 inches wide and all necessary appurtenances including mounting hardware, brackets, slip joints, corners, downspouts, and end caps. New sections of the vinyl rain gutters shall be of standard industry quality and must be compatible with the existing rain gutter trough system. Troughs shall be furnished in 10-foot lengths. The existing system included components of the Raingo gutter system, manufactured by Genova Products, 7034-T East Court Street, Davison, Michigan, 48423, telephone: (810) 744-4500.

(3) Structural supports.--The existing structural supports consist of angle iron, L 1 1/2 x 1 1/2 x C, ASTM A36 steel. Replacement materials shall be fiberglass reinforced plastic (FRP) "T" section, T 2 x 1 1/2 x 3/16. Fabricated lengths of the "T" section shall match the length of the existing angle iron that is being replaced. The FRP materials shall meet the requirements for composite materials and the industry standards, ISO 9001/9002.

(4) Stiffeners.--The Contractor shall use rectangular sections, 1 1/2 x 3/4 of a composite material. This material may be fiberglass or fiber reinforced plastic (FRP). Standard length of existing redwood stiffeners is 4 feet in length. The exact lengths will be verified by the Contractor prior to fabrication of the replacement stiffeners.

(5) Expansion shields and hanger rods.--Existing expansion shields are 1/2-inch diameter female threads, Federal Specification FF-S-325, Group II, Type IV. Hanger rods are 1/2-inch diameter stainless steel conforming to ASTM A582 (1995), with continuous threads. All existing expansion shields and hanger rods, including existing stainless steel washers and nuts shall remain in place and shall be reused. Any damaged or missing components shall be replaced in kind.

(6) Bolts, nuts and washers.--Bolts, nuts and washers shall be stainless steel and shall meet the requirements of ASTM F593 (1998).

(7) Polyethylene tubing.--2-inch nominal diameter polyethylene tubing in accordance with ASTM D2737 (1999).

(8) Sealant.--Calking compound shall be an elastomeric sealing compound in accordance with Federal Specification TT-S-00230C, type II, class A.

(9) Miscellaneous materials.--Miscellaneous materials not specifically covered herein by detailed specifications shall be of standard commercial quality suitable for the intended use as approved by the Contracting Officer.

c. Installation.--The Contractor shall install new corrugated fiberglass panels, salvaged (reusable) existing fiberglass panels, "T" section FRP supports and rectangular FRP stiffener cross braces, new sections of drainage gutters and discharge tubing in accordance with standard industry practice. The details and installation notes shown on Drawing Nos. 45-300-831, -832, and -833 are included as "information only". The Contractor shall install new and existing materials as required to most closely match the existing overhead fiberglass canopy drainage collection system. Overlaps in adjoining fiberglass sheets shall be made such that the lower or downstream sheet is overlapped by the upper sheet.

The Contractor shall remove any debris from the existing vinyl rain gutter systems that serves as drainage troughs. Debris that would clog existing drainage tubes shall be removed by hand. Smaller items of debris may be removed by flushing with water. These items of work shall be performed simultaneously with the general inspection of the drainage trough system by the Contractor. Sections of the existing drainage troughs that are cracked, leak, or do not drain properly shall be replaced.

The existing downspouts from the drainage troughs are adequately spaced and are fabricated with corrugated polyethylene drainage tubing.

d. Payment.--Payment for removing, modifying, and reinstalling damaged sections of the overhead fiberglass canopy drainage collection systems for Lower Nevada (Section 21 to 42) and Lower Arizona (Section 19 to 32) penstock tunnels will be made at the respective unit prices bid in the schedules, which prices shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing existing angle iron support braces with new fiberglass reinforced plastic (FRP) "T" sections for Lower Nevada (Section 43 to 86) and Lower Arizona (Section 33 to 86) penstock tunnels will be made at the respective unit prices bid in the schedules, which prices shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing damaged (or missing) wood cross braces/stiffeners with rectangular FRP bars for Lower Nevada (Section 43 to 86) and Lower Arizona (Section 33 to 86) penstock tunnels will be made at the respective unit prices bid in the schedules, which

prices shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing damaged (or missing) corrugated fiberglass sheeting panels for Lower Nevada (Section 43 to 86) and Lower Arizona (Section 33 to 86) penstock tunnels will be made at the respective unit prices bid in the schedules, which prices shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

C.8.2. Repair Work, Collection System for Upper Penstocks

a. General.--Seepage through the concrete lining in the upper penstock tunnels is significantly less than in the lower penstock tunnels. In the initial contract in 1986, an overhead fiberglass canopy drainage collection system was not considered for the upper penstock tunnels. In lieu of the overhead canopy, a network of drainage troughs, fabricated out of half-sections of corrugated drainage tubing, PVC pipe couplings and fixtures, and polyethylene tubing was installed.

The Contractor shall inspect all components of the existing half-sections of corrugated drainage tubing which serve as drainage troughs. Those that leak onto the penstock pipe or walkway grating shall be removed and reinstalled with new stainless steel clamps and new stainless steel expansion anchors

b. Materials.--

(1) PVC pipe and fittings.--Schedule 40 pipe in accordance with ASTM D-1785 (1999), Schedule 40 PVC fittings in accordance with ASTM D-2466 (1999).

(2) Polyethylene tubing.--Two-inch nominal diameter polyethylene tubing in accordance with ASTM D-2737 (1999)

(3) Hanger straps.--The straps shall be of nylon, plastic or other non-corrosive materials.

(4) Concrete studs.--Concrete studs, if used, shall be ¼-inch diameter by 1-¼-inch long threaded studs. The studs shall be installed in the concrete by means of a 22-caliber stud driver. If the Contractor elects to use concrete studs, the Contractor must demonstrate to the satisfaction of the Contracting Officer that no excessive damage to the concrete will result from the use of this type of fastener. If this type of fastener proves unsatisfactory for any reason, it shall not be used and expansion shields or expansion anchors shall be used instead.

(5) If the Contractor elects to use expansion shields or expansion anchors, they shall be stainless steel, and shall be long enough to provide a minimum embedment in concrete of 1-½ inches. Expansion shields and expansion anchors shall meet the requirements of FF-S-325.

(6) Nuts and washers.--Stainless steel in accordance with ASTM F594 (1998) and ASME B18.22.1 (1998).

c. Installation.--Drawing No. 5 (45-300-834) shows typical gutter installations. Actual gutter lengths and configurations could vary from those shown. Following removal of the existing drainage collection system, the Contractor will be required to install gutters as directed by the Contracting Officer, to collect drainage from all leaks in the upper portion of the tunnel.

d. Payment.--Payment for furnishing and installing PVC drainage troughs in the Upper Nevada and Upper Arizona penstock tunnels will be made at the unit price bid per trough in the schedule, which price shall include the cost of all labor, materials, and incidentals required for performing the work as shown on the drawings and specified herein.

C.8.3. Repair Work, Existing Drainage (Weep) Holes

a. General.--A large number of the existing drainage (weep) holes in the four penstock tunnels and in the 16 penstock lateral tunnels are not fully functional. Some were improperly installed, some leak around the fittings, some have filled in with mineral deposits or silt, and some have had damage to the materials that has caused a failure.

In the large penstock tunnels, it is estimated that approximately 815 drainage holes are accessible. The majority of these weep holes are located between 2 feet to 10 feet above the walkways. The weep holes are approximately 4 feet in depth into the canyon wall and have 2-inch diameter PVC fittings epoxied into the concrete opening. The existing drain has a 2-inch diameter nylon fabric drainline attached with a plastic clip. Many of the nylon fabric drains and plastic clips have failed.

The Contractor shall remove and dispose of the plastic clips, the nylon fabric drain, and the existing fittings (PVC pipe in the majority but there are a few with badly corroded black iron pipe). The Contractor shall then redrill or ream out each weep hole to remove sediment and mineral deposits. Any debris shall be flushed out from the drainage holes using medium to high pressure water jets. The Contracting Officer will then inspect each weep hole to determine the extent of leakage, if any. The Contractor will then be directed to install new PVC fittings, 2-inch diameter polyethylene tubing, stainless steel hose clamps, and the appropriate non-corrosive mounting brackets and stainless steel anchors to attach to the concrete wall. As needed, the Contractor shall cut 2 ½-inch by 2 ½-inch square openings near the inside edge of the walkway grating to allow the respective polyethylene tube to pass a minimum of 5 feet below the walkway before discharging the drainage waters.

During the inspection of the weep hole, if the Contracting Officer determines that the existing weep hole can not be adequately repaired, the weep hole shall be filled with an expansive grout material and shall be abandoned.

If the Contracting Officer determines that an area has poor drainage after all existing weep holes have been refurbished, the Contractor will be directed to drill a new 2-inch diameter by 4-foot deep drain in the vicinity.

b. Drilling new drainage holes.--The Contractor will be required to drill approximately 50 new drainage holes in the four penstock tunnels and sixteen penstock lateral tunnels. The holes shall be drilled through the existing concrete tunnel lining in locations determined by the Contracting Officer.

The holes shall be approximately 2 inches in diameter (or as required to allow sufficient room for installation of insert elbows and a sufficient quantity of epoxy to form a strong bond between the concrete and the PVC fitting). The holes shall be drilled to an approximate depth of 4 feet. Actual hole depths may vary due to variations in the lining thickness or angle at which the holes are drilled. All holes shall be drilled completely through the concrete lining and shall terminate in the native rock. The holes shall be drilled in a workmanlike manner and shall be completed without chipping, cracking or otherwise damaging existing concrete which is to remain in place. Equipment used to drill drainage holes shall be subject to the approval of the Contracting Officer.

Clearance between the tunnel walls and the penstocks is approximately 3'-6" in the upper tunnels. Clearance in the 18-foot diameter penstock lateral tunnels is much less, perhaps 2'-0" to 2'-6" in most areas. More working space is available in the lower tunnels. Due to the limited operating space, the Contractor may be allowed to vary the angle of the holes slightly to gain additional operating room. Drilling the holes in stages using segmented bits will be an acceptable method of operation in the limited space.

c. PVC fittings.--Following the completion of refurbishing the existing drainage (weep) holes and the drilling of new weep holes, the Contractor shall install the PVC fitting and polyethylene tubing as shown on Information Drawing No. 5 (45-300-834).

d. Materials.--

(1) Schedule 40 PVC pipe and PVC pipe fittings.--Schedule 40 PVC pipe and Schedule 40 PVC pipe fittings shall be in accordance with ASTM D1785 (1999) and ASTM D2466 (1999), respectively.

(2) Polyethylene tubing.--Two-inch nominal diameter polyethylene tubing in accordance with ASTM D2737 (1999).

(3) Epoxy.--Epoxy shall meet the requirements of ACI 503.1 (1992/R1997).

(4) Stainless steel tubing clamps.--Tridon clamps, type 301 stainless steel worm gear clamps, 2 1/4-inch nominal size, Series 225, Marine Grade as manufactured by NewAge Industries, or equal. NewAge Indust, Inc., 145 James Way, Southhampton, PA 18966-3817, phone (215) 526-2300.

d. Payment.--Payment for all labor, materials and incidentals required for drilling drainage holes and furnishing and installing polyethylene tubing and pipe fittings, will be made at the unit price bid per drainage hole in the schedule for drilling drainage holes.

SUBSECTION C.9 - METALWORK

C.9.1. Miscellaneous Metalwork

a. General.--The item of the schedule for furnishing and installing miscellaneous metalwork includes furnishing and installing the following items of metalwork:

(1) Pipe handrails.--The Contractor shall replace approximately 200 linear feet (LF) of damaged handrail sections along existing walkways and stairways. The handrail sections are located randomly in the 4 penstock tunnels and the 16 penstock lateral tunnels. Handrailing is located along the outer edge of each walkway and on both sides of the majority of stairways. The specific locations of the damaged handrail sections are not shown on the drawings. The Contracting Officer will designate the sections of handrail to be replaced. The Contractor shall furnish and install the new handrail sections to match the existing adjacent handrail. Information drawings are included with the specifications that show the general configuration of all handrail sections, dimensions, and mounting details.

(2) Walkway grating.--The Contractor shall replace 230 damaged grating sections. The grating sections are located randomly in the 4 penstock tunnels and the 16 penstock lateral tunnels. The standard walkway widths vary from nominal dimensions of 36-inch, 42-inch, and 48-inch in the 4 penstock tunnels.

The Contractor shall also replace approximately 500 square feet of grating that include custom shapes (trapezoidal or triangular), narrow widths, extended lengths, etc.

The Contracting Officer will designate the damaged grating sections which are to be replaced. The Contractor shall be responsible for obtaining actual dimensions of items to be replaced and for furnishing and installing replacement items to match adjacent materials which are to remain in place.

(3) Stair steps.--The Contractor shall replace 30 individual stair steps on various stairways throughout the 4 penstocks tunnels. The nominal dimension for the standard stair treads are 11-inch by 36-inch. Information drawings are included with the specifications that show the general configuration of all stair treads, dimensions, and mounting details.

The Contractor shall replace 50 individual stair steps on the stairways throughout the 8 inclined penstock lateral tunnels. The nominal dimension for the standard stair treads are 11-inch by 19-inch. Information drawings are included with the specifications that show the general configuration of all stair treads, dimensions, and mounting details.

(4) Stairway and landing replacement.--Stairways S-A and S-1 and the landing section adjacent to the Lower Arizona Penstock Viewing Platform shall be completely removed and shall be reconstructed using all new materials. Replacement shall include stair treads, pipe handrailing, I-beams, channel iron, angle iron, stiffener plates, grating, and related hardware. Details are shown on Drawing Nos. 45-D-9525, -9530, -13323, and -13326.

(5) Expansion anchors, bolts, nuts, screws, capscrews, washers and accessory materials not otherwise provided for in these specifications.

b. Materials.--

(1) Structural steel.--ANSI/ASTM A36 (1997).

(2) Walkway gratings.--The Contractor shall furnish steel grating which has the same overall dimensions as the damaged grating which is being replaced. The grating shall be similar in appearance to the adjacent existing grating. Grating shall be similar or equal to Type W/B grating, size 4, with 1-inch by 3/16-inch bearing bars. Grating shall be galvanized.

(3) Expansion anchors.--Federal Specification FF-S-325, Group II, Type IV, Class 1 or 2. Where the length of the bolt is not indicated on the drawings, the bolt length shall be the minimum length recommended for that bolt diameter in the Federal Specification.

(4) Steel pipe.--ASTM A 53 (1999). Except where extra-strong pipe is called for on the drawings, pipe shall be standard-weight galvanized steel pipe.

(5) Bolts.--ASTM A 307 (1997). The length of bolt threads shall be in accordance with ASME B18.2.1 (1996). Threads shall be class 2 free fit, American National coarse-thread series.

(6) Nuts.--ASTM A 563 (1997).

(7) Washers.--ASME B18.22 (1998), steel or wrought iron washers, or ASTM F436 (1993), hardened steel washers.

(8) Miscellaneous metalwork required for the work and not specifically covered herein shall be of good commercial quality approved by the Contracting Officer.

c. Fabrication.--All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the type covered by these specifications, notwithstanding any omissions from these specifications or drawings. Fabrication of metalwork shall be in accordance with the applicable provisions of the latest AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" (1994), including all supplementary provisions and with the details shown on the drawings. All welding and work related thereto shall be performed in accordance with the latest edition of AWS "Structural Welding Code" (D1.1-1998). Before being laid off or worked, material shall be straight and free from sharp kinks and bends.

Shearing and cutting by torch or electric arc shall be performed carefully and all portions of the work which will be exposed to view after completion shall be finished neatly. After fabrication, all material shall be straight and true and free from kinks, twists, and warps. If straightening is necessary, it shall be done by methods that will not injure the metal. All welds on ladders, and handrailings shall be ground smooth.

Hot-dip galvanizing, where required after fabrication, shall be in accordance with the applicable provisions of ASTM A 123 (1997) and A 385 (1998).

d. Installation.--Stair steps, handrails and grating shall be installed in a rigid and workmanlike manner. After the installation is completed, the work shall be cleaned of all foreign material. Surfaces of miscellaneous metalwork, except galvanized surfaces, exposed after installation shall be painted in accordance with Paragraph C.10.1. (Painting, General).

Grating on the walkways shall be installed with adequate size nuts, bolts, and washers to secure the replacement grating section to the existing (adjoining) grating section and to the structural steel support member. The existing individual grating sections are attached together with 1/4-inch spacer plates to maintain uniformity. The Contractor shall be required to place 1/4-inch spacers as required for all new grating sections to prevent unnecessary gaps from developing and to maintain conformity with the existing quality of work.

e. Payment.--Payment for removing and replacing walkway grating sections will be made at the applicable unit prices bid in the schedules, which price shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing individual stairs on various stairways along the walkway sections will be made at the applicable unit prices bid in the schedules, which price shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing damaged sections of pipe handrailing for walkways and stairways will be made at the applicable unit prices bid in the schedules, which price shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

Payment for removing and replacing stairway, handrailing, landing, and structural steel support members, Arizona Viewing Platform, will be made at the lump sum price bid in Schedule No. 2, which price shall include the cost of all labor, materials, equipment, and incidentals required for performing the work as shown on the information drawings and specified herein.

SUBSECTION 10 - PAINTING

C.10.1. Painting and Coating, General

a. General. - The Contractor shall submit all purchase orders and certifications; furnish all materials; clean surfaces; and apply the approved protective coatings in accordance with this paragraph and paragraphs C.10.2. (Coating Tabulations and Categories) and C.10.3. (Coating Colors).

Coating materials required by these specifications, but not covered or listed in the coating tabulations, shall be subject to certification and testing in accordance with subparagraph c. (Coating Materials Approval) below. Methods of surface preparation and application shall be in accordance with the manufacturer's instructions and the general requirements of these specifications.

(1) Protection of newly coated and adjacent surfaces, and equipment. - Items or surfaces not to be coated, but which are adjacent to surfaces to be cleaned and coated, shall be protected against contamination and damage during the cleaning and coating operations. This includes surfaces and equipment which are subject to contact by airborne contaminants as well as those which are in physical contact with the areas being cleaned or coated.

(2) Coating system components shall be compatible products of the same manufacturer.

(3) Damage caused by the Contractor. - Any items or surfaces which in the Contracting Officer's opinion are damaged or contaminated by the Contractor's operations shall be returned to their original condition by and at the expense of the Contractor. Before top coating any coated surfaces, the Contractor shall reclean any exposed surfaces and apply coating materials as necessary to restore damaged or defective surfaces to the specified condition. Manufacturer-coated equipment shall be restored to the original appearance of the equipment by appropriate methods.

Temporary or permanent welding for the convenience of the Contractor shall not be permitted on areas where the welding will damage other protective coatings, unless the areas of coatings which would be damaged are accessible for repairing and inspection.

(4) Safety and health.--The Contractor shall develop, for this phase of work, a safety and health plan to include exposure monitoring, ventilation requirements, respirator use, work practices, lighting, and the necessary safety equipment for the protection of the workmen; and shall comply with all other applicable safety requirements during painting and coating operations. The Contractor shall submit in writing a proposed safety program in the form and time intervals prescribed in Section 2 of the RSHS.

All applicable Federal, state, and local requirements, and the manufacturer's recommended safety and health procedures, shall be followed when applying all coatings.

The Contractor's Safety Plan shall be tailored in accordance with county, state, and Federal regulatory guidelines. The Contractor shall be familiar with the additional sections of the Code of Federal Regulations (CFR) applicable to the services required by the Bureau of Reclamation for the Hoover Dam facilities as follows:

29 CFR 1910.34 -	Respiratory Protection
29 CFR 1910.38 -	Employee Emergency Plans and Fire Prevention Plans
29 CFR 1910.1000 -	Toxic and Hazardous Substances - Air Contaminants, Permissible Exposure Limits (PEL's)
29 CFR 1910.1020 -	Employee Access to Exposure and Medical Records.
29 CFR 1926.55 -	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59 -	Hazard Communication
29 CFR 1926.103 -	Respiratory Protection
40 CFR 261 -	Identification and Listing of Hazardous Waste
40 CFR 262 -	Standards Applicable to Generators of Hazardous Waste
40 CFR 263 -	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264 -	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

In case of conflict between reference standards listed above, the more stringent requirement will apply.

b. References. - The publications with the approval or revision date listed below form a part of this specification to the extent referenced:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

Standard	Title
D 522-93a	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
D 870-92	Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
D 1141-90 Reapproved -92	Standard Specification for Substitute Ocean Water

Standard	Title
D 2244-93	Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates
D 2697-86 Reapproved -91	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
D 3359-95a	Standard Test Methods for Measuring Adhesion by Tape Test
D 3363-92a	Standard Test Method for Film Hardness by Pencil Test
D 4214-97	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
D 4541-95	Standard Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers
D 4587-91	Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

Standard	Date Mo-Day-Yr	Title
SSPC-SP11	07-01-95	Surface Preparation Specification No. 11 - Power Tool Cleaning to Bare Metal
SSPC-PA2	06-01-96	Measurement of Dry Paint Thickness with Magnetic Gages
SSPC-VIS 3	07-01-95	GUIDE TO SSPC-VIS3, Visual Standard for Power- and Hand-Tool Cleaned Steel (Standard Reference Photographs)

JOINT STANDARD:

SOCIETY FOR PROTECTIVE COATINGS (SSPC)/NACE INTERNATIONAL (NACE)

Standard	Date Mo-Day-Yr	Title
SSPC-SP10/NACE No. 2	09-15-94	Joint Surface Preparation Standard - SSPC-SP10/NACE No. 1 - Near-White Blast Cleaning

c. Coating materials approval. -

(1) General. - The Contractor shall submit for approval, complete and legible copies of purchase orders and material certifications, as specified herein. Submittals shall be in accordance with paragraph C.1.3. (Submittal Requirements) and C.4.1. (Submittal of Material Safety Data Sheets (MSDS)); except that, at the Contractor's option, the RSN for coatings may be divided into several individual submittals composed of one or more materials. Each submittal will be reviewed for approval individually.

(2) Submittals. -

(a) Product data and application. - Manufacturer's product data and application sheets for coating material to be applied.

(b) Purchase orders. - Purchase orders shall contain the following information for the represented material:

(aa) Supplier's name, address, and phone number, purchase order number, and purchase order date.

(bb) Manufacturer's name, address, and phone number.

(cc) Batch number(s) for each material, except thinners.

(dd) Quantities ordered for each material, except thinners.

(ee) Color and gloss for each material.

(c) Manufacturer's certification of compliance. -

(aa) The certification shall state that the material is of the same composition and formulation as one of the following:

1. Material complies with these specifications based on complete performance tests which manufacturer has conducted previously and has conducted manufacturer's quality control (QC), quality assurance (QA) on the particular batch of material, assuring the Government that this batch is unchanged from previously tested batches.

2. Material meets coating manufacturer's QC and QA requirements and complies with manufacturer's published product data sheets and long-term product performance testing.

(bb) Manufacturer's certification of compliance for represented material shall contain following information:

1. Manufacturer's name, address, and phone number for each material.

2. Batch number(s) for each material, except thinners.

3. Quantities ordered for each material, except thinners.

(d) Specific material certification of compliance and documentation. - The Contractor shall submit the following specific manufacturer/supplier certification of compliance or other specific documentation for the following materials:

(aa) Abrasive materials. - Abrasive materials used in surface preparation shall be certified in accordance with subparagraph C.10.1.e. (Preparation of surfaces).

(e) "Or equivalent commercial" material substitution for atmospheric exposure. - Some coatings or coatings systems are specified using a Government specifications number followed by "or commercial equivalent." A commercial equivalent is a coating or coating system which will meet or exceed the specification coating on the specified feature and exposure conditions for application and the expected life cycle environment that the coating will be exposed to.

To obtain approval of a proposed substitution of commercial coatings in quantities of 20 gallons or less, the Contractor shall submit the following information:

(aa) Product and application data sheets.

(bb) Manufacturer's certifications of compliance stating the coating will meet or exceed the specified coating listed in the tabulation.

(cc) Items to coated listed by tabulation number, sub-letter, and sub-number.

(dd) 1-quart sample, if requested by the Government.

(f) Qualification of coating applicators.--Each coating applicator shall be skilled and experienced in the application of each coating material which they will apply under this contract.

d. Materials. - Materials shall meet or exceed the salient characteristics for composition, physical, and performance requirements listed in the coating categories in paragraph C.10.2. (Coating Tabulations and Categories).

(1) Containers. - All pigmented coatings and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer unless the Contractor is equipped at the coating site to handle and thoroughly mix coatings which are delivered in larger containers. All materials shall be delivered to the jobsite in their original unopened containers labeled with the manufacturer's name, brand, batch number, date of manufacture, and any special instructions.

(2) Colors and tinting. - Colors of finish coatings shall be in accordance with paragraph C.10.3. (Coating Colors). All colors and tints shall be prepared by the manufacturer. No tinting shall be permitted at the jobsite.

(3) Shelf life of coating material. - Coating material shall not be used that exceeds the manufacturer's minimum specified storage stability period and shall be removed from the jobsite.

(4) Volatile organic compounds (VOC). - The volatile organic compound (VOC) content of all specified coatings systems shall not exceed the maximum VOC content permitted by Federal, State, and local air pollution control regulations. VOC content shall be determined in accordance with ASTM D 2697. VOC content for the individual coatings or coating systems are listed in the coating categories and are identified as either "as supplied" or "reduced for spray." The addition of thinners to the coating material, if required, shall determine the maximum VOC allowable, not the "as supplied" VOC content. Thinning of coating material shall not exceed the allowable maximum VOC limit.

(5) Abrasives. - The abrasives used to prepare the specified surfaces shall meet the requirements of SSPC-AB 1, SSPC "Abrasive Specifications No. 1, Mineral and Slag Abrasives." The abrasives shall be either Type I or Type II, Class A material. The abrasive's grade shall be the grade required to produce the surface profiles specified or recommended by the manufacturer.

e. Preparation of surfaces. - For metallic or coated surfaces in which surface preparation has been completed but the substrate has flash rusted, corroded, become contaminated, or improperly cured, the Contractor shall re-clean or perform additional surface preparation to the required surface preparation, prior to coating application.

(1) Surface profile. -

(a) Specified surface profile. - Where abrasive blasting is specified for a given service environment, the profile shall be as recommended by either the coating's manufacturer(s) or as specified in the coating category or tabulation.

(b) Non-specified surface profile. - Where the surface profile is not specified, the blasted surface shall have the following profile for the listed service environments:

(aa) Atmospheric. - 1 mil or greater angular profile and shall be less than the specified millage of the first applied coat.

(bb) Burial and immersion. - Angular profile between 1.5 to 3-mils.

(2) Metalwork and equipment, except spot repair coatings on existing metalwork and equipment and Government furnished metalwork and equipment. - Surface preparation shall be in accordance with these specifications and as indicated in the coating tabulation. Any coatings not required by and not shown in the coating tabulation shall be removed from the

surfaces by suitable and effective means, unless otherwise directed. All surfaces not specifically covered shall be prepared by methods common to industry practices for the particular surface.

(a) Surface irregularities. - Weld spatter, slag burrs, porosity, sharp edges, pits, laminations, crevices, or other objectionable surface shall be removed or repaired before cleaning.

(b) Specific surface preparation. - Following removal or repair of surface irregularities, specific surface preparation shall be by the following method, as specified for each item in the coating tabulation:

Method C. - The surfaces of new (uncoated) structural steel components or the surfaces of existing structural steel components with damaged coated areas and prepared in accordance with SSPC-SP10/NACE No. 2, "Near-White Blast Cleaning." The abrasive blaster used for this work shall be equipped with an ON-OFF control at the nozzle. Abrasive blasting will be restricted to the affected areas, and abrasive blast damage to equipment and other coated surfaces shall be repaired by the Contractor.

In situations where abrasive blasting is impractical, the Contractor shall clean the metal surface to equal or exceed SSPC-SP11, "Power Tool Cleaning to Bare Metal." The surface preparation tools and media used to prepare the surfaces shall retain or produce a surface profile. Use of SSPC-VIS3 standard, SP3/PWB will be prohibited.

The Contractor shall feather the edges of existing sound coating surrounding the spot repaired areas to remove any abrupt edges and shall roughen the surface of the feathered coating being overcoated to achieve a matted or lusterless finish by brush blasting.

f. Application. -

(1) General material preparation and application. - Materials shall be thoroughly mixed at the time of application, and shall be clean and free from moisture.

All Contractor-applied coatings exposed to public view shall display a uniform texture and color-matched appearance.

Thinning of coatings to facilitate satisfactory application shall be kept to a minimum and shall not exceed 1 pint per gallon. Only manufacturer's approved thinners for the type of coating shall be used.

(2) Environmental temperatures and humidities. - The application and curing of individual coating systems shall be restricted within the maximum and minimum specified temperatures and relative humidities applicable to that coating system. The temperature and humidity limits shall be as defined on the coating category sheets or the manufacturer's product data sheets, whichever is more restrictive. Temperature and humidity restrictions are listed in Table 6-1 (Temperature and Humidity Restrictions) below. These restrictions shall apply and are

referenced by the corresponding number for specific materials listed in subparagraph C.10.1.f.(6) (Application of specific materials) below.

Table 6-1 - Temperature and Humidity Restrictions

Restriction No.	Description
1	For surfaces that are not thoroughly dry at application time, the substrate shall be heated to 80 degrees Fahrenheit, to drive off any moisture present before application.
2	The surfaces shall be a minimum of 5 degrees Fahrenheit above the dewpoint temperature at time of coating application and through the curing completion period.
3	Application shall not proceed unless the humidity of the atmosphere and the surface to be coated are such that evaporation rather than condensation will result.
4	Coatings shall not be applied when either the air or surface temperature is below 45 degrees Fahrenheit.
5	Surfaces shall be free of ice and ice crystals.
6	Application shall not be allowed on surfaces with free moisture.
7	Air and substrate temperatures shall be above 50 degrees Fahrenheit during application and the curing period.

(3) Recoating times at a reference temperature. - Coated surfaces that are to receive subsequent coats shall be recoated within a time frame window. Recoat windows at specified temperatures are provided in paragraph C.10.2. (Coating Tabulations and Categories) and the manufacturer's recommendations. For recoating at temperatures other than listed and fluctuating temperatures, the Contractor shall consult the coating manufacturer for adjusted recoat limits and curing times. Where the recoat limit has been exceeded, the Contractor shall follow surface preparation methods for the coated surface in accordance with the manufacturer's instructions.

(4) Spray application. - All air supply lines of spray equipment shall be free from oil and moisture. Spray equipment shall be equipped with pressure gauges and pressure regulators. Nozzle pressure shall be consistent to produce an atomized spray to form a continuous and uniform coating film. Spray equipment shall also be equipped with mechanical agitators.

(5) Coating application. - Each coat shall be applied to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the substrate or previous coat. Each coat shall be free from runs, pinholes, sags, laps, brush marks, voids, and other defects. Each coat shall be allowed to dry or to harden before the succeeding coat is applied.

(a) Primer coats. - Primer coats shall cover the peaks of the surface profile by the specified dry film thickness (DFT) listed in tabulations. Unless otherwise specified, primer coats shall be applied as follows:

(aa) Edge coats. - The first primer coat shall be an edge coat applied to edges, boltheads, welds, corners, and similar surfaces by brushing to thoroughly and effectively coat these areas. The coating material may be delivered to the surface by spraying and then "scrubbed in" by brushing.

(bb) General primer coats. - After the edge coat has been applied, primer coats shall be applied by conventional brush, roller, or spray equipment to all surfaces, including edge coated surfaces, to achieve a smooth, uniform coating.

(b) Intermediate coats and topcoats. - After the primer coat has been applied and cured, intermediate and topcoats, if specified, shall be applied in accordance to the applicable tabulation number for number of coats and thickness.

(6) Application of specific materials:

(a) Priming coats for atmospheric exposure only. - Priming coats shall be applied, unless otherwise specified in the coating tabulations or category sheets, at a DFT of not less than 1.0 mil for the first coat. Following the first coat of priming, an additional edge coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. The first coat shall be applied by brush or roller, and subsequent coats shall be applied by either brush, roller, or spray, except that priming coats may be applied by spraying when method B surface preparation is specified.

Temperature and humidity restrictions: 1, 2, 3, 4, 5, and 6

(b) Enamels for exterior exposure. - For ferrous surfaces, unless otherwise specified, enamels shall be spray applied to produce a minimum DFT of 1.5 mils per coat, and the total minimum DFT of the coating system shall be 4.0 mils.

Temperature and humidity restrictions: 1, 2, 3, 4, 5, and 6

(c) Epoxy coating for nonpotable water. - The epoxy coating shall be mixed and applied according to the manufacturer's instructions, except as otherwise specified. The first coat shall be applied by brush or roller over the areas listed below and succeeding coats by spray. Prior to applying the first coat, all welds and rough or irregular surfaces, including edges, shall be given a vigorously brushed coat to ensure complete coverage free of pinholes. The first general coat may then be sprayed over the wet brush coat. All coats shall be applied in rigid adherence to the manufacturer's time-temperature limits on time between coats. The minimum curing times before immersion shall be according to these specifications and the manufacturer's instructions.

Damaged areas or other areas requiring touchup coating shall be sanded to roughen the surface, and then the manufacturer's special instructions regarding special solvent wiping or other preparation for touch up repair shall apply; areas in which the specified drying time between coats is exceeded shall be treated and prepared by the same method.

Temperature and humidity restrictions: 1, 2, 3, 5, 6, and 7

(f) Weathering aliphatic polyurethane topcoats over epoxy coatings. - Weathering aliphatic polyurethane topcoats shall be mixed and applied according to the manufacturer's recommendations and to the manufacturer's compatible epoxy base coating, except as otherwise specified. Application should be applied within the epoxy base coating recoat "window." For application exceeding the epoxy base coating recoat "window," the base coat shall be abraded to the manufacturer's recommendations.

Temperature and humidity restrictions: 1, 2, 3, 5, 6, and 7

g. Testing. - The hardened coating shall be tested for acceptance by the applicable standards listed below for the following coating system exposure:

(1) All coating exposures (atmospheric, burial, and partial or complete immersion). - The dry film thickness (DFT) shall be measured on hardened completed coating systems, but before the recoating interval has been exceeded, on steel surfaces in accordance with SSPC-PA2, "Measurement of Dry Paint Thickness with Magnetic Gages," except that the third sentence of section 3.1 shall read " No single spot measurement in any 100 square foot area shall be less than 90% of the specified thickness." The least value readings on the bare substrate shall be used to specify the DFT measurement is taken from the peaks and not the valleys of surface profile. In accordance with section 3.2 of SSPC-PA2, irregular or complex shapes of areas less than 50 square feet per face shall have a minimum of three spot measurements taken.

The average of the five spot measurements and the average of the three spot measurements for irregular or complex shapes shall not be less than the specified thickness for DFT acceptance.

h. Repair of construction related defects. - Damaged areas, pinholes, holidays, laps, voids, or other defects shall be repaired within the minimum and maximum recoat window times in accordance with the coating manufacturer's recommendations and the applicable tabulation that the coating was applied. Repaired areas shall be retested. The cost of furnishing all materials and performing all work required in repairs of defective coatings shall be the responsibility of the Contractor.

i. Payment. - Payment for furnishing, preparing, and applying materials for cleaning or coating operations; for providing services of the coating manufacturer's representative where such services are required; shall be included in the lump sum price bid in the schedule for coatings.

C.10.2. Coating Tabulations and Categories

- a. General. - Items shall receive the cleaning, surface preparation, painting, and coating systems shown in the tabulations below. Paint and coatings shall be applied in accordance with Paragraph C.10.1. (Painting and Coating, General).
- b. Coating tabulations. - The tabulation specifies the items to be coated, the substrate surface, the coating or coating material options by an alphanumeric label, Federal or Military specification number, or "Brand" name, the number and thickness of coats to be applied, the surface preparation method, and the surface profile if different from general conditions. Within some coating options, there may be more than one coating category listed. The Contractor shall apply only one coating category per option. Individual system coats shall be compatible with the other applied coats, either primer, intermediate, or topcoat.
- c. Coating categories. - Specific coating categories referenced in the coating tabulations identify product name and manufacturer or Federal or Military specification and list the generic chemical composition, physical characteristics, and performance requirements.

Tabulation No. 21. -

The metal items* listed below shall be coated in accordance with the requirements of this tabulation.

Items to be coated:

- a. Structural steel; including I-beams, C-channels, angle iron, and steel plate for replacement of existing Stairways S-A and S-1
- b. Existing structural steel; including I-beams, C-channels, and angle iron that supports existing walkway grating. NOTE: (Only those areas that are beneath grating or individual stairway treads that are being removed and replaced shall be considered)
- c. Structural steel I-beam that supports ventilation fan, Lower Nevada Adit

Coating materials	Number and thickness of coats	Surface preparation method
Base coats: Category: IE-1C IE-1J	2 or more coats 4-mil DFT, minimum, per coat 8-mil DFT, minimum, plus edge coats	C
Finish coat(s): Category: IE-1CT over IE-1C IE-1DT over IE1J Match the compatible category "T" aliphatic polyurethane to the base coat used. (Colors and glosses as shown in the color schedule.)	1 or more coats of compatible "T" aliphatic polyurethane 3 to 4 mils DFT, minimum, for finish coat, per coat 11-mil DFT, minimum, for total system, excluding edge coats	Follow the Manufacturer's specific application instructions and/or specifications for surface preparation before applying next coat.
* Stainless steel items shall not be coated, unless specifically listed elsewhere in these tabulations, or otherwise specified.		

Category IE-1C

Category IE-1C coating system shall be:

Tnemec, Series 69, Hi-Build Epoxoline II; as manufactured by:

Tnemec Company, Inc.
PO Box 411749
Kansas City MO 64141
(816) 483-3400

or equal, having the following salient characteristics:

COMPOSITION:

Self-priming, two-component, polyamidoamine epoxy

PHYSICAL CHARACTERISTICS:

Volume solids:	67 percent, minimum
VOC (as supplied):	2.29 pounds per gallon (275 grams per liter), maximum
Minimum curing temperature:	50 degrees F
Surface application temperature above dew point:	5 degrees F, minimum
Mixed usable pot life at 77 degrees F:	4 hours, minimum
Maximum applied DFT per coat:	5 mils
Curing time at 75 degrees F:	Touch - 2 hours; Handle - 6 hours
Recoating time at 75 degrees F:	8 hours, minimum; 14 days, maximum; after 14 days abrade surfaces
Mixing ratio:	1 to 1, by volume
Application method:	Brush or roller (small areas only); conventional, or airless spray
Time before immersion after the final coat has been applied at 70 degrees F:	7 days, minimum

COATING SYSTEM PERFORMANCE REQUIREMENTS:

Fresh/Deionized water immersion test: (ASTM D 870)	passes 3,000 hour test with aerated water held at ambient temperatures with no blisters evident on either the 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 temperatures with no blisters evident on either the scribed or unscribed sides.
QUV Accelerated weathering test: (ASTM 4587, ASTM G 53)	passes 3,000 hour test with no blisters evident on either the scribed or unscribed sides, minimal chalking (ASTM D 4214) 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) (Elcometer)	greater than 500 psi
Tape adhesion: (ASTM D 3359)	equal to or better than 4A
Cathodic disbondment:	Has passed a recognized standard cathodic disbondment test.

Category IE-1CT is the weathering topcoat for this epoxy system, if one is specified.

Category IE-1J

Category IE-1J coating system shall be:

Bar-Rust 235, Multi-Purpose Epoxy; as manufactured by:

Devoe Coatings
4000 Dupont Circle
Louisville KY 40207
(502) 897-9861

or equal, having the following salient characteristics:

COMPOSITION:

Self-priming, two-component, modified polyamide amine epoxy

PHYSICAL CHARACTERISTICS:

Volume solids:	68 percent, minimum
VOC (as supplied):	2.4 pounds per gallon (292 grams per liter), maximum
Minimum curing temperature:	40 degrees F
Surface application temperature above dew point:	5 degrees F, minimum
Mixed usable pot life at 77 degrees F and 50 percent relative humidity:	3.5 hours, minimum
Maximum applied DFT per coat:	8 mils
Recoating time at 77 degrees F and 50 percent relative humidity:	5 hours, minimum; 1 month, maximum
Mixing ratio:	4 to 1, by volume
Application method:	Brush or roller (small areas only); conventional or heavy-duty airless spray (preferred)
Time before immersion after the final coat has been applied at 70 degrees F:	7 days, minimum

COATING SYSTEM PERFORMANCE REQUIREMENTS:

Fresh/Deionized water immersion test: (ASTM D 870)	passes 3,000 hour test with aerated water held at ambient temperatures with no blisters evident on either the 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 temperatures with no blisters evident on either the scribed or unscribed sides.
QUV Accelerated weathering test: (ASTM 4587, ASTM G 53)	passes 3,000 hour test with no blisters evident on either the scribed or unscribed sides, minimal chalking (ASTM D 4214) or color difference (ASTM D 2244).
Flexibility: (ASTM D 522, 180 degree bend over 1-inch mandrel)	passes
Pencil hardness: (ASTM D 3363)	3H, minimum
Pulloff Adhesion: (ASTM D 4541) (Elcometer)	greater than 500 psi
Tape adhesion: (ASTM D 3359)	equal to or better than 4A
Cathodic disbondment:	Has passed a recognized standard cathodic disbondment test.

Category IE-1DT is the weathering topcoat for this epoxy system, if one is specified.

Category IE-1CT

Category IE-1CT coating system shall be:

Tnemec, Series 75, Enduro-Shield; as manufactured by:

Tnemec Company, Inc.
PO Box 411749
Kansas City MO 64141
(816) 483-3400

or equal, having the following salient characteristics:

COMPOSITION:

Two-component, high-build, aliphatic, acrylic polyurethane enamel, topcoat

PHYSICAL CHARACTERISTICS:

Volume solids:	70 percent, minimum
VOC (as supplied):	2.11 pounds per gallon (253 grams per liter), maximum
Minimum curing temperature:	40 degrees F
Surface application temperature above dew point:	5 degrees F, minimum
Mixed usable pot life at 77 degrees F:	2 hours, minimum
Maximum applied DFT per coat:	5 mils
Curing time at 75 degrees F:	Touch - 1 hour; Handle - 6 hours
Recoating time at 75 degrees F:	8 hours, minimum; 14 days maximum
Mixing ratio:	4 to 1, by volume
Application method:	Brush, roller, conventional, or airless spray
Time before immersion after the final coat has been applied at 70 degrees F:	7 days, minimum

COATING SYSTEM PERFORMANCE REQUIREMENTS:

Fresh/Deionized water immersion test: (ASTM D 870)	passes 3,000 hour test with aerated water held at ambient temperatures with no blisters evident on either the 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 temperatures with no blisters evident on either the scribed or unscribed sides.
QUV Accelerated weathering test: (ASTM 4587, ASTM G 53)	passes 3,000 hour test with no blisters evident on either the scribed or unscribed sides, minimal chalking (ASTM D 4214) 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) (Elcometer)	greater than 500 psi
Tape adhesion: (ASTM D 3359)	equal to or better than 4A
Cathodic disbondment:	Has passed a recognized standard cathodic disbondment test, when applied over the specified epoxy base coat.

This is the weathering topcoat for Category IE-1C, if one is specified.

Category IE-1DT

Category IE-1DT coating system shall be:

Devthane 379, Aliphatic Urethane Gloss Enamel; as manufactured by:

Devoe Coatings
4000 Dupont Circle
Louisville KY 40207
(502) 897-9861

or equal, having the following salient characteristics:

COMPOSITION:

Two-component, aliphatic, polyurethane, topcoat

PHYSICAL CHARACTERISTICS:

Volume solids:	63 percent, minimum
VOC (as supplied):	2.6 pounds per gallon (311 grams per liter), maximum
Minimum curing temperature:	40 degrees F
Surface application temperature above dew point:	5 degrees F, minimum
Mixed usable pot life at 77 degrees F:	4 hours, minimum
Maximum applied DFT per coat:	3 mils
Recoating time at 80 degrees F and 50 percent relative humidity:	3 hours, minimum; 24 hours, maximum
Mixing ratio:	4 to 1, by volume
Application method:	Brush, roller, conventional, or airless spray
Time before immersion after the final coat has been applied at 70 degrees F:	6 days, minimum

COATING SYSTEM PERFORMANCE REQUIREMENTS:

Fresh/Deionized water immersion test: (ASTM D 870)	passes 3,000 hour test with aerated water held at ambient temperatures with no blisters evident on either the 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 temperatures with no blisters evident on either the scribed or unscribed sides.
QUV Accelerated weathering test: (ASTM 4587), ASTM G 53)	passes 3,000 hour test with no blisters evident on either the scribed or unscribed sides, minimal chalking (ASTM D 4214) 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) (Elcometer)	greater than 500 psi
Tape adhesion: (ASTM D 3359)	equal to or better than 4A
Cathodic disbondment:	Has passed a recognized standard cathodic disbondment test, when applied over the specified epoxy base coat.

This is the weathering topcoat for Category IE-1D, IE-1E, IE-1F, and IE-1J, if one is specified.

C.10.3. Coating Colors

The colors of the finish coat for all structural steel, new or existing, shall be black. Exceptions will be made when existing coating colors are a different color. For colors, other than black, the Contractor shall obtain an accurate match of color. Color of primer may be white, gray, rust-color, or black. Gloss of the final coating shall be a full gloss (G).

SUBSECTION 11--DRAWINGS

C.11.1. Drawings, General

- a. General.--Specifications and details shown on drawings which are not applicable under these specifications shall be disregarded. In the event there are minor differences as determined by the Contracting Officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.
- b. Additional or revised drawings.--Except as otherwise provided in these specifications for drawings to be furnished by the Contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the Contractor shall do no work without proper drawings and instructions. The additional or revised general and detail drawings furnished by the Government will show dimensions and details necessary for construction purposes more completely than are shown on the specifications drawings for all features of the work and for equipment and other metalwork not yet purchased. The Contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.
- c. Additional copies of drawings.--The Contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work. Full-size contact prints of the original drawings from which the attached reproductions were made will be furnished to the Contractor for construction purposes upon request. The number of prints of each drawing furnished to the Contractor will be limited to 2 contact prints and 1 reproducible.
- d. Mailing address.--All drawings and data submitted by the Contractor for which a specific mailing address is not given in these specifications shall be submitted to the Bureau of Reclamation, Regional Engineer (LC-6000), Lower Colorado Regional Office, P.O. Box 61470, Boulder City, Nevada 89006-1470.

C.11.2. List of Drawings

The following drawings are made a part of these specifications.

Penstock Tunnel Repairs
Hoover Dam and Powerplants
Lower Colorado Dams Facilities Office
Boulder Canyon Project
Arizona-Nevada

Information Drawings

Sheet No.	Drawing No.	Drawing Title
1.	45-300-830	Location Map
2.	45-300-831	Lower Arizona-Nevada, Plan - Section - Details - View
3.	45-300-832	Lower Arizona-Nevada, Plan - Sections - Elevations - Views
4.	45-300-833	Lower Arizona-Nevada, Details
5.	45-300-834	Upper Arizona-Nevada, Plans - Sections - Details
6.	45-300-835	Upper Arizona-Nevada, Plan - Sections - Elevations - Views
7.	45-300-836	Upper Arizona-Nevada, Plans - Details
8.	45-D-2246	Penstock and Outlet Tunnels - General Layout
9.	45-D-2303	Upper Arizona and Nevada Tunnels - Anchor and Thrust Blocks
10.	45-D-2304	Lower Arizona and Nevada Tunnels - Anchor and Thrust Blocks
11.	45-D-8231	Upper Arizona Tunnel - General Arrangement
12.	45-D-8232	Upper Nevada Tunnel - General Arrangement
13.	45-D-8244	Upper Arizona Tunnel, Tunnel Walkway - Units at 30' Pipe
14.	45-D-8245	Upper Arizona Tunnel, Tunnel Walkway - Units UA-4, UA-6, UA-14,UA-20 and UA-26
15.	45-D-8246	Upper Arizona Tunnel, Tunnel Walkway - Units UA-8, UA-18, and UA-22
16.	45-D-8249	Upper Arizona Tunnel, Tunnel Walkway - Units at 25' Pipe
17.	45-D-8253	Upper Nevada Tunnel, Tunnel Walkway - Miscellaneous Units
18.	45-D-8254	Upper Nevada Tunnel, Tunnel Walkway - Unit UN-6
19.	45-D-8255	Upper Nevada Tunnel, Tunnel Walkway - Unit UN-10

Sheet No.	Drawing No.	Drawing Title
20.	45-D-8257	Upper Arizona Tunnel, Tunnel Walkway - Connection to Penstock Lateral A1 - General Arrangement
21.	45-D-8259	Upper Arizona and Nevada Tunnels - Tunnel Walkway - Units in Penstock Laterals Above Anchor No. 2
22.	45-D-8260	Upper Arizona and Nevada Tunnels - Tunnel Walkway - Units in Penstock Laterals Below Anchor No. 2 - A1, N2, N4, N6, and N8
23.	45-D-8261	Upper Arizona and Nevada Tunnels - Tunnel Walkway - Typical Units in Penstock Laterals - A1, N2, N4, N6, and N8
24.	45-D-8262	Upper Arizona and Nevada Tunnels - Tunnel Walkway - Units in Penstock Laterals Above Anchor No. 1 - A1, N2, N4, N6, and N8
25.	45-D-8275	Upper Arizona and Nevada Tunnels - Tunnel Walkway - Units UA41 and UN45 Treads and Special Grating
26.	45-D-8276	Upper Arizona Tunnel - Tunnel Walkway Handrail Units UAR1 to UAR7
27.	45-D-8279	Upper Nevada Tunnel - Tunnel Walkway Miscellaneous Handrail Units
28.	45-D-9093	Penstock Tunnels, Ventilating System General Arrangement
29.	45-D-9096	Penstock Tunnels, Ventilating System Profile - Lower Arizona Tunnel
30.	45-D-9097	Penstock Tunnels, Ventilating System Profile - Lower Nevada Tunnel
31.	45-D-9513	Lower Arizona Tunnel - Tunnel Walkway General Arrangement
32.	45-D-9514	Lower Nevada Tunnel - Tunnel Walkway General Arrangement
33.	45-D-9522	Lower Arizona Tunnel - Tunnel Walkway Miscellaneous Units
34.	45-D-9525	Lower Arizona Tunnel - Tunnel Walkway Units LA13, LA14, and LA15
35.	45-D-9530	Lower Arizona Tunnel - Tunnel Walkway Stairs S1 and S2 at Contractor's Adit

Sheet No.	Drawing No.	Drawing Title
36.	45-D-9543	Lower Nevada Tunnel - Tunnel Walkway Units LN 42 and LN44
37.	45-D-9544	Lower Nevada Tunnel - Tunnel Walkway Units LN43, LN45, LN46, and LN47 Stair Treads and Grating
38.	45-D-9545	Lower Nevada Tunnel - Tunnel Walkway Units LN48, LN49, and LN50
39.	45-D-9548	Lower Arizona and Nevada Tunnels - Tunnel Walkway - Handrail Units
40.	45-D-13323	Lower Arizona Penstock Tunnel Observation Platform - Plan - Elevation
41.	45-D-13326	Lower Arizona Penstock Tunnel Observation Platform - Stair SA - Stair Treads
42.	45-301-4564	Portable Work Platform for 50' diameter Penstock Tunnels - Elevation
43.	45-301-4565	Portable Work Platform for 50' diameter Penstock Tunnels - Plan - Elevation
44.	45-301-4566	Portable Work Platform for 50' diameter Penstock Tunnels - Details
45.	45-301-4567	Portable Work Platform for 50' diameter Penstock Tunnels - Details

Attachment No. 2

Drawings

**[Not available online -
Contact issuing office at
(702) 293-8588 for copies]**