

**CONTRACT DOCUMENTS
AND
SPECIFICATIONS
FOR
PROJECT NO. TMUA-W 19-01
EUCHA DAM ANCHORING**

ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

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Volume II

**CONSTRUCTION SPECIFICATIONS
AND CONTRACT DOCUMENTS
FOR**

**EUCHA DAM
ANCHORING
TMUA-W 19-01**

ISSUE FOR BID

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Prepared by



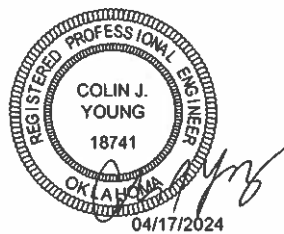
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Tulsa, Oklahoma 74135
TUL19780**

TULSA METROPOLITAN UTILITY AUTHORITY

**EUCHA DAM ANCHORING
TMUA-W 19-01**

CONSTRUCTION SPECIFICATIONS AND CONTRACT DOCUMENTS

ISSUE FOR BID



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01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Construct Work as described in the Contract Documents.
 - 1. Provide the materials, equipment, and incidentals required to complete the Project per the Plans and Specifications.
 - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.

1.02 DESCRIPTION OF WORK

- A. Work is described in general, non-inclusive terms as:
 - 1. Installation of 96 post-tensioned strand anchors at Eucha Dam. This includes (72) anchors with a range of 33-40 strands per anchor in the overflow section (depths ranging from 100 feet to 158 feet); (20) 40-strand anchors in the gated spillway section (depths ranging from 120 to 125 feet); and (4) 40-strand anchors in the non-overflow section (depths ranging from 166 feet to 171 feet).
 - 2. Anchor installation includes any temporary measures such as rails, scaffolding, platforms, etc. needed to facilitate anchor installation at all specified locations.
 - 3. Limited concrete work to include filling of anchor head holes back to original lines and grades after anchor testing and completion.
 - 4. Environmental controls to prevent drill cuttings, fuels, lubricants, construction debris or other construction-related environmental contaminants from entering Lake Eucha or Spavinaw Creek.

1.03 WORK UNDER OTHER CONTRACTS

- A. Owner has no knowledge of work, other than the Work included in this Contract, which may impact construction scheduling, testing, and startup.

1.04 WORK BY OWNER

- A. Owner will provide normal operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.05 NOMINATED SUBCONTRACTOR (NOT USED)

1.06 DEFINITIONS

- A. *Construction Manager* – The individual or entity names as Construction Manager below and the consultants, subconsultants, individuals, or entities directly or indirectly employed or retained by them to provide construction management as advisor services to Owner.

1. The Construction Manager for this Project is:

Freese and Nichols

B. *Owner's Project Team (OPT)* – The Owner, Design Professional, Construction Manager, and the consultants, subconsultants, individuals or entities directly or indirectly employed or retained by them to provide services to Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials and products per individual Sections of the Specifications.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 26 00 CHANGE MANAGEMENT

PART 1 - GENERAL

1.01 REQUESTS FOR CHANGE PROPOSAL

- A. Construction Manager will initiate Modifications by issuing a Request for Change Proposal (RCP).
 - 1. Construction Manager and Design Professional will prepare a description of proposed Modifications.
 - 2. Construction Manager will issue the Request for Change Proposal form to Contractor. A number will be assigned to the Request for a Change Proposal when issued.
 - 3. Contractor will return a Change Proposal in accordance with Paragraph 1.02 for evaluation by the OPT.

1.02 CHANGE PROPOSALS

- A. Contractor will submit a Change Proposal (CP) to the Construction Manager for Contractor proposed changes in the Contract Documents or in response to a Request for Change Proposal. Submit the Change Proposal and attach the forms provided by the Construction Manager.
 - 1. Use the Change Proposal form provided by the Construction Manager.
 - 2. Include with the Change Proposal:
 - a. A complete description of the proposed Modification if Contractor initiated or proposed changes to the OPT's description of the proposed Modification.
 - b. The reason the Modification is requested, if not in response to a Request for a Change Proposal.
 - c. A detailed breakdown of the cost of the change if the Modification requires a change in Contract Price. The itemized breakdown is to include:
 - 1) List of materials and equipment to be installed;
 - 2) Man hours for labor by classification;
 - 3) Equipment used in construction;
 - 4) Consumable supplies, fuels, and materials;
 - 5) Royalties and patent fees;
 - 6) Bonds and insurance;
 - 7) Overhead and profit;
 - 8) Field office costs;
 - 9) Home office cost; and
 - 10) Other items of cost.

- d. Provide the level of detail outlined in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outlined in the paragraph above for self-performed Work.
 - e. Submit Change Proposals that comply with the General Conditions for Cost of Work.
 - f. Provide a revised schedule. Show the effect of the change on the Project Schedule and the Contract Times.
- B. Submit a Change Proposal to the Construction Manager to request a Field Order.
 - C. A Change Proposal is required for all substitutions or deviations from the Contract Documents.
 - D. Request changes to products in accordance with Section 01 33 02 "Shop Drawings."

1.03 CONSTRUCTION MANAGER WILL EVALUATE THE REQUEST FOR A MODIFICATION

- A. Construction Manager will issue a Modification per the General Conditions if the Change Proposal is acceptable to the Owner. Construction Manager will issue a Change Order or Contract Amendment for any changes in Contract Price or Contract Times.
 - 1. Change Orders and Contract Amendments will be sent to the Contractor for execution with a copy to the Owner recommending approval. A Work Change Directive may be issued if Work needs to progress before the Change Order or Contract Amendment can be authorized by the Owner.
 - 2. Work Change Directives, Change Orders, and Contract Amendments can only be approved by the Owner.
 - a. Work performed on the Change Proposal prior to receiving a Work Change Directive or approval of the Change Order or Contract Amendment is performed at the Contractor's risk.
 - b. No payment will be made for Work on Change Orders or Contract Amendments until approved by the Owner.
- B. Contractor may be informed that the Change Proposal is not approved and construction is to proceed in accordance with the Contract Documents.

1.04 EQUAL NON-SPECIFIED PRODUCTS

- A. The products of the listed manufacturers are to be furnished where the Specifications list several manufacturers and do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution. Follow the procedures in Paragraph 1.05 for a substitution.
- B. Contractor may submit other manufacturers' products that are in full compliance with the Specifications where Specifications list one or more manufacturers followed by the phrase "or equal" or "or approved equal."

1. Submit a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to document that the proposed product is equal or superior to the specified product.
 2. Prove that the product is equal. It is not the OPT's responsibility to prove the product is not equal.
 - a. Indicate on a point-by-point basis for each specified feature that the product is equal to the Contract Document requirements.
 - b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the Shop Drawing.
 - c. The decision of the Design Professional regarding the acceptability of the proposed product is final.
 3. Provide a certification that, in furnishing the proposed product as an equal, the Contractor:
 - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
 - b. Has determined that the product will perform in the same manner and result in the same process as the specified product.
 - c. Will provide the same warranties and/or bonds as for the product specified.
 - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.
 - e. Will maintain the same time schedule as for the specified product.
- C. A Change Proposal is not required for any product that is in full compliance with the Contract Documents. If the product is not in full compliance, it may be offered as a Substitution.

1.05 SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product. Submit a Change Proposal per Paragraph 1.02] along with documents required for a Shop Drawing as required by Specification Section 01 33 02 to request approval of a substitution.
- B. Prove that the product is acceptable as a substitute. It is not the Design Professional's responsibility to prove the product is not acceptable as a substitute.
 1. Indicate on a point-by-point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
 2. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the Shop Drawing.
 3. The decision of the Design Professional regarding the acceptability of the proposed substitute product is final.

- C. Provide a certification that, in making the substitution request, the Contractor:
1. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product;
 2. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the manufacturer of the specified product;
 3. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent; and
 4. Will maintain the same time schedule as for the specified product.
- D. Pay for excessive review of substitutions in accordance with Section 01 33 02 "Shop Drawings."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 00 APPLICATION FOR PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Applications for Payment for completed Work and for materials and equipment in accordance with the Contract Documents and Specifications, and this Section. The Contract Price is to include costs for:
1. Providing the Work in accordance with the Contract Documents;
 2. Providing Work for alternates and allowances, if any;
 3. Providing Work for extra work items, if any and if authorized
 4. Acceptance testing at the manufacturer's facilities or at the Site;
 5. All home office overhead costs and expenses, including profit made directly or indirectly from the Project;
 6. Project management, contract administration, and field office and field operations staff including supervision, clerical support, and technology system support;
 7. Professional services including design fees, legal fees, and other professional services;
 8. Bonds and insurance;
 9. Permits, licenses, patent fees, and royalties;
 10. Taxes;
 11. Providing all documentation and Samples required by the Contract Documents;
 12. Facilities and equipment at the Site including:
 - a. Field offices, office furnishings, and all related office supplies, software, and equipment,
 - b. Storage facilities for Contractor's use and storage facilities for stored materials and equipment including spare parts storage,
 - c. Shops, physical plant, construction equipment, small tools, vehicles, and technology and telecommunications equipment,
 - d. Safety equipment and facilities to provide safe access and working conditions for workers and for others working at the Site,
 - e. Temporary facilities for power and communications,
 - f. Potable water and sanitation facilities, and
 - g. Mobilization and demobilization for all these facilities and equipment.
 13. Products, materials, and equipment stored at the Site or other suitable location in accordance with Section 01 31 00 "Project Management and Coordination";
 14. Products, materials, and equipment permanently incorporated into the Project;

15. Temporary facilities for managing water including facilities for pumping, storage, and treatment as required for construction and protection of the environment;
 16. Temporary facilities for managing environmental conditions and Constituents of Concern;
 17. Temporary facilities such as sheeting, shoring, bracing, formwork, embankments, storage facilities, working areas, and other facilities required for construction of the Project;
 18. Temporary and permanent facilities for protection of all overhead, surface, or underground structures or features;
 19. Temporary and permanent facilities for removal, relocation, or replacement of any overhead, surface, or underground structures or features;
 20. Products, materials, and equipment consumed during the construction of the Project;
 21. Contractor labor and supervision to complete the Project including that provided through Subcontractors or Suppliers;
 22. Correcting Defective Work during the Contract Times, during the Correction Period, or as required to meet any warranty provision of the Contract Documents;
 23. Risk associated with weather and environmental conditions;
 24. Contractor safety programs, including management, administration, and training;
 25. Warranties;
 26. Cleanup and disposal of any and all surplus materials; and
 27. Demobilization of all physical, temporary facilities not incorporated into the Project.
- B. Include the cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price.
- C. Provide written approval of the surety company providing performance and payment bonds for the Schedule of Values, Application for Payment form, and method of payment prior to submitting the first Application for Payment. Submit approval using the "Consent of Surety Company to Payment Procedures" form provided by the Construction Manager. Payment will not be made without this approval.
- D. Construction Manager may withhold processing the Applications for Payment if any of the following processes or documentation is not up to date:
1. Progress Schedule per Section 01 33 05 "Construction Progress Schedule."
 2. Project videos and photographs per Section 01 33 06 "Graphic Documentation."
 3. Record Documents per Section 01 31 13 "Project Administration."

1.02 SCHEDULE OF VALUES

- A. Divide the Contract Price into an adequate number of line items to allow more accurate determination of the earned value for each line item when evaluating progress payments. Submit a detailed Schedule of Values for the Project at least 10 days prior to submitting the first Application for Payment using forms provided by the Construction Manager.

- B. Do not apply for payment until the Schedule of Values has been approved by the Construction Manager.
- C. Divide the cost associated with each line item in the Schedule of Values into installation and materials components.
 - 1. Installation cost is to include all cost associated with the line item except materials cost.
 - 2. Materials cost is the direct cost (as verified by invoice values) for products, materials, and equipment to be permanently incorporated into the Project associated with the line item.
 - 3. Installation cost is to include all direct costs and a proportionate amount of the indirect costs for the Work associated with each line item. Include costs not specifically set forth as an individual payment item but required to provide a complete and functional system.
 - 4. The sum of materials and installation costs for all line items must equal the Contract Price.
- D. Use each unit price line item in the Bid Form as a line item in the Schedule of Values. The sum of materials and installation costs for each line item for unit price contracts must equal the value of the line item in the Bid Form. In addition to the installation cost described in Paragraph 1.02.C.3, installation costs for unit price items are to include costs for waste and overages.
 - 1. Installation and materials cost may be left as a single installation component if:
 - a. Contractor does not intend to request payment for stored materials for that line item; or
 - b. Work in the line item will be completed within a single payment period.
 - 2. Provide adequate detail to allow a more accurate determination of the earned value for installation costs, expressed as a decimal fraction of Work completed, for each line item.
 - 3. Installation cost line items may not exceed \$50,000.00. Items that are not subdivided into smaller units may only be included in the Application for Payment when Work on the entire unit is complete.
 - 4. Lump sum items may be divided into an estimated number of units to estimate earned value. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
 - 5. Include Contractor's overhead and profit in the installation costs each line item in proportion to the value of the line item to the Contract Price.
 - 6. Include cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price for each item.
 - 7. Line items may be used to establish the value of Work to be added or deleted from the Project.
- E. Include a breakdown of both mobilization and demobilization costs in the Schedule of Values. The total cost for both mobilization and demobilization may not exceed five

percent of the total Contract Price. Payment for mobilization and demobilization will be based on the earned value of Work completed. Payment for these costs will only be made for Work completed for the following:

1. Bonds and insurance;
2. Transportation and setup for equipment;
3. Transportation and/or erection of all field offices, sheds, and storage facilities;
4. Salaries for preparation of documents required before the first Application for Payment; and
5. Salaries for field personnel directly related to the mobilization of the Project.

1.03 SCHEDULE OF ANTICIPATED PAYMENTS

- A. Submit a schedule of the anticipated Application for Payments showing the anticipated application numbers, submission dates, and the amount to be requested for each Application for Payment on the form provided by the Construction Manager.
- B. Update the schedule of anticipated payments as necessary to provide a reasonably accurate indication of the funds required to make payments each month to the Contractor for Work performed.

1.04 ALLOWANCES AND EXTRA WORK ITEMS

- A. Include line items and amounts for specified allowances for Work in the Agreement, if any, and as described in Section 01 29 01 "Measurement and Basis for Payment."
- B. Include line items and amounts for Extra Work items in the Agreement, if any, and as described in Section 01 29 01 "Measurement and Basis for Payment."

1.05 RETAINAGE

- A. Retainage will be withheld from each Application for Payment per the Contract.

1.06 PROCEDURES FOR SUBMITTING AN APPLICATION FOR PAYMENT

- A. Submit a draft Application for Payment to the Construction Manager each month at least 20 days before the date established in the Contract for Owner to make progress payments. Do not submit Applications for Payment more often than monthly. Review the draft Application for Payment with the Construction Manager to determine concurrence with:
 1. Values requested for materials and equipment, stored or incorporated into the Project as documented by invoices;
 2. The earned value for installation costs for each line item in the Application for Payment form expressed as a percent complete for that line item;
 3. The quantity of Work completed for each unit price item;
 4. Amount of retainage to be withheld.
- B. Submit Applications for Payment to the Construction Manager after agreement has been reached on the draft Application for Payment with the Construction Manager.

- C. Provide all information requested in the Application for Payment form. Do not leave any blanks incomplete. If information is not applicable, enter "N/A" in the space provided.
1. Number each application sequentially and include the dates for the application period.
 2. Complete the "Contract Time Summary" section on the Application for Payment form. If the Final Completion date shows the Project is more than 30 days behind schedule, revise the Schedule of Anticipated Payments to correspond to the updated schedule required per Section 01 33 05 "Construction Progress Schedule."
 3. Complete the "Summary of Earned Value and Set-offs" section on the Application for Payment form. Show the total amounts for earned value of original Contract performed, earned value for Work on approved Contract Amendments and Change Orders, retainage and set-offs.
 4. Sign and date the Contractor's Certification on the Application for Payment form that all Work, including materials, covered by this Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous Payment has been made by the Owner, and that the current payment amount shown in this Application for Payment is now due.
 5. Include "Attachment A - Tabulation of Earned Value of Original Contract Performed" to show the value of materials stored and successfully incorporated into the Project and the earned value for installation of the Work for each line item in the Application for Payment for Work. Attachment A includes Work on the original Contract Price and on approved Contract Amendments and Change Orders.
 6. Include "Attachment B - Tabulation of Values for Materials and Equipment" to track invoices used to support amounts requested as materials in Attachment A. Enter materials to show the amount of the invoice assigned to each item in Attachment A if an invoice includes materials used on several line items.
 7. Include "Attachment C - Summary of Set-offs" to document set-offs made per the Contract Documents. Show each set-off as it is applied. Show a corresponding line item to reduce the set-off amount if a payment held by a set-off is released for payment.
 8. Include "Attachment D - Retainage Calculation" to show method for calculating retainage. The amount of retainage with respect to progress payments is stipulated in the Agreement. Any request for a reduction in retainage must be accompanied by a Consent of Surety to Reduction or Partial Release of Retainage.
 9. Include "Attachment E - EVA Calculation" and the EVA Chart showing the anticipated and actual total earned value of fees, Work, and materials. Create a graphic representation (curve) of the anticipated progress on the Project each month. Compare the anticipated cumulative total earned value of fees, Work, and materials to the actual total earned value of fees, Work, and materials to determine performance on budget and schedule. Adjust the table and curve to incorporate Modifications.
- D. Submit attachments in Portable Document Format (PDF).
1. Generate attachments to the Application for Payment using the Excel spreadsheet provided by the Construction Manager.

2. Submit PDF documents with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.

1.07 ADJUSTMENTS TO THE SCHEDULE OF VALUES IN THE APPLICATION FOR PAYMENT

- A. Submit a Change Proposal to request any changes to the Schedule of Values incorporated into the Application for Payment once approved. A Field Order will be issued by the Construction Manager to modify the Application for Payment form if approved.
- B. Payment for materials and equipment shown in the Application for Payment will be made for the total of associated invoice amounts, up to the value shown for materials in the Application for Payment for that line item.
 1. If the total amount for invoices for materials and equipment for a line item are less than the amount shown for the materials component of that line item in the Application for Payment, and it can be demonstrated that no additional materials or equipment are required to complete Work described in that item, the difference between the total invoice for materials and equipment and the materials component for that line item can be added to the installation component of that Work item.
 2. Costs for material and equipment in excess of the value shown in the Schedule of Values may not be paid for under other line items.

1.08 CONSTRUCTION MANAGER'S RESPONSIBILITY

- A. Construction Manager will review each draft Application for Payment with Contractor to reach an agreement on the amount to be recommended to Owner for payment. Contractor is to revise the Application for Payment to incorporate changes, if any, resulting from this review process.
- B. Construction Manager will review the Application for Payment to determine that the Application for Payment has been properly submitted and is in accordance with the agreed to draft Application for Payment.
- C. Construction Manager will either recommend payment of the Application for Payment to Owner or notify the Contractor of the reasons for not recommending payment. Contractor may make necessary corrections and resubmit the Application for Payment. Construction Manager will review resubmitted Application for Payment and reject or recommend payment of the Application for Payment to Owner as appropriate.
- D. Construction Manager's recommendation of the Application for Payment constitutes a representation that based on its experience and the information available:
 1. The Work has progressed to the point indicated;
 2. The quality of the Work is generally in accordance with the Contract Documents; and
 3. Requirements prerequisite to payment have been met.
- E. This representation is subject to:
 1. Further evaluation of the Work as a functioning whole;
 2. The results of subsequent tests called for in the Contract Documents; or

3. Any other qualifications stated in the recommendation.
- F. Construction Manager does not represent by recommending payment that:
1. Inspections made to check the quality or the quantity of the Work as it was performed were exhaustive or extended to every aspect of the Work in progress; or
 2. Other matters or issues that might entitle Contractor to additional compensation or entitle Owner to withhold payment to Contractor exist.
- G. Neither Construction Manager's review of Contractor's Work for the purposes of recommending payments nor Construction Manager's recommendation of payment imposes responsibility on the Construction Manager or Owner:
1. To supervise, direct, or control the Work;
 2. For the means, methods, techniques, sequences, or procedures of construction, or safety precautions and programs;
 3. For Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 4. To make examinations to ascertain how or for what purposes Contractor has used the monies paid on account of the Contract Price; or
 5. To determine that title to the Work, materials, or equipment has passed to Owner free and clear of Liens.

1.09 FINAL APPLICATION FOR PAYMENT

- A. Include adjustments to the Contract Price in the final Application for Payment for:
1. Approved Change Orders and Contract Amendments;
 2. Allowances not previously adjusted by Change Order;
 3. Deductions for Defective Work that have been accepted by the Owner;
 4. Penalties and bonuses;
 5. Deduction for all final set-offs; and
 6. Other adjustments if needed.
- B. Construction Manager will prepare a final Change Order reflecting the approved adjustments to the Contract Price which have not been covered by previously approved Change Orders and, if necessary, to reconcile estimated unit price quantities with actual quantities.
- C. Submit the final Application for Payment per the General Conditions, including the final Change Order. Provide the following with the final Application for Payment:
1. Evidence of payment or release of Liens on the forms provided by the Construction Manager and as required by the General Conditions.
 2. Consent from surety to final payment.
- D. Final payment will also require additional procedures and documentation per Section 01 70 00 "Execution and Closeout Requirements."

1.10 PAYMENT BY OWNER

- A. Owner is to pay the amount recommended for monthly payments within 30 days after receipt of the Construction Manager's recommended Application for Payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 01 MEASUREMENT AND BASIS FOR PAYMENT

PART 1 - GENERAL

1.01 PAYMENT FOR MATERIALS AND EQUIPMENT

- A. Payment will be made for materials and equipment properly stored and successfully incorporated into the Project less the specified retainage.
- B. Provide a bill of sale, invoice, or other documentation warranting that Owner has received the materials free and clear of Liens. Provide documentation of payment for materials with the next Application for Payment. Remove items from the tabulation of materials if this documentation is not provided with the next Application for Payment.
- C. Provide evidence that the materials are covered by appropriate property insurance or other arrangements to protect Owner's interest.
- D. The Work covered by progress payments becomes the property of the Owner at the time of payment. The Contractor's obligations with regard to proper care and maintenance, insurance, and other requirements are not changed by this transfer of ownership until final acceptance in accordance with the General Conditions.
- E. Payment for materials and equipment does not constitute acceptance of the product.

1.02 PAYMENT FOR ALLOWANCES

- A. Include the specified allowance amounts in the Contract Price.
- B. Do not perform Work until approval of allowance release has been approved by the Owner.
- C. Provide actual invoices for the materials.

1.03 MEASUREMENT AND BASIS FOR PAYMENTS ON LUMP SUM ITEMS

- A. Measurement for progress payments is the invoice value for stored materials and the earned value for all other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total lump sum amount for that item.

1.04 MEASUREMENT AND BASIS FOR PAYMENTS ON UNIT PRICE ITEMS

- A. Measure the Work using the unit of measure indicated in this Section for each unit price line item. Payment will be made only for the actual measured unit and/or computed length, area, solid contents, number, and weight unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside dimensions shown in the Contract Documents.
- B. Payment will be made for the actual quantity of Work completed and for materials and equipment stored during the payment period. Payment amount is the Work quantity measured per Paragraph A above multiplied by the unit price for that line item in the Agreement.
- C. Progress payments may be made on items measured in units of "Each". Measurement for progress payments is the invoice value for stored materials and the earned value for all

other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total amount bid for that item.

1.05 MEASUREMENT AND BASIS FOR PAYMENT FOR BASE ITEMS

A. Item 1 - Mobilization:

1. No measurement shall be required.
2. Payment for mobilization will be based on the earned value of Work completed. The total bid amount shall not exceed 5% of the Proposal, exclusive of this item. Mobilization shall consist of the mobilization of personnel, equipment, and supplies at the project site in preparation for beginning work on other contract items. Mobilization shall include, but is not limited to, securing bonds, permits, the movement of equipment, personnel, material, supplies, etc. to the project site; the establishment and maintenance facilities necessary including power and restroom facilities; and any preliminary engineering or administrative work performed prior to beginning the work, and permitting.
3. Refer to City of Tulsa Specification No. 303 for additional Measurement and Payment requirements.

B. Item 2 – Care of Water:

1. No measurement shall be required.
2. Payment shall be made at the lump sum price bid for which payment shall constitute full compensation for all costs of furnishing all labor, equipment, and materials for any flashboards, cofferdams, pumps, piping and other facilities to assist in the control and removal of surface water, waves, lake water, tailwater, and flood water as necessary to perform the required work. Refer to Specification Section 31 23 19.01, CARE OF WATER DURING CONSTRUCTION. This item shall include handling, removing, and diverting any flood flows and stream flows and any other water encountered during the progress of the work. This item shall include, but is not limited to, all labor, materials, equipment, transportation, submittals, and incidentals necessary to build, maintain, and operate splashboards, cofferdams, diversion barriers, diversion siphons, channels, flumes, sumps, valves, and other temporary works as needed to manage floodwater, divert river flow, or pass other surface water through or around the construction site and away from construction work while it is in progress. Remove the temporary works, equipment, and materials after completion in strict accordance with the specifications.

Partial payments will be made based upon the number of days bid for the Contract and the number of contract days completed. If the contract term is changed by Change Order, the remaining portion of the sum will be divided over the remaining term of the Contract for partial payments. No payment for Care of Water shall be made until submittals required under Specification Section 31 23 19.01 have been adequately submitted and reviewed by Engineer and Owner.

C. Item 3 – Standby Time:

1. Measurement shall be based on days of standby time.

2. Payment shall be made at the unit price bid per day and is inclusive of all labor, equipment, material, and overhead costs. The Owner may request that the Contractor evacuate the work areas during lake levels above 778 ft. If the Contractor cannot work due to increased lake level conditions above 778 ft for a period of two or more consecutive days, the Contractor shall be paid standby time beginning on the third day the elevation remains above 778 ft for the same occurrence and ending when the water surface elevation drops below 778 ft. Payment of standby time per day shall be based on unit price bid and is inclusive of all cost (labor, equipment, material, and overhead). Contract schedule will be adjusted for the days the Contractor is on stand-by. Unused stand-by funds upon substantial project completion will be reverted back to the Owner. No remobilization shall be paid.
- D. Item 4 – Anchor Test Program:
1. No measurement shall be required.
 2. Payment shall be made at the lump sum price bid for which payment shall constitute full compensation for all costs of furnishing all labor, equipment, materials, and incidentals for performing an Anchor Test Program to demonstrate ability to provide production anchors in accordance with the Contract Documents. Payment shall constitute full compensation for performing drilling, pressure (consolidation) grouting, re-drilling, and testing for water tightness for as many series as needed; providing anchor tendons, corrugated sheathing, and concrete cap; performing anchorage, grouting, stressing; performing performance and lift-off testing; final surface preparation; and all appurtenant items.
- E. Item 5 – Grout to Foundation Testing:
1. No measurement shall be required.
 2. Payment shall be made at the lump sum price bid for which payment shall constitute full compensation for all costs of furnishing all labor, equipment, materials, and incidentals for performing the grout to foundation testing to verify the grout-to-rock bond strength. Payment shall constitute full compensation for performing drilling, grouting, and pull-tests; providing anchor bars and nuts; final grouting; and all appurtenant items.
- F. Item 6 – Overflow Spillway Strand Post-Tensioned Anchors (33-Strand):
1. Post-Tensioned Anchors are measured as the individual 33-strand anchors, regardless of length.
 2. Payment for Installation of Post-Tensioned Anchors shall be at the unit price bid per each (EA), regardless of length, complete and in place in accordance with the Contract Documents, which payment shall constitute full compensation for furnishing all plant, labor, materials, equipment; transportation; submittals; and incidentals necessary for drilling and testing for water tightness. Payment shall constitute full compensation for providing anchor tendons, corrugated sheathing, and concrete cap; performing anchorage, grouting, stressing; performing performance and lift-off testing; final surface preparation; and all appurtenant items. Holes that do not meet criteria during the initial water tightness test will engage the respective “Grout, Redrill, and Retest” pay item.

- G. Item 7 – Overflow Spillway Strand Post-Tensioned Anchors (40-Strand):
1. Post-Tensioned Anchors are measured as the individual 40-strand anchors, regardless of length.
 2. Payment for Installation of Post-Tensioned Anchors shall be at the unit price bid per each (EA), regardless of length, complete and in place in accordance with the Contract Documents, which payment shall constitute full compensation for furnishing all plant, labor, materials, equipment; transportation; submittals; and incidentals necessary for drilling and testing for water tightness. Payment shall constitute full compensation for providing anchor tendons, corrugated sheathing, and concrete cap; performing anchorage, grouting, stressing; performing performance and lift-off testing; final surface preparation; and all appurtenant items. Holes that do not meet criteria during the initial water tightness test will engage the respective “Grout, Redrill, and Retest” pay item.
- H. Item 8 – Gated Spillway Strand Post-Tensioned Anchors (40-Strand):
1. Post-Tensioned Anchors are measured as the individual 40-strand anchors, regardless of length.
 2. Payment for Installation of Post-Tensioned Anchors shall be at the unit price bid per each (EA), regardless of length, complete and in place in accordance with the Contract Documents, which payment shall constitute full compensation for furnishing all plant, labor, materials, equipment; transportation; submittals; and incidentals necessary for drilling and testing for water tightness. Payment shall constitute full compensation for providing anchor tendons, corrugated sheathing, and concrete cap; performing anchorage, grouting, stressing; performing performance and lift-off testing; final surface preparation; and all appurtenant items. Holes that do not meet criteria during the initial water tightness test will engage the respective “Grout, Redrill, and Retest” pay item.
- I. Item 9 – Non-Overflow Spillway Post-Tensioned Anchors (40-Strand):
1. Post-Tensioned Anchors are measured as the individual 40-strand anchors, regardless of length.
 2. Payment for Installation of Post-Tensioned Anchors shall be at the unit price bid per each (EA), regardless of length, complete and in place in accordance with the Contract Documents, which payment shall constitute full compensation for furnishing all plant, labor, materials, equipment; transportation; submittals; and incidentals necessary for drilling and testing for water tightness. Payment shall constitute full compensation for providing anchor tendons, corrugated sheathing, and concrete cap; performing anchorage, grouting, stressing; performing performance and lift-off testing; final surface preparation; and all appurtenant items. Holes that do not meet criteria during the initial water tightness test will engage the respective “Grout, Redrill, and Retest” pay item.
- J. Item 10 – Overflow Spillway (33-Strand) Grout, Redrill, Retest:
1. Any hole grouting, re-drilling, and re-testing for water tightness will be measured as the incremental times the series of actions are performed per anchor (33-strand) as directed by engineer.

2. Payment for Grout, Redrill, Retest shall be at the unit price bid per each (EA) series of pressure (consolidation) or gravity grouting, re-drilling, and additional water tightness testing of holes drilled for the anchors that fail the initial water tightness tests as described in this specification. If, in the judgment of the engineer, the failure of the water tightness test was due to improper construction techniques, the grouting, re-drilling, and additional water tightness testing of holes will be performed at the Contractor's expense. This price shall be full compensation for providing labor, equipment, materials, transportation, submittals, and incidentals necessary for grouting, re-drilling, and re-testing for water tightness.
- K. Item 11 – Overflow Spillway (40-Strand) Grout, Redrill, Retest:
1. Any hole grouting, re-drilling, and re-testing for water tightness will be measured as the incremental times the series of actions are performed per anchor (40-strand) as directed by engineer.
 2. Payment for Grout, Redrill, Retest shall be at the unit price bid per each (EA) series of pressure (consolidation) or gravity grouting, re-drilling, and additional water tightness testing of holes drilled for the anchors that fail the initial water tightness tests as described in this specification. If, in the judgment of the engineer, the failure of the water tightness test was due to improper construction techniques, the grouting, re-drilling, and additional water tightness testing of holes will be performed at the Contractor's expense. This price shall be full compensation for providing labor, equipment, materials, transportation, submittals, and incidentals necessary for grouting, re-drilling, and re-testing for water tightness.
- L. Item 12 – Gated Spillway Grout, Redrill, Retest:
1. Any hole grouting, re-drilling, and re-testing for water tightness will be measured as the incremental times the series of actions are performed per anchor as directed by engineer.
 2. Payment for Grout, Redrill, Retest shall be at the unit price bid per each (EA) series of pressure (consolidation) or gravity grouting, re-drilling, and additional water tightness testing of holes drilled for the anchors that fail the initial water tightness tests as described in this specification. If, in the judgment of the engineer, the failure of the water tightness test was due to improper construction techniques, the grouting, re-drilling, and additional water tightness testing of holes will be performed at the Contractor's expense. This price shall be full compensation for providing labor, equipment, materials, transportation, submittals, and incidentals necessary for grouting, re-drilling, and re-testing for water tightness.
- M. Item 13 – Non-Overflow Spillway Grout, Redrill, Retest:
1. Any hole grouting, re-drilling, and re-testing for water tightness will be measured as the incremental times the series of actions are performed per anchor as directed by engineer.
 2. Payment for Grout, Redrill, Retest shall be at the unit price bid per each (EA) series of pressure (consolidation) or gravity grouting, re-drilling, and additional water tightness testing of holes drilled for the anchors that fail the initial water tightness tests as described in this specification. If, in the judgment of the engineer, the failure of the water tightness test was due to improper construction techniques, the grouting, re-

drilling, and additional water tightness testing of holes will be performed at the Contractor's expense. This price shall be full compensation for providing labor, equipment, materials, transportation, submittals, and incidentals necessary for grouting, re-drilling, and re-testing for water tightness.

N. Item 14 – Temporary Facilities for Overflow Spillway:

1. No measurement shall be required.
2. Payment for Temporary Facilities for Overflow Spillway shall be made at the price bid for which payment shall constitute full compensation for furnishing all labor, materials, equipment, and incidentals necessary to install post-tensioned anchors on the dam. Payment shall constitute full compensation to provide, erect, maintain, and remove temporary facilities including, but not limited to, floating work platforms, barges, cranes, scaffolding, temporary platforms, and temporary containments to control debris and pollution generated by anchor installation.

O. Item 15 – Temporary Facilities for Gated Spillway:

1. No measurement shall be required.
2. Payment for Temporary Facilities for Gated Spillway shall be made at the price bid for which payment shall constitute full compensation for furnishing all labor, materials, equipment, and incidentals necessary to install post-tensioned anchors on the dam. Payment shall constitute full compensation to provide, erect, maintain, and remove temporary facilities including, but not limited to, floating work platforms, barges, cranes, scaffolding, temporary platforms, and temporary containments to control debris and pollution generated by anchor installation.

P. Item 16 – Allowance for Temporary Facilities Repair:

1. No measurement shall be required.
2. Payment for the Allowance for Temporary Facilities Repair shall be based following a flood event more than 25,000 cfs. This item shall consist of an allowance for cleanup of the work site following a flood event as specified in 31 23 09.01 Care of Water During Construction. Prior to initiating any item of extra work under this bid item, the Owner, Engineer, and Contractor will agree as to the scope and cost of work performed. A written field order or change order for the flood cleanup work will be approved by all parties according to the requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS. Expenditure of the allowance funds is reserved for the Cost of the Work associated with cleanup of flood damage and repair to the Work in progress. If no flood cleanup work is required and approved by the Owner, the allowance fund will not be expended.

Q. Item 17 – Allowance for Anchor Replacement:

1. No measurement shall be required.
2. Payment for the Allowance for Anchor Replacement shall be based following a flood event more than 25,000 cfs. This item shall consist of an allowance for replacement of anchor(s) as needed following a flood event as specified in 31 23 09.01 Care of Water During Construction. Prior to initiating any item of extra work under this bid item, the Owner, Engineer, and Contractor will agree as to the scope and cost of work

performed. A written field order or change order for the anchoring work will be approved by all parties according to the requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS. Expenditure of the allowance funds is reserved for the Cost of the Work associated with the replacement of anchors in progress at the time of the flood that are deemed damaged to the extent that a new anchor is required. If no anchor replacement work associated with flooding is required and approved by the Owner, the allowance fund will not be expended.

- R. Item 18 – Seeding/Sodding: Refer to City of Tulsa Specification No. 325 for Measurement and Payment.
- S. Item 19 – Temporary Stormwater Pollution Control:
 - 1. No measurement shall be required.
 - 2. Payment for Erosion Control shall be made at the lump sum price bid for “Erosion Control”, which payment shall constitute full compensation for all costs to develop and implement the Stormwater Pollution Prevention Plan in accordance with Specification Section 01 57 23, TEMPORARY STORMWATER POLLUTION CONTROL; including the cost of labor, materials, equipment, and incidentals to furnish, install, and maintain erosion and sediment control features for the duration of the project and to properly remove the features when no longer required.
 - 3. Partial payments for “Erosion Control” shall be made in accordance with the Schedule of Values. At a minimum, the Schedule of Values shall identify line items for Installation, Removal, and Monthly Maintenance.
- T. Item 20 – Owner Allowance: Refer to notes on Sheet 2 of the Drawings for Measurement and Payment.

1.06 MEASUREMENT AND BASIS FOR PAYMENT FOR EXTRA WORK ITEMS

- A. Extra Work Item 1 – Additional Anchor Length: 33-Strand
 - 1. Measurement shall be made in linear feet.
 - 2. Payment for Additional Anchor Length: 33-Strand shall be made at the unit price bid for which payment shall constitute full compensation for furnishing all labor, materials, equipment, and incidentals necessary to furnish and install additional length of 33-strand anchors in excess of what is shown on the Drawings.
 - 3. This item will only be executed if the Engineer deems that additional anchor length is necessary based on pre-production testing.
- B. Extra Work Item 2 – Additional Anchor Length: 40-Strand
 - 1. Measurement shall be made in linear feet.
 - 2. Payment for Additional Anchor Length: 40-Strand shall be made at the unit price bid for which payment shall constitute full compensation for furnishing all labor, materials, equipment, and incidentals necessary to furnish and install additional length of 40-strand anchors in excess of what is shown on the Drawings.
 - 3. This item will only be executed if the Engineer deems that additional anchor length is necessary based on pre-production testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish equipment, manpower, products, and other items necessary to complete the Project with an acceptable standard of quality and within the Contract Time. Construct Project in accordance with current safety practices.
- B. Manage Site to allow access to Site and control construction operations.
- C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- D. Provide temporary controls for pollutions, management of water and management of waste materials as required in Section 01 57 23 "Temporary Stormwater Pollution Control."

1.02 QUALITY ASSURANCE

- A. Employ competent workmen, skilled in the occupation for which they are employed. Provide Work meeting quality requirements of the Contract Documents as determined by the Engineer and Owner.
- B. Remove defective Work from the Site immediately unless provisions have been made and approved by the Engineer to allow repair of the product at the Site.

1.03 STANDARDS

- A. Perform Work to comply with:
 - 1. Requirements of the Contract Documents;
 - 2. Laws and Regulations; and
 - 3. Specified industry standards.

1.04 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."
- B. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation.
- C. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings per Section 01 31 13 "Project Administration."
- D. Create, maintain, and make available to all project personnel including authorized visitors a project-specific safety plan.

1.05 PERMITS

- A. Retain copies of permits and licenses at the Site and observe and comply with all regulations and conditions of the permit or license, including additional insurance requirements.

- B. Obtain and pay for other permits necessary to conduct any part of the Work.
- C. Arrange for inspections and certification by agencies having jurisdiction over the Work.
- D. Make arrangements with private utility companies and pay for fees associated with obtaining services, or for inspection fees.
- E. Obtain environmental permits required for construction at the Site.
- F. Provide required permits for transporting heavy or oversized loads.
- G. Provide other permits required to conduct any part of the Work.
- H. Arrange for inspections and certification by agencies having jurisdiction over the Work and include the cost for these inspections and certifications in the Contract Price.
- I. Make arrangements with private utility companies and pay fees associated with obtaining services or inspections.
- J. Retain copies of permits and licenses at the Site and comply with all regulations and conditions of the permit or license.

1.06 SAFETY REQUIREMENTS

- A. Manage safety to protect the safety and welfare of persons at the Site, to include an on-site safety plan that includes locations of PPE, anchoring locations, lifejackets, etc.
- B. Provide safe access to move through the Site. Provide protective devices to warn and protect from hazards at the Site.
- C. Provide safe access for those performing tests and inspections.
- D. Maintain a supply of personal protective equipment for visitors to the Site.
- E. Comply with latest provisions of the Occupational Health and Safety Administration (OSHA) and other Laws and Regulations.
- F. Cooperate with accident investigations. Provide two copies of all reports, including insurance company reports, prepared concerning accidents, injuries, or deaths related to the Project to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.07 ACCESS TO THE SITE

- A. Maintain access to the facilities at all times. Do not obstruct roads, or access to the various buildings, structures, stairways, or entrances. Provide safe access for normal operations during construction.
- B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding, and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.
- C. Use roadways for construction traffic only with written approval of the appropriate representatives of each entity. Roadways may not be approved for construction traffic. Obtain written approval to use roads to deliver heavy or oversized loads to the Site. Furnish copies of the written approvals to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.08 CONTRACTOR'S USE OF THE SITE

- A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the Site with the Construction Manager.
- B. Provide security at the Site as necessary to protect against vandalism and loss by theft.
- C. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 23 "Erosion Control."
- D. Park employees' vehicles in designated areas only.
- E. Obtain written permission of the property owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.
- F. Cooperate with public and private agencies with facilities operating within the limits of the Project. Provide 48 hours' notice to any applicable agency when Work is anticipated to proceed in the vicinity of any facility by using Okie811.
- G. Conduct of Contractor's or Subcontractor's Employees:
 - 1. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.
 - 2. Do not allow the use of offensive language or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.
 - 3. Require workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, or any exceedingly torn, ripped, or soiled clothing to be worn on the Site.
 - 4. Do not allow the use, possession, concealment, transportation, promotion, or sale of the following prohibited items anywhere on the Site:
 - a. Firearms (including air rifles and pistols and BB or pellet guns) and ammunition;
 - b. Bows, crossbows, arrows, bolts, or any other projectile weapons;
 - c. Explosives of any kind, including fireworks;
 - d. Illegal knives;
 - e. Other weapons prohibited by state Laws and Regulations; and
 - f. Any other item that has been designed or intended to be used as a weapon.

No exceptions will be made for the possession of a firearm by a person that has a valid state-issued license to carry a firearm. Remove any of the prohibited items listed above from the Site immediately and permanently. Any person found to be in possession of any prohibited item must also be removed from the Site and may be reported to local law enforcement.

1.09 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the Site and review the available information concerning the Site. Locate utilities, underground facilities, and existing structures. Verify the elevations of the structures adjacent to excavations. Report any discrepancies from information in the Contract Documents to the Construction Manager before beginning construction.
- B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 31 13 "Project Administration." Coordinate Work with local utility company and others for the relocation or replacement.
- C. Protect utilities, underground facilities and existing structures unless they are shown to be replaced or relocated on the Drawings. Restore damaged items to the satisfaction of the Owner and utility or property owner.
- D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless required by the Contract Documents or approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines, or other obstructions.

1.10 DISRUPTION TO SERVICES/CONTINUED OPERATIONS

- A. Owner's facilities are to continue in service as usual during the construction unless noted otherwise. Owner must be able to operate and maintain the facilities. Keep disruptions to existing utilities to a minimum and coordinate with Owner regarding sequencing of anchor installations.
 - 1. Do not restrict access to critical valves, gates, operators, or electrical panels.
 - 2. Do not store material or products inside structures unless authorized by the Construction Manager.
 - 3. Limit operations to the minimum amount of space needed to complete the specified Work.

1.11 FIELD VERIFICATION

- A. Perform complete field measurements prior to purchasing products or beginning construction for products required to fit existing conditions.
- B. Verify property lines, control lines, grades, and levels indicated on the Drawings.
- C. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.
- D. Include field measurements in Record Documents as required in Section 01 31 13 "Project Administration."

1.12 REFERENCE DATA AND CONTROL POINTS

- A. Construction Manager will provide the following control points:
 - 1. Base line or grid reference points for horizontal control.

2. Benchmarks for vertical control.
- B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Designated control points may be on an existing structure or monument. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when a reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original survey. Control points or benchmarks damaged, disturbed or destroyed as a result of the Contractor's negligence will be restored by the Construction Manager. Owner will impose a set-off as compensation for the effort required.
 - C. Provide complete engineering layout of the Work needed for construction.
 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
 2. Provide Record Data per Section 01 31 13 "Project Administration" and measurements per standards.

1.13 DELIVERY AND STORAGE

- A. Deliver products and materials to the Site in time to prevent delays in construction.
- B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in original packages or other containers until installed. If original packages or containers are damaged, repackage in containers and include packing slips, labels and other information from the original packaging.
- C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs or pallets.
- D. Assume full responsibility for the protection and safekeeping of products stored at the Site.
- E. Store products at locations acceptable to the Construction Manager and to allow Owner access to maintain and operate existing facilities.
- F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- G. Provide additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products.
- H. Provide adequate exterior storage for products that may be stored out-of-doors.
 1. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.

2. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
- I. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
 1. Storage facilities continue to meet specified requirements;
 2. Supplier's required environmental conditions are continually maintained; and
 3. Products that can be damaged by exposure to the elements are not adversely affected.
- J. Replace any stored item damaged by inadequate protection or environmental controls.
- K. Payment may be withheld for any products not properly stored.

1.14 CLEANING DURING CONSTRUCTION

- A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from disbursing into the atmosphere. Control dust and dirt from demolition, drilling, cutting, and patching operations.
- B. Clean the Site as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers at the Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.
- C. Comply with Laws and Regulations. Do not burn or bury waste materials. Remove waste materials, rubbish, and debris from the Site and legally dispose of these at public or private disposal facilities.

1.15 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

- A. Assume responsibility for any damage resulting from construction along roads or drives.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 13 PROJECT ADMINISTRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the Owner's Project Team (OPT).

1.02 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."

1.03 COMMUNICATION DURING THE PROJECT

- A. Construction Manager is to be the first point of contact for all parties on matters concerning this Project. A specific individual point of contact will be identified at the pre-construction meeting.
- B. Construction Manager will coordinate correspondence concerning:
 - 1. Contract administration;
 - 2. Clarification and interpretation of the Contract Documents;
 - 3. Contract modifications;
 - 4. Observation of Work and testing; and
 - 5. Claims.
- C. Construction Manager will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.
- D. Direct written communications to the Construction Manager at the address indicated at the pre-construction conference. Include the following with communications as a minimum:
 - 1. Name of the Owner;
 - 2. Project name;
 - 3. Contract title;
 - 4. Project number;
 - 5. Date; and
 - 6. A reference statement.
- E. Submit communications on the forms referenced in this Section or in Section 01 33 00 "Document Management."

1.04 PROJECT MEETINGS

- A. Pre-Construction Conference:
 - 1. Attend a pre-construction conference;

2. The location of the conference will be determined by the Construction Manager;
 3. The time of the conference will be determined by the Construction Manager, but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued;
 4. OPT, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference; and
 5. Provide and be prepared to discuss:
 - a. Preliminary construction schedule per Section 01 33 05 "Construction Progress Schedule";
 - b. Preliminary Schedule of Documents per Section 01 33 00 "Document Management";
 - c. Schedule of Values and anticipated schedule of payments per Section 01 29 00 "Application for Payment Procedures";
 - d. List of Subcontractors and Suppliers;
 - e. Contractor's organizational chart as it relates to this Project; and
 - f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications, and payment requests.
- B. Progress Meetings:
1. Attend meetings with the Construction Manager, Design Professional, and Owner.
 - a. Meet monthly or as requested by the Construction Manager to discuss the Project.
 - b. Meet at the Site or other location as designated by the Construction Manager.
 - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
 - d. Notify the Construction Manager of any specific items to be discussed a minimum of 1 week prior to the meeting.
 2. Provide information as requested by the Construction Manager, Design Professional, or Owner concerning this Project. Prepare to discuss:
 - a. Status of overall project schedule;
 - b. Contractor's detailed schedule for the next month;
 - c. Anticipated delivery dates for equipment;
 - d. Coordination with the Owner;
 - e. Status of documents;
 - f. Information or clarification of the Contract Documents;
 - g. Claims and proposed modifications to the Contract;

- h. Field observations, problems, or conflicts; and
 - i. Maintenance of quality standards.
- 3. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- C. Pre-Documentation and Pre-Installation Meetings:
 - 1. Conduct pre-documentation and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).
 - 2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph 1.07 for the meeting 2 weeks before the meeting. OPT must approve of the proposed time and location.
 - 3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.
 - 4. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- D. Weekly Coordination Meetings: Meet on a weekly basis with the Construction Manager or designated on-site representative of the OPT to discuss Work planned for the following week, review coordination issues, testing required, or other issues. Records of these meetings are not required.

1.05 REQUESTS FOR INFORMATION

- A. Submit a Request for Information to the Construction Manager to obtain additional information or clarification of the Contract Documents.
 - 1. Submit a separate Request for Information for each item on the form provided by the Construction Manager.
 - 2. Attach adequate information to permit a response without further clarification. Construction Manager will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple reviews due to inadequate information.
 - 3. A response will be made when adequate information is provided. The response will be made on the Request for Information form provided by the Construction Manager.
- B. Response to a Request for Information is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.

1. Submit a Change Proposal per Section 01 26 00 "Change Management" if a contract modification is suggested or required.
- C. Use the Decision Register to document decisions made at meetings and actions to be taken in accordance with Paragraph 1.06.
- D. Use the Action Item Register to document assignments for actions to be taken in accordance with Paragraph 1.06.

1.06 DECISION AND ACTION ITEM REGISTER

- A. Construction Manager will maintain a Decision Register to document key decisions made during meetings, telephone conversations, or visits to the Site using the format provided by the Construction Manager:
 1. Review the Decision Register prior to each regular meeting.
 2. Report any discrepancies to the Construction Manager for correction or discussion at the next monthly meeting.
- B. Construction Manager will maintain an Action Item Register in conjunction with the Decision Register to track assignments made during meetings, telephone conversations or visits to the Site using the format provided by the Construction Manager:
 1. Review the Action Item Register prior to each regular meeting.
 2. Report actions taken after the previous progress meeting on items in the register assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Construction Manager. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Construction Manager to update the register prior to the Progress Meetings.
 3. Be prepared to discuss the status at each meeting.
- C. Decisions or action items in the register that require a change in the Contract Documents will have the preparation of a Modification as an action item if appropriate. The Contract Documents can only be changed by a Modification.

1.07 NOTIFICATION BY CONTRACTOR

- A. Notify the Construction Manager of:
 1. Need for testing;
 2. Intent to work outside regular working hours;
 3. Request to shut down facilities or utilities;
 4. Proposed utility connections;
 5. Required observation by Construction Manager, Engineer, or inspection agencies prior to covering Work; and
 6. Training.
- B. Provide notification a minimum of 2 weeks in advance to allow OPT time to respond appropriately to the notification.

C. Use the Notification by Contractor form provided by the Construction Manager.

1.08 REQUESTS FOR MODIFICATIONS

A. Submit requests for Modifications per Section 01 26 00 "Change Management."

1.09 RECORD DATA

A. Submit information required by the Contract Documents that is not related to a product as Record Data using the form provided by the Construction Manager.

1.10 RECORD DOCUMENTS

A. Maintain one complete set of printed Record Documents at the Site including:

1. Drawings;
2. Specifications;
3. Addenda;
4. Modifications;
5. Product Data and approved Shop Drawings;
6. Construction photographs;
7. Test Reports;
8. Clarifications and other information provided in Request for Information responses; and
9. Reference standards.

B. Store printed Record Documents and Samples in the Contractor's field office.

1. Record Documents are to remain separate from documents used for construction.
2. Provide files and racks for the storage of Record Documents.
3. Provide a secure storage space for the storage of Samples.
4. Maintain Record Documents in clean, dry, legible conditions, and in good order.
5. Make Record Documents and Samples available at all times for inspection by the OPT.

C. Maintain an electronic record of Specifications and Addenda to identify products provided in PDF format.

1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
2. Reference Modifications by type and number for all changes.

D. Maintain an electronic record of Drawings in PDF format.

1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
2. Reference Modifications by type and number for all changes.

3. Record information as construction is being performed. Do not conceal any Work until the required information is recorded.
 4. Mark drawings to record actual construction.
 - a. Depths of anchors in reference to top of concrete elevation of overflow spillway, gated section, and left non-overflow section as applicable.
 - b. Horizontal locations of existing utilities encountered during construction.
 - c. Changes of dimension and detail.
 - d. Changes by Modifications.
 - e. Information in Requests for Information or included in the Decision Register.
 - f. Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.
 5. Mark Drawings with the following colors:
 - a. Highlight references to other documents, including Modifications in blue.
 - b. Highlight mark ups for new or revised Work (lines added) in yellow.
 - c. Highlight items deleted or not installed (lines to be removed) in red.
 - d. Highlight items constructed per the Contract Documents in green.
 6. Submit Record Documents to Construction Manager for review and acceptance 30 days prior to Final Completion of the Project.
- E. Applications for Payment will not be recommended for payment if Record Documents are found to be incomplete or not in order. Final payment will not be recommended without complete Record Documents.

END OF SECTION

01 33 00 DOCUMENT MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit documentation as required by the Contract Documents and as requested by the Construction Manager.
- B. Use the Project Management Information System (PMIS) provided by the Owner. Software for the PMIS is FNiManager which has the following system requirements:
 - 1. Operating Systems: Windows 7 or later and OS X v10.8 or later.
 - 2. Supported Internet Browsers: Internet Explorer 11.0 or later, Google Chrome 70.0 or later, Firefox 63.0 or later, Safari 11.0 or later, and Microsoft Edge 17.0 or later.
 - 3. Screen Resolution: The recommended screen resolution is 1280 x 1024 or higher. The minimum screen resolution required to support all features is 1024 x 768.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Documents not meeting these criteria will be returned without review as "Not Approved."
- B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including Drawings and Specifications as modified by Addenda, Field Orders, and Change Orders.
- C. Furnish and install products that fully comply with the information included in the submittal.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Review documents prior to submission. Make certifications as required by the Contract Documents and as indicated on Construction Manager provided forms.
- B. Provide a Schedule of Documents to list the documents that are to be submitted and the dates on which documents are to be sent to the Construction Manager for review. Use the form provided by the Construction Manager for this list.
- C. Incorporate the dates for processing documents into the Progress Schedule required by Section 01 33 05 "Construction Progress Schedule."
 - 1. Provide documents in accordance with the schedule so construction of the Project is not delayed.
 - 2. Allow a reasonable time for the review of documents when preparing the Progress Schedule. Assume a 14-day review cycle for each document unless a longer period of time is indicated in the Contract Documents or agreed to by Construction Manager and Contractor.
 - 3. Schedule delivery of review documents to provide all information for interrelated Work at one time.

4. Allow adequate time for processing documents so construction of the Project is not delayed.

1.04 FORMS AND WORKFLOWS

- A. Use the forms or workflow process provided by the Construction Manager for project documentation.

1.05 DOCUMENT PREPARATION AND DELIVERY PROCEDURES

- A. Deliver documents in electronic format as directed by the Construction Manager.
 1. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 2. Deliver all documents in Portable Document Format (PDF).
 - a. Create PDF document using Bluebeam Revu software.
 - b. Create PDF documents from native format files unless files are only available from scanned documents.
 - c. Rotate pages so that the top of each document appears at the top of the monitor screen when opened in PDF viewing software.
 - d. Provide PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.
 - e. Submit color PDF documents where color is required to interpret the document.
 - f. Create or convert documents to allow text to be selected for comments or searched using text search features. Run scanned documents through Optical Character Recognition (OCR) software if necessary.
 - g. Flatten markups in documents to prevent markups made by Contractor from being moved or deleted. Flatten documents to allow markup recovery.
 - h. Use Bluebeam Revu software to reduce file size using default settings except the option for "Drop Metadata". Uncheck the "Drop Metadata" box when reducing file size.
 - i. Add footers to each document with the name of the Project.
- B. Software Requirements:
 1. Owner, Engineer, and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the following software formats:

Document	Document Format
Email	.htm, .rtf, or .txt without formatting that impairs legibility of content on screen or in printed copies
Submittals	Bluebeam PDF

Document	Document Format
Applications for Payment	Bluebeam PDF and Microsoft® Excel
Progress Schedules	PDF and Schedule in Native Format
Layouts and drawings to be submitted to Owner for future use and modification.	Autodesk® AutoCAD .dwg format
Document submitted to Engineer for future word processing use and modification.	Microsoft® Word
Spreadsheets and data submitted to Engineer for future data processing use and modification.	Microsoft® Excel

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this Section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Paragraph 1.05.B.

1.06 DOCUMENT NUMBERING

- A. Assign a document number to the Contractor originated document to allow tracking of the document during the review process.

1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes will be as follows:

Prefix	Description
AP	Application for Payment
CP	Change Proposal
CTR	Certified Test Report
EIR	Equipment Installation Report
GD	Graphic Documentation
NBC	Notification by Contractor
O&M	Operation and Maintenance Manuals
PD	Product Data
RD	Record Data
RFI	Request for Information
SD	Shop Drawing
SCH	Schedule of Progress

2. Issue sequence numbers in chronological order for each type of document as directed by the Construction Manager.
3. Issue numbers for resubmittals that have the same number as the original document followed by an alphabetical suffix indicating the number of times the same document has been sent to the Construction Manager for processing. For example: SD-025 A represents Shop Drawing number 25 and the letter "A" designates this is the second time this document has been sent for review.

4. Clearly note the document number on each page or sheet of the document.
 5. Correct assignment of numbers is essential since different document types are processed in different ways.
- B. Include reference to the Drawing number and/or Specification Section, detail designation, schedule, or location that corresponds with the data submitted on the Document Transmittal form. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

1.07 DOCUMENTATION

- A. Furnish documents as indicated in the individual Specification Sections. Submit documents per the procedures described in the Contract Documents.
- B. Submit documents per the Specification Sections shown in the following table:

Document Type	Specification Section
Application for Payment	01 29 00
Quality Management	01 40 00 to demonstrate compliance
Shop Drawings	01 33 02
Product Data	01 33 03
Document Register	01 33 01
Construction Progress Schedule	01 33 05
Execution and Closeout Requirements	01 70 00

1.08 Electronic Documents Protocol

- A. The parties shall follow the provisions in this Section, referred to as the Electronic Documents Protocol ("EDP"), for exchange of electronic transmittals.
- B. Basic Requirements:
1. Except as otherwise stated elsewhere in the Contract Documents, the Owner, Engineer, and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols provided in this Section.
 2. The contents of the information in any Electronic Document will be the responsibility of the transmitting party. Electronic Documents may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, and are subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
 3. Provisions of this Contract regarding Electronic Documents must be incorporated into other agreements or subcontracts on the Project. Nothing in this paragraph reduces or eliminates requirements:
 - a. to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations;
 - b. to comply with any applicable Law or Regulation governing the signing and sealing of design documents and related Modifications or the signing and electronic transmission of any other documents; or

- c. to comply with the notice requirements.
4. When sending Electronic Documents by Electronic Means the sending party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or sending Electronic Documents.
- C. System Infrastructure for Electronic Document Exchange:
1. Contractor will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost. System Infrastructure must comply with these requirements.
 2. The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 100 MB. Attachments larger than that may be exchanged in parts or by using large file transfer functions or physical media.
 3. Contractor assumes full and complete responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software.
 4. Contractor is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
 5. Contractor will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems that are intended to protect others from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. Contractor will not be liable to others for any breach of system security to the extent that Contractor maintains and operates required security software and systems.
 6. In the case of disputes, conflicts, or modifications to the use of Electronic Documents required to address issues affecting System Infrastructure, Contractor, Engineer, and Owner will cooperatively resolve the issues; but, failing resolution, Engineer and Owner is authorized to make and require reasonable and necessary changes meet its original intent. Contractor may submit a Change Proposal if the changes cause additional cost or time to Contractor that could not have reasonably been anticipated.
 7. Contractor, Engineer, and Owner are responsible for their own back-up and archive of documents sent and received during the term of the contract. Contractor, Engineer, and Owner remain solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract as each party deems necessary for its own purposes.

8. If a Contractor, Engineer, and Owner receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
9. Engineer and Owner will operate a project information management system (Project Website) for use of Engineer and Owner and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this Contract, use of the Project Website will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information.

D. Software Requirements:

1. Engineer, Owner, and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the following software formats:

Document	Document Format
Email	.htm, .rtf, or .txt without formatting that impair legibility of content on screen or in printed copies
Submittals	Bluebeam PDF
Applications for Payment	Bluebeam PDF and Microsoft® Excel
Progress Schedules	PDF and Schedule in Schedule in Native Format
Layouts and drawings to be submitted to Owner for future use and modification	Autodesk® AutoCAD .dwg format
Document submitted to Engineer or Owner for future word processing use and modification	Microsoft® Word
Spreadsheets and data submitted to Engineer or Owner for future data processing use and modification	Microsoft® Excel
Photographs	.jpg or .jpeg
Videos	.mp4, .mpeg, or .avi

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Section.
3. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender

not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

E. Requests by Contractor for Electronic Documents in Other Formats:

1. Release of any Electronic Documents developed during the design process (including Contract Documents, Technical Data, Drawings, and computer models) in formats other than those identified in this Section will be at the discretion of the Engineer or Owner.
2. To the extent determined by Engineer or Owner, release of Electronic Documents and other project information requested by Contractor ("Request") in formats other than those identified in this Section will be subject to the provisions of Owner's response to the Request, and to the following conditions:
 - a. The content included in the Electronic Documents covered by the Request was prepared by Design Professional as an internal working document or electronic computer model solely for Design Professional's purposes and not for any construction processes and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, any implied warranties of fitness for any purpose. Contractor is advised and acknowledges that the content may not be suitable for Contractor's application or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.
 - b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Design Professional to Contractor under the Request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and Contractor waives any claims against the Design Professional or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. **CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER AND DESIGN PROFESSIONAL AND THEIR SUBCONSULTANTS FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES, INCLUDING ATTORNEYS' FEES AND DEFENSE COSTS ARISING OUT OF OR RESULTING FROM THE CONTRACTOR'S USE, ADAPTATION, OR DISTRIBUTION OF ANY ELECTRONIC DOCUMENTS PROVIDED UNDER THE REQUEST.**
 - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Design Professional, unless such distribution is specifically identified in the Request and is limited to the Contractor's subcontractors. Contractor warrants that subsequent use by the Contractor's subcontractors complies with all terms of the Contract Documents and the Owner's response to Request.
3. In the event that Owner elects to provide or directs Design Professional to provide to Contractor any Contractor-requested Electronic Document versions of project

information that is not explicitly identified in the Contract Documents as being available to Contractor, Owner shall be reimbursed by Contractor on an hourly basis for any costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Design Professional in accordance with the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 02 SHOP DRAWINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection, or installation of the product without additional detailed information from the Supplier.
- B. Submit Shop Drawings as required by the Contract Documents and as reasonably requested by the Construction Manager to:
 - 1. Record the products incorporated into the Project;
 - 2. Provide detailed information for the products proposed for the Project regarding their fabrication, installation, commissioning, and testing; and
 - 3. Allow the Design Professional to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Shop Drawings, Samples, or mockups.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be approved by Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Shop Drawings not meeting these criteria will not be approved.
- B. Demonstrate that the proposed products are in full compliance with the design criteria and requirements of the Contract Documents, or will be if deviations requested per Paragraph 1.11 are approved.
- C. Furnish and install products that fully comply with the information included in the Shop Drawings.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Shop Drawings are required for the following items:

Specification Section	Shop Drawing Description
01 50 00	Field office
03 30 00.01	Reinforcing bar layout
31 23 19.01	Care of Water Measures
31 51 19	Drilling Equipment and Procedures Plan
31 51 19	Bore Hole Plug/Cover Design and Installation Details

Specification Section	Shop Drawing Description
31 51 19	Tendon Equipment and Anchorage Hardware Shop Drawing
31 51 19	Tendon Handling and Installation Plan
31 51 19	Grouting Equipment and Procedures Plan
31 51 19	Anchor Stressing Equipment and Procedures Plan
31 51 19	Anchorage concrete cap and anchor vault shop drawing
31 51 19	Concrete mix design for anchorage concrete cap
31 51 19	Water containment system and procedures

- B. Include Shop Drawings in the Schedule of Documents required by Section 01 33 00 "Document Management" to indicate the Shop Drawings to be submitted, the dates on which Shop Drawings are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Incorporate the dates for processing Shop Drawings into the Progress Schedule required by Section 01 33 05 "Construction Progress Schedule."
1. Submit Shop Drawings in accordance with the schedule so construction of the Project is not delayed.
 2. Submit Shop Drawings for interrelated Work at one time.
 3. Allow adequate time for ordering, fabricating, delivering, and installing products so construction of the Project is not delayed.
- D. Complete the following before submitting a Shop Drawing or Sample:
1. Prepare and review the Shop Drawing or Sample. Coordinate the Shop Drawing or Sample with other Shop Drawings and Samples, with the requirements of the Work, and the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to Shop Drawings and Samples;
 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- E. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Shop Drawing and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Shop Drawing have been shown and conflicts between the products, existing structures, utilities, and equipment have been identified;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;

4. Shop Drawing is complete for its intended purpose; and
 5. Conflicts between the Shop Drawing related to the various Subcontractors and Suppliers have been resolved.
- F. Review Shop Drawings prior to submitting to the Construction Manager. Certify that all Shop Drawings have been reviewed by the Contractor and are in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Shop Drawings except for deviations specifically brought to the Construction Manager's attention on an attached Shop Drawing Deviation Request form in accordance with Paragraph 1.08.
 - G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Defective products may be rejected at the Owner's option.
 - H. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Construction Manager and Design Professional.

1.04 DOCUMENTATION

- A. Provide adequate information in Shop Drawings so the Design Professional can:
 1. Compare the proposed features of the product with the specified features and advise Owner that the product does, in general, conform to the Contract Documents.
 2. Compare the performance features of the proposed product with those specified and advise the Owner that the product does, in general, conform to the performance criteria specified in the Contract Documents.
 3. Review required certifications, guarantees and warranties for compliance with the Contract Documents.
- B. Include a complete description of the material to be furnished, including:
 1. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 2. All applicable standards;
 3. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 4. Wiring and piping diagrams and related controls;
 5. Mix designs for concrete, grout, or other materials proportioned for the Project; and
 6. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- C. Submit Shop Drawings that require coordination with other Shop Drawings for fabrication at the same time. Shop Drawings requiring coordination with other Shop Drawings will not be approved until a complete package is submitted, unless approved by the Construction Manager.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required special certifications, reports, and other documentation with the Shop Drawings as specified in the individual Specification Sections which may include:
 - 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product, when installed, will meet the requirements of the Contract Documents and is part of the Shop Drawing. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Shop Drawing.

1.06 WARRANTIES AND GUARANTEES

- A. Provide all required warranties, guarantees, and related documents with the Shop Drawing. The effective date of warranties and guarantees will be the date of Substantial Completion.
- B. Identify all extended warranties which are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner. Provide a warranty bond for extended warranties if required by the individual Specification Sections.
- C. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 SHOP DRAWING SUBMITTAL PROCEDURES

- A. Submit Shop Drawings to the Construction Manager. Send all documents in digital format for processing.
 - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Shop Drawing.
 - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Shop Drawings for more than one independent system in the same Submittal.
 - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 - 5. Define abbreviations and symbols used in Shop Drawings.
 - a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
 - c. Provide a legend for symbols used on Shop Drawings.
 - 6. Mark Shop Drawings to reference:
 - a. Related Specification Sections;

- b. Drawing number and detail designation;
 - c. Location where the product is incorporated into the Project.
- B. Use the following conventions to markup Shop Drawings for review:
 1. Make comments and corrections in the color blue. Add explanatory comments to the markup.
 2. Highlight items in black (redact) that are not being furnished when the Supplier's standard drawings or information sheets are provided so that only the products to be provided are in their original color.
 3. Make comments in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action requested of the Design Professional.
 4. Make comments in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Include explanatory comments in the Shop Drawing Deviation Request form.
 5. Mark dimensions with the prefix "FD" to indicate field verified dimensions on the Shop Drawings.
- C. Designate a document as requiring priority treatment to place the review of the Shop Drawing ahead of other Shop Drawings previously delivered. Shop Drawings are typically reviewed in the order received, unless Contractor requests that a different priority be assigned. Priority Shop Drawings will be reviewed before other Shop Drawings already received but not yet reviewed. Use of this priority designation for Shop Drawings may delay the review of Shop Drawings previously submitted. Contractor is responsible for delays resulting from the use of the priority designation status on Shop Drawings.
- D. Complete the certification required by Paragraph 1.03.G.

1.08 REQUESTS FOR DEVIATION

- A. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures.
- B. Provide a Shop Drawing with the Change Proposal that clearly identifies deviations for any product or component of the product that does not fully comply with the Contract Documents using the Shop Drawing Deviation Request form provided by the Construction Manager. Mark deviations on the Shop Drawing per Paragraph 1.08.B.
- C. Include a description of why the deviation is required and the impact on Contract Price or Contract Times. Include the amount of any cost savings to the Owner for deviations that result in a reduction in cost.
- D. Identify each deviation request as a separate item. Include all requested deviations that must be approved as a group together and identify them as a single item.

- E. Construction Manager will issue a Field Order or Change Order to approve acceptable deviations. Approval of a requested Shop Drawing deviation by the Design Professional on the Shop Drawings Deviation Request form indicates approval of the requested deviation only on its technical merits as generally conforming to the Contract Documents. Deviations from the Contract Documents can only be approved by a Modification issued by the Construction Manager.

1.09 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Shop Drawings will be received by the Construction Manager. Construction Manager will log the documents and forward to the Design Professional for review per this Section for general conformance with the Contract Documents.
 - 1. Design Professional's review and approval will be only to determine if the products described in the Shop Drawing or Sample will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 - 2. Design Professional's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 - 3. Design Professional's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- B. Comments will be made on items called to the attention of the Design Professional for review and comment. Any marks made by the Design Professional do not constitute a blanket review of the document or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
 - 1. Design Professional will respond to Contractor's markups by either making markups directly in the Shop Drawing file using the color red or by attaching a Document Review Comments form with review comments keyed to the Drawings or Shop Drawing Deviation Request.
 - 2. Shop Drawings that are reviewed will be returned with one or more of the following status designations:
 - a. Approved: Shop Drawing is found to be acceptable as submitted.
 - b. Approved as Noted: Shop Drawing is approved so long as corrections or notations made by Design Professional are incorporated into the Shop Drawing.
 - c. Not Approved: Shop Drawing or products described are not acceptable.
 - d. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
 - 3. Shop Drawings will also be designated for one of the following actions:
 - a. Documents Filed: Shop Drawing is acceptable without further action and has been filed as a record document.

- b. Shop Drawing Not Required: A Shop Drawing was not required by the Contract Documents. Resubmit the document per Section 01 33 03 "Product Data."
- c. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
- d. Revise and Resubmit: Shop Drawing has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

Actions "a" through "c" will close out the Shop Drawing review process and no further action is required as a Shop Drawing. Action "d" requires follow up action to close out the review process.

- 4. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted." These drawings are to be revised to provide a clean record of the document. Proceed with ordering products as the documents are revised.
 - 5. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as "At Variance With" (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with the Contract Documents.
- C. Bring deviations to the Shop Drawings to the attention of the Design Professional for approval by using the Shop Drawing Deviation Request form. Use a single line for each requested deviation so the Status and Action for each deviation can be determined for that requested deviation. If approval or rejection of a requested deviation will impact other requested deviation, then all related deviations should be included in that requested deviation line so the status and action can be determined on the requested deviation as a whole.
- D. Requested deviations will be reviewed as a possible Modification to the Contract Documents.
- 1. A requested deviation will be marked as "Not Approved" if the requested deviation is unacceptable. Contractor is to revise and resubmit the Shop Drawing with corrections for approval.
 - 2. A Field Order will be issued by the Construction Manager for deviations approved by the Design Professional if the requested deviation is acceptable and if the requested deviation will not result in a change in Contract Price or Contract Times. Requested deviations from the Contract Documents may only be approved by Field Order.
 - 3. A requested deviation will not be approved if the requested deviation is acceptable but the requested deviation will or should result in a change in Contract Price or Contract Times. Submit any requested deviation that requires a change in Contract Price or Contract Times as a Change Proposal for approval prior to resubmitting the Shop Drawing.
- E. Contractor is to resubmit a complete Shop Drawing incorporating revisions until it is acceptable and marked "Approved" or "Approved as Noted" and is assigned an action per Paragraph 1.10.B.3 that indicates that the Shop Drawing process is closed.

- F. Information that is submitted as a Shop Drawing that should be submitted as Product Data or other type of document, or is not required may be returned without review, or may be deleted. No further action is required and the Shop Drawing process for this document will be closed.

1.10 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes required by the Design Professional in the document and resubmit to the Construction Manager until approved.
- B. Resubmit a complete Shop Drawing for each resubmittal. The last approved Shop Drawing must not rely on previous submissions. The final Shop Drawing is to provide a complete record for the Owner's records.
- C. Revise initial drawings or data and resubmit as specified for the reviewed document.
 - 1. Highlight or cloud in green those revisions which have been made in response to the previous reviews by the Design Professional. This will include changes previously highlighted or clouded in yellow to direct attention to Design Professional to items requiring selections, decisions by the Design Professional or highlighted or clouded in orange for a requested deviation from the Contract Documents, or comments in red made by the Construction Manager.
 - 2. Highlight and cloud new items in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action to be taken by the Design Professional.
 - 3. Highlight and cloud new items in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Numbering for these new items is to start with the next number following the last Shop Drawing deviation requested. Include explanatory comments in the Shop Drawing Deviation Request form.
- D. Pay for excessive review of Shop Drawings.
 - 1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
 - 2. Review of Shop Drawings or Samples will be an additional service requiring payment by the Contractor if the Contractor submits a substitution for a product for which a Shop Drawing or Sample has previously been approved, unless the need for such change is beyond the control of Contractor.
 - 3. Need for more than one resubmission or any other delay in obtaining Design Professional's approval of Shop Drawings will not entitle the Contractor to an adjustment in Contract Price or an extension of Contract Times.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 03 PRODUCT DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.
- B. Submit Product Data to provide documents that allow the Owner to:
 - 1. Record the products incorporated into the Project; and
 - 2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Product Data is required for the following items:

Specification Section	Product Data Description
01 40 00	Contractor's Quality Management Plan
03 30 00.01	Steel reinforcement
	Portland cement
	Coarse aggregate
	Fine aggregate
	Water
	Concrete admixtures
	Curing materials
09 96 00.01	Paint cut sheet and color chart
31 51 19	Bearing plate calculations
	Calibration certificates for stressing equipment
	Qualifications of contractor's proposed QC testing lab
	Pressure grouting plan

Specification Section	Product Data Description
	Material sample and compliance documentation of corrugated sheathing, anchor strand, strand spacers, centralizers, anchor head, and wedges
	Corrosion Protection Plan and Details
	Procedures in the event of equipment failure
	Installation, testing, and assessment procedures for test anchors
	Anchor hole drilling logs, grouting, and water tightness testing reports
	Corrugated sheathing leakage testing reports
	Weekly check of pressure gauge calibration against master gauge
	Anchor stressing and testing reports
	Post-tensioned anchor record drawings

- B. Include Product Data in the Schedule of Documents required by Section 01 33 00 “Document Management” to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Complete the following before submitting Product Data:
1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;
 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determine and verify information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- D. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 4. Product Data is complete for its intended purpose; and
 5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.

- E. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

1.04 DOCUMENTATION

- A. Include a complete description of the material to be furnished, including:
 - 1. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 - 2. All applicable standards;
 - 3. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 - 4. Mix designs for concrete, grout, or other materials proportioned for the Project; and
 - 5. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.

1.05 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

1.06 WARRANTIES AND GUARANTEES

- A. Provide all required warranties, guarantees, and related documents with the Product Data. The effective date of warranties and guarantees will be the date of Substantial Completion.
- B. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 PRODUCT DATA SUBMITTAL PROCEDURES

- A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.
 - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.
 - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.
 - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 - 5. Define abbreviations and symbols used in Product Data.

- a. Use terms and symbols in Product Data consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Product Data.
 - c. Provide a legend for symbols used on Product Data.
6. Mark Product Data to reference:
- a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Location where the product is incorporated into the Project.
- B. Complete the certification required by Paragraph 1.03.E.

1.08 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.
- 1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
 - 2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
 - 3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.
- B. Construction Manager may take the following action in processing Product Data:
- 1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
 - 2. Not approve the Product Data for one of the following reasons:
 - a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."
 - b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked "Not Approved" and "Revise and Resubmit." Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received." When Product Data is filed, no further action is required and the Product Data process will be closed.
 - c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked "Not Approved" and "Cancelled." No further action is required and the Product Data process will be closed.

- C. Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 03 PRODUCT DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.
- B. Submit Product Data to provide documents that allow the Owner to:
 - 1. Record the products incorporated into the Project; and
 - 2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Product Data is required for the following items:

Specification Section	Product Data Description
01 40 00	Contractor's Quality Management Plan
03 30 00.01	Steel reinforcement
03 30 00.01	Portland cement
03 30 00.01	Coarse aggregate
03 30 00.01	Fine aggregate
03 30 00.01	Water
03 30 00.01	Concrete admixtures
03 30 00.01	Curing materials
09 96 00.01	Paint cut sheet and color chart
31 51 19	Bearing plate calculations
31 51 19	Calibration certificates for stressing equipment
31 51 19	Qualifications of contractor's proposed QC testing lab
31 51 19	Pressure grouting plan

Specification Section	Product Data Description
31 51 19	Material sample and compliance documentation of corrugated sheathing, anchor strand, strand spacers, centralizers, anchor head, and wedges
31 51 19	Corrosion Protection Plan and Details
31 51 19	Procedures in the event of equipment failure
31 51 19	Installation, testing, and assessment procedures for test anchors
31 51 19	Anchor test program results
31 51 19	Anchor hole drilling logs, grouting, and water tightness testing reports
31 51 19	Corrugated sheathing leakage testing reports
31 51 19	Weekly check of pressure gauge calibration against master gauge
31 51 19	Anchor stressing and testing reports
31 51 19	Post-tensioned anchor record drawings

- B. Include Product Data in the Schedule of Documents required by Section 01 33 00 “Document Management” to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Complete the following before submitting Product Data:
1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;
 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determine and verify information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- D. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 4. Product Data is complete for its intended purpose; and

5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.
- E. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

1.04 DOCUMENTATION

- A. Include a complete description of the material to be furnished, including:
1. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 2. All applicable standards;
 3. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 4. Mix designs for concrete, grout, or other materials proportioned for the Project; and
 5. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.

1.05 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

1.06 WARRANTIES AND GUARANTEES

- A. Provide all required warranties, guarantees, and related documents with the Product Data. The effective date of warranties and guarantees will be the date of Substantial Completion.
- B. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 PRODUCT DATA SUBMITTAL PROCEDURES

- A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.
1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.
 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.

4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 5. Define abbreviations and symbols used in Product Data.
 - a. Use terms and symbols in Product Data consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Product Data.
 - c. Provide a legend for symbols used on Product Data.
 6. Mark Product Data to reference:
 - a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Location where the product is incorporated into the Project.
- B. Complete the certification required by Paragraph 1.03.E.

1.08 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.
1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
 2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
 3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.
- B. Construction Manager may take the following action in processing Product Data:
1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
 2. Not approve the Product Data for one of the following reasons:
 - a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."
 - b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked "Not Approved" and "Revise and Resubmit." Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received." When Product Data is filed, no further action is required and the Product Data process will be closed.

- c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked “Not Approved” and “Cancelled.” No further action is required and the Product Data process will be closed.
- C. Contractor is to resubmit the Product Data until it is acceptable and marked “Filed as Received.”

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 05 CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

- A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.
- B. Provide Progress Schedule in adequate detail to allow Owner to monitor progress and to relate submittal processing to sequential activities of the Work.
- C. Incorporate Contract Milestones into the schedule and show activities leading to achievement of these milestones.
- D. Assume complete responsibility for maintaining the progress of the Work per the Progress Schedule submitted.

1.02 DOCUMENTATION

- A. Submit the schedules to the Construction Manager. Send all documents in digital format for processing.
- B. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
- C. Provide schedules, schedule updates and revisions to the Construction Manager in electronic format in its originating software and in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management."
- D. Submit a preliminary Progress Schedule at the pre-construction conference. This will be considered the baseline schedule.
- E. Submit a detailed Progress Schedule at least 10 days prior to the first payment request.
- F. Submit Progress Schedule updates monthly within 10 days after submitting Applications for Payment to indicate the progress made on the Project to the closing date for the Application for Payment. Failure to submit Progress Schedules will cause delay in the review and approval of subsequent Applications for Payment.

1.03 PROGRESS SCHEDULE REQUIREMENTS

- A. Progress Schedule is to be in adequate detail to:
 - 1. Ensure adequate planning, scheduling, and reporting during the execution of the Work;
 - 2. Ensure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers;
 - 3. Monitor the progress of the Work; and
 - 4. Evaluate the impact of proposed changes to the Contract Times and Project Schedule.

- B. Provide personnel with 5 years' minimum experience in scheduling construction work comparable to this Project. Prepare the Progress Schedule using acceptable scheduling software.
- C. Provide the Progress Schedule in the form of a computer-generated critical path schedule which includes Work to be performed on the Project. It is intended that the Progress Schedule accomplish the following:
 - 1. Give early warning of delays in time for correction.
 - 2. Provide detailed plans for the execution of the Work in the form of future activities and events in sequential relationships.
 - 3. Establish relationships of significant planned Work activities and provide a logical sequence for planned Work activities.
 - 4. Provide continuous current status information.
 - 5. Allow analysis of the Contractor's program for the completion of the Project.
 - 6. Permit schedules to be revised when the existing schedule is not achievable.
 - 7. Log the progress of the Work as it actually occurs.
- D. Provide a time-scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The chart is to indicate:
 - 1. Complete sequence of construction by activity;
 - 2. Identification of the activity by structure, location, and type of Work;
 - 3. Chronological order of the start of each item of Work;
 - 4. The activity start and stop dates;
 - 5. The activity duration; and production rates used to determine the duration;
 - 6. Successor and predecessor relationships for each activity;
 - 7. A clearly indicated single critical path; and
 - 8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the first day of each month.
- E. Provide a Progress Schedule for Submittals:
 - 1. Indicate the specific dates each document is to be delivered to the Construction Manager.
 - 2. Allow a reasonable time to review each document, taking into consideration the size and complexity of the document, other documents being processed, and other factors that may affect review time.
 - 3. Include time for making revisions to the Shop Drawings and resubmitting the Shop Drawing for at least a second review.
 - 4. Assume a 14-day review cycle for each time a Shop Drawing is submitted for review unless a longer period is indicated in the Contract Documents or provided by the Construction Manager.

5. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous documents and for time lost when documents are submitted for products that do not meet specification requirements.

1.04 PROGRESS SCHEDULE REVISIONS

- A. Revise the Progress Schedule if it appears that the schedule no longer represents the actual progress of the Work.
 1. Submit a Plan of Action for schedule recovery if the Progress Schedule or earned value analysis indicates that the Project is more than 30 days behind schedule. The report is to include:
 - a. Number of days behind schedule;
 - b. Narrative description of the steps to be taken to bring the Project back on schedule; and
 - c. Anticipated time required to bring the Project back on schedule.
 2. Submit a revised Progress Schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.
- B. Revise the Progress Schedule to indicate any adjustments in Contract Times approved by a Modification.
 1. Include a revised Progress Schedule with Change Proposals if a change in Contract Times is requested.
 2. Construction Manager will deem any Change Proposal that does not have a revised Progress Schedule and request for a change in Contract Times as having no impact on the ability of the Contractor to complete the Project within the Contract Times.
- C. Updating the Progress Schedule to reflect actual progress is not considered a revision to the schedule.
- D. Applications for Payment will not be recommended for payment without a revised Progress Schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

1.05 FLOAT TIME

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.
- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Where several subsystems each have a critical path, the subsystem with the longest time of completion is the critical path and float time is to be assigned to other subsystems.
- D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is float time.

1.06 MODIFICATION OF CONTRACT TIMES

- A. Contract Times cannot be changed by the submission of a Progress Schedule. Contract Times can only be modified by a Change Order or Contract Amendment.
- B. Submit a Change Proposal for any proposed change in Contract Times, and include justification for the change in accordance with the provisions of the Contract Documents.

1.07 NEAR-TERM LOOK AHEAD SCHEDULES

- A. Provide a near-term look ahead schedule (NTLA Schedule) every 30 days, typically at periodic coordination meetings, using the form provided by the Construction Manager which shows the days of planned activity for the following:
 - 1. Submittals to be provided and day of anticipated return;
 - 2. Equipment and material deliveries;
 - 3. Arrival and departure of key construction equipment; and
 - 4. Activities for the Contractor and each Subcontractor.
- B. Coordinate NTLA Schedule with Project Schedule. Submit a report with each NTLA Schedule identifying deviations from the Project Schedule.
- C. Submit a report of near-term work planned in the previous NTLA Schedule that was delayed or not executed by marking actual activity on the previous near term look ahead schedule. Provide explanation of why planned work was not executed and plan to execute in the future and regain time lost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 06 GRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.
 - 1. Provide aerial photographs of the completed Project from an angle and height to include the entire Site.
 - 2. Provide a minimum of four different views.
 - 3. Photograph a panoramic view of the entire Site.
 - 4. Photograph all significant areas of completed construction.
 - 5. Do not take completion photographs until all construction trailers, excess materials, trash, and debris have been removed.
 - 6. Employ a professional photographer approved by the Construction Manager to photograph the Project.
- B. Provide video recordings of the Site.
 - 1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including streets, curb and gutter, utilities, driveways, fencing, landscaping, etc., prior the beginning of construction. Provide one copy of the dated and labeled recording to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.
 - 2. Provide a video recording of the Site after the Project is complete and all construction trailers, excess materials, trash, and debris have been removed. Provide a 360-degree view of the Project from a consistent height and angle.
 - 3. Format must allow photographic still shots to be extracted from the video recording.
- C. All photographs and video recordings are to become the property of the Owner. Photographs or recordings may not be used for public or private publication or display without the written consent of the Owner.
- D. Unmanned Aerial Vehicles used for aerial photography must be registered and piloted by licensed individuals in accordance with Laws and Regulations.

1.02 DOCUMENTATION

- A. Submit photographic documentation in accordance with Section 01 33 00 "Document Management."

1.03 QUALITY ASSURANCE

- A. Provide clear photographs and video recordings taken with proper exposure. View photographs and video recordings in the field and take new photographs or video

recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS

- A. Provide photographs in digital format with a minimum resolution of 1280x960, accomplished without a digital zoom.
- B. Take photographs at locations acceptable to the Construction Manager.
- C. Provide a digital copy of each photograph taken.
- D. Identify each photograph with:
 - 1. Name of the Project.
 - 2. Date, time, location, and orientation of the exposure.
 - 3. Description of the subject of photograph.

2.02 VIDEO RECORDING

- A. Provide video recordings in digital format that can be played with Windows Media Player in full screen mode without loss of resolution.
- B. Identify Project on video by audio or visual means.
- C. Provide video with file size that does not exceed 1 GB.
- D. Provide video resolution of at least 1080p.
- E. The quality of the video must be adequate to determine the existing conditions of the construction area. Camera panning must be performed while at rest; do not pan the camera while walking or driving. Camera pans should be performed at intervals to clearly view the entire construction area.
- F. Construction stationing is to be annotated in the video.
- G. The entire construction area recording must be submitted at once. Sections submitted separately will not be accepted.
- H. Site components must be video recorded in an organized sequential order with major components identified.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 40 00 **QUALITY MANAGEMENT**

PART 1 - GENERAL

1.01 OVERVIEW

- A. Quality management refers to the overall process of delivering a completed Project to the Owner that complies with the requirements of the Contract Documents. Quality management applies to documentation, products, services, and the Work.
- B. Contractor is responsible for the quality of documentation, products, services, and the Work provided.
 - 1. Contractor is to integrate quality control procedures into the execution of the Work that are adequate to produce a Project that meets the requirements of the Contract Documents, while minimizing loss of time and increased costs. Contractor is solely responsible for time and cost impacts of correcting Defective Work.
 - 2. Contractor is to provide all testing and inspection required to control the quality of the Work in progress to determine that completed Work will comply with the requirements of the Contract Documents.
 - 3. Contractor is to provide verification or acceptance testing as required by the Contract Documents to demonstrate that the completed Work complies with the requirements of the Contract Documents, except for those tests that the Owner has determined are to be conducted independent of the Contractor and identified as Owner testing in the Owner's Quality Management Plan.

1.02 STANDARDS

- A. Provide testing laboratories that comply with the American Council of Independent Laboratories (ACIL) "Recommended Requirements for Independent Laboratory Qualifications."
- B. Perform testing in accordance with the published standards and procedures for testing listed in the Specifications and applicable Laws and Regulations.

1.03 DOCUMENTATION

- A. Provide documentation which includes:
 - 1. Contractor's Quality Management Plan that establishes the methods of ensuring compliance with the Contract Documents. Submit this plan as Product Data per Section 01 31 13 "Project Administration."
 - 2. A statement of qualifications for any proposed testing laboratory that includes a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification, and a list of recent projects for which testing has been performed with references for those projects.
 - 3. Certified Test Reports for products to be incorporated into the Project. Provide reports to indicate that the proposed products comply with the Contract Documents or

indicate that the proposed products do not comply with the Contract Documents and why those products do not comply. Submit Certified Test Reports as part of a Shop Drawing submitted per Section 01 33 02 "Shop Drawings."

4. Certified Test Reports for inspections and testing required in this Section and in other Sections of the Specifications. Provide reports to indicate that the Work complies with the Contract Documents or indicate that the Work does not comply with the Contract Documents and why the Work does not comply. Submit these test reports on forms provided by the Construction Manager per Section 01 33 00 "Document Management."
5. Certified Test Reports of Defective Work and Certified Test Reports documenting that successful corrective action has produced Work that complies with the Contract Documents. Maintain a register listing Defective Work and record when corrective action has produced Work that complies with the Contract Documents. Present this Defective Work register as part of the Quality Report at progress meetings as described in Paragraph 1.05.E. Incorporate this register in the closeout documentation per Section 01 70 00 "Execution and Closeout Requirements" to demonstrate that all Defective Work has been corrected.

1.04 OWNER'S QUALITY MANAGEMENT ACTIVITIES

- A. Owner may perform its own verification testing independent of the Contractor. The Owner's Quality Management Plan (OQMP) describes the Owner's anticipated verification testing program for this Project. The preliminary testing plan is shown in Paragraph 3.04. This plan outlines the anticipated testing in general terms and may not reflect the actual testing performed by the Owner. Actual testing will depend on the Contractor's means, methods, and procedures of construction which will not be known until the Contractor submits the Contractor's Quality Control Plan (CQCP) to the Construction Manager. There is no guarantee that all testing in the preliminary OQMP included in the Bidding/Proposal Documents will be performed by the Owner. Contractor will arrange and pay for all production control testing deemed necessary by the Contractor to produce quality results.
- B. Quality management activities of the Owner are for verifying the results of the Contractor's Work complies with the requirements of the Contract Documents. Performance or non-performance of verification activities by the Owner:
 1. Does not relieve the Contractor of its responsibility to provide Work and furnish products that comply with the requirements of the Contract Documents;
 2. Does not relieve the Contractor of its responsibility to provide adequate quality control measures to produce quality documents, products, services, or Work;
 3. Does not relieve the Contractor of its responsibility for damage to or loss of Work or products before Owner's acceptance; and
 4. Does not affect the continuing rights of the Owner after acceptance of the completed Work.
- C. The Work is subject to observations or testing at any time by the OPT. Products which have been tested or inspected and accepted by the Owner at a supply source or staging area may be inspected or tested again by the OPT before, during, or after incorporation into the Work and rejected if products do not comply with the Contract Documents.

- D. Verification testing performed by the OPT will be paid for by the Owner, except for testing related to Defective Work as discussed in Paragraph 3.03.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Review the OQMP and provide a Contractor's Quality Control Plan (CQCP) outlining testing to be provided by the Contractor per Paragraph 1.07.
- B. Implement the CQCP to provide Work that complies with the requirements of the Contract Documents.
 - 1. Provide quality documents meeting the requirements of the Contract Documents.
 - 2. Provide services meeting the requirements of the Contract Documents.
 - 3. Provide the services of a Construction Materials Inspection and Testing (CMIT) provider meeting the requirements of this Section to provide testing required by the Contract Documents to demonstrate that products proposed for the Project in Shop Drawings and Product Data fully comply with the Contract Documents.
 - 4. Inspect and test products to be incorporated into the Project to identify defects before installing them. Do not install Defective products. Conspicuously mark Defective products and remove from the Site. If products are installed before the defect is recognized, remove the Defective products, mark them as Defective and remove them from the Site when the defect is recognized.
 - 5. Integrate production quality control measures into construction activities to produce Work meeting the requirements of the Contract Documents. Inspect self-performed Work and the Work of Subcontractors and Suppliers to identify defects. Correct or replace Defective Work.
 - 6. Provide facilities, equipment, and Samples required for inspections and tests.
 - a. Give the Construction Manager adequate notice before proceeding with Work that would interfere with inspections or testing.
 - b. Notify the Construction Manager and CMIT provider prior to the time that testing is required, providing adequate lead time to allow arrangements for inspections or testing to be performed.
 - c. Do not proceed with Work that would impact the ability to correct defects, or with Work that would require that it be removed to correct defects, until testing is complete, and test results indicate that the corrected Work is acceptable.
 - d. Provide safe access for all CMIT activities, including those to be conducted as part of the Owner's Quality Management Program.
 - e. Cooperate fully with the performance of sampling, inspection, and testing. Provide personnel to assist with sampling or to assist in making inspections and field tests.
 - f. Provide Samples and products in adequate quantities for testing at the Site or at the production source of the product for testing.
 - g. Provide facilities required to store and cure concrete and grout test Samples.
 - h. Make Contract Documents available to testing agencies when requested.

- C. Perform tests as indicated in Contract Documents. All verification testing is to be observed by the Construction Manager or its designated representative.
- D. Submit test reports to the Construction Manager.
- E. Provide an update on quality control activities performed the previous month and planned for the coming month at monthly progress meetings required by Section 01 31 13 "Project Administration."
- F. Determine testing or inspections required to implement the CQCP. Include costs for additional testing and inspections required to meet the Contractor's quality control obligations in the Contract Price.

1.06 CONTRACTOR'S QUALITY CONTROL MANAGER

- A. Provide a Quality Control Manager for the Project. Quality Control Manager must have authority to reject Defective Work, redirect the efforts of the Contractor, Subcontractor and Suppliers to correct Defective Work, and implement steps to prevent future Defective Work.
- B. The resident superintendent or an approved assistant can serve as Quality Control Manager, provided other duties will allow adequate time to serve in this capacity.

1.07 CONTRACTOR'S QUALITY CONTROL PLAN

- A. Provide a CQCP that describes testing and inspections for Work performed at the Site and at remote locations. Include Work by Subcontractors and Suppliers. The CQCP is to include:
 1. A description of the quality control organization, including an organization chart showing lines of authority to control the quality of Work.
 2. Documentation describing name, qualifications (in resume format), duties, responsibilities, and level of authority of the Quality Control Manager.
 3. The name, qualifications (in resume format), duties, responsibilities, and authorities of other persons assigned a quality control function.
 4. Procedures for scheduling, reviewing, certifying, and managing documentation including documentation provided by Subcontractors and Suppliers.
 5. Control, verification, and acceptance testing procedures for each specific test. Include:
 - a. Name of tests to be performed;
 - b. Specification paragraph requiring test;
 - c. Parameters of Work to be tested;
 - d. Test frequency;
 - e. Persons responsible for each test; and
 - f. Applicable industry testing standards and laboratory facilities to be used for the test.
 6. Incorporate the testing specified in the OQMP into the CQCP, specifically identifying the tests or inspections that will be provided by the OQMP;

7. Procedures for tracking and documenting quality management efforts per Paragraph 1.03.
 8. Reporting procedures which incorporate the use of forms provided by the Construction Manager.
 9. The name of the proposed testing laboratories along with documentation of qualifications per Paragraph 1.03.
- B. Use the Contractor's Quality Control Plan Checklist provided by the Construction Manager to review the CQCP before submitting and include a copy of the completed checklist with the CQCP. Do not begin Work until the CQCP is accepted. Submit an interim plan covering only the portion of Work to be performed if the Contractor plans to begin Work prior to submitting the complete CQCP for the Project. Do not begin Work on other parts of the Project until the complete CQCP is accepted.
 - C. Meet with the OPT 7 days after CQCP is submitted and before start of construction to discuss the CQCP.
 - D. Notify the Construction Manager of any changes to the CQCP or quality control personnel.

1.08 CONTRACTOR'S USE OF OWNER'S TEST REPORTS

- A. Contractor will receive copies of all test reports documenting the Owner's verification tests. Contractor is entitled to rely on the accuracy of these tests results and use these as part of its quality control efforts.
- B. Contractor is responsible for payment for any re-tests resulting from a failed Owner's verification test.
- C. Contractor may submit a Change Proposal if the Owner's testing program deviates significantly from the OQMP. Contractor must demonstrate that actual testing and inspection costs were incurred implementing the CQCP as a result of Owner's decision to not provide testing described in the OQMP.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing testing services and interpreting the results of the test performed.
- B. The testing laboratory is not authorized to:
 1. Alter the requirements of the Contract Documents;
 2. Accept or reject any portion of the Work;
 3. Perform any of the duties of the Contractor; or
 4. Direct or stop the Work.

1.10 TEST REPORTS

- A. Certified Test Reports are to be prepared for all tests.

1. Tests performed by testing laboratories may be submitted on their standard test report forms if acceptable to the Owner using the process directed by the Construction Manager. These reports must include the following:
 - a. Name of the Owner, Project title and number, and name of the Contractor;
 - b. Name, address, and telephone number of the laboratory;
 - c. Name and signature of the laboratory personnel performing the test;
 - d. Description of the product being sampled or tested;
 - e. Date and time of sampling, inspection, and testing;
 - f. Date the report was issued;
 - g. Description of the test performed;
 - h. Weather conditions and temperature at time of test or sampling;
 - i. Location at the Site or structure where the test was taken;
 - j. Standard or test procedure used in making the test;
 - k. A description of the results of the test;
 - l. Statement of compliance or non-compliance with the Contract Documents; and
 - m. Interpretations of test results, if appropriate.
 2. Submit reports on tests performed by the Contractor, Subcontractors, or Suppliers as directed by the Construction Manager.
 3. OPT will prepare test reports on tests performed by the OPT.
- B. Submit test reports as directed by the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Notify the Construction Manager, using acceptable means other than the test report, immediately of any test that fails to comply with the Contract Documents.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures. Provide facilities for storing, curing, and processing test specimens as required by test standards to maintain the integrity of Samples. Transport test specimens in a manner to prevent damage to specimens while in transit.

PART 2 - PRODUCTS

2.01 TESTING APPARATUS

- A. Furnish testing apparatus and related accessories necessary to perform the tests.

2.02 SAMPLE PRODUCTS

- A. Provide Samples of products in adequate quantity for testing.

PART 3 - EXECUTION

3.01 IMPLEMENTING CONTRACTOR'S QUALITY CONTROL PLAN

- A. Perform quality control observations and testing as required in each Section of the Specifications and where indicated on the Drawings.
- B. Include the phases listed below for each definable work task. A definable work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.
 - 1. Planning Phase: Perform the following before beginning each definable work task:
 - a. Review the Contract Documents.
 - b. Review documents the Contractor will submit and determine that they are complete in accordance with the Contract Documents.
 - c. Check to ensure that all materials and/or equipment have been tested, submitted, and approved.
 - d. Examine the work area to ensure that all required preliminary Work has been completed and complies with the Contract Documents.
 - e. Examine required materials, equipment, and sample Work to ensure that they are on hand, conform to Contract Documents, Shop Drawings and Product Data, and are properly stored.
 - f. Review requirements for quality control inspection and testing.
 - g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the work task.
 - h. Check that the portion of the plan for the Work to be performed incorporates document review comments.
 - i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Construction Manager, Quality Control Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the work task. Instruct applicable workers as to the acceptable level of workmanship required to meet the requirements of the Contract Documents. Document the results of the planning phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.
 - j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
 - 2. Work Phase: Complete this phase after the planning phase.
 - a. Notify the Construction Manager at least 1 week in advance of beginning the Work and discuss the review of the planning phase effort to indicate that requirements have been met.

- b. Check the Work to ensure that it is in full compliance with the Contract Documents.
 - c. Verify adequacy of controls to ensure full compliance with the Contract Documents. Verify required control inspection and testing is performed.
 - d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required Sample panels as appropriate.
 - e. Repeat the work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.
3. Follow-Up Phase: Perform daily checks to ensure control activities, including control testing, are providing continued compliance with contract requirements.
- a. Make checks daily and record observations in the quality control documentation.
 - b. Conduct follow-up checks and correct all defects prior to the start of additional work tasks that may be affected by the Defective Work. Do not build upon nor conceal Defective Work.
 - c. Conduct a review of the Work at least 1 month prior to the expiration of the correction period prescribed in the General Conditions with the OPT. Correct defects as noted during the review.
- C. Conduct additional planning and work phases if:
- 1. The quality of on-going Work is unacceptable;
 - 2. Changes are made in applicable quality control staff, on-site production supervision, or crews;
 - 3. Work on a task is resumed after a substantial period of inactivity; or
 - 4. Other quality problems develop.

3.02 DEFECTIVE WORK

- A. Immediately correct any Defective Work or notify the Construction Manager why the Work is not to be corrected immediately and when corrective action will be completed.
- B. Work performed that is connected or adjacent to Defective Work or Work that would have to be removed to correct Defective Work is also considered to be Defective. Contractor is responsible for all costs associated with replacing any acceptable Work that must be removed, or might be damaged by corrective actions.
- C. Document Defective Work, corrective actions taken to correct defects, and that corrected Work complies with the Contract Documents.
- D. Implement countermeasures to prevent future Defective Work.
- E. No payment will be made for Defective Work. Remove Work from the Application for Payment if Work paid for on a previous Application for Payment is found to be Defective.
- F. Owner will withhold payment for Defective Work or Work that has not been tested or inspected in accordance with the CQCP, OQCP, or the Contract Documents.

3.03 VERIFICATION TESTING FOR CORRECTED DEFECTS

- A. Provide verification testing on corrected Work when corrective action is complete to demonstrate that the corrected Work complies with the Contract Documents. Conduct the same tests or inspections used to determine that the original Work was Defective. Different tests or methods may be used if approved by the Owner. Document that Defective Work has been corrected with the Construction Manager.
- B. Pay for verification testing until Work meets quality requirement set forth in the Contract Documents. OPT may perform verification testing as part of the Owner's Quality Management Program and impose a set-off to recover the cost for this testing.

3.04 OWNER'S PRELIMINARY QUALITY CONTROL PLAN

Spec. Section	Test / Frequency	OPT or Contractor
03 30 00.01	Field test data or trial batch mixture data to validate specified compressive strength	Contractor
	Aggregate reactivity in accordance with ASTM C1567	Contractor
	Composite sample for each pour in according with ACI 301	Contractor
09 96 00.01	Coating thickness testing	Contractor
31 51 19	Verification of material quality	Contractor
	Grout quality control	Contractor
	Test anchor	Contractor
	Anchor load testing	Contractor
	Monitoring	Contractor
	Load loss evaluation period	Contractor
	Equipment Calibration and Certification	Contractor

END OF SECTION

01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide temporary facilities, including OPT's field office, Contractor's field offices, storage sheds, workshops, and other facilities needed to complete the Work.
- B. Provide temporary utilities needed to support the operation of the facilities and construction activities.
- C. Provide and maintain temporary project identification signs for City of Tulsa
- D. Provide temporary informational signs to identify key elements of construction and direct the flow of traffic.
- E. Provide a weatherproof kiosk for display of permits and other notices required by Laws and Regulations.

1.02 DOCUMENTATION

- A. Submit a Shop Drawing, in accordance with Section 01 33 02 "Shop Drawings," showing a scaled office floor plan prior to installation of OPT's field office. Include details for:
 - 1. Telephone equipment;
 - 2. Internet equipment;
 - 3. Computer equipment;
 - 4. Security/alarm systems; and
 - 5. Office furniture and appliances.

1.03 QUALITY ASSURANCE

- A. Inspect and test each utility before using facilities. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use of facilities.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Transport, unload, and set up all temporary buildings and utilities.

1.05 JOB CONDITIONS

- A. Locate buildings and sheds at the Site as indicated or as approved by the OPT.
- B. Prepare the Site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.
- C. Provide Contractor's temporary facilities and utilities in time to avoid delays in the performance of the Work.

- D. Provide OPT's field office, complete and ready for occupancy, and use no later than 7 days after the Notice to Proceed. Applications for Payment will not be processed until OPT's field office facilities are completed and approved.
- E. Provide and maintain temporary facilities and utilities.
- F. Operate temporary facilities in a safe and efficient manner.
 - 1. Restrict loads on utilities to operate within their designed or designated capacities.
 - 2. Provide sanitary conditions. Prevent public nuisance or hazardous conditions from developing or existing at the Site.
 - 3. Prevent freezing of pipes, flooding, or the contamination of water.
 - 4. Maintain site security and protection of the facilities.
- G. Remove temporary facilities and utilities when construction is complete and removal is approved by the Construction Manager.

PART 2 - PRODUCTS

2.01 OPT FIELD OFFICES

- A. Provide and continuously maintain OPT's field office separate from Contractor's field office. Provide an office with a minimum nominal size of 12 feet by 40 feet.
 - 1. Office and/or materials of construction may be new or slightly used but must be serviceable, adequate for the intended purpose, acceptable to the Construction Manager, and must not violate codes or regulations.
 - 2. Offices are to be structurally sound, weather-tight, insulated and have floor raised above the ground. Brace and anchor offices to prevent movement.
 - 3. Skirt around perimeter of structures with the same material as structure siding.
 - 4. The space must have one private office with full height interior door, one open conference space for meeting with up to 8 people, and one guest work desk area.
 - 5. Provide vinyl or VCT tile on floors.
 - 6. Provide burglar bar security on doors and windows.
 - 7. Provide outside doors with padlocks and door locks.
 - 8. Provide operable, screened windows with locks.
 - 9. Provide Venetian type window blinds.
 - 10. Provide mounted boot brush / cleaner / scraper on porch at entrances.
- B. Construct a wood porch with steps and a covered overhang at doors that ensures that rain will be completely diverted from doors. Provide wooden railing around porch and on the steps.
- C. Provide electricity to the field office adequate to power equipment, appliances, and heating and cooling systems.

1. Provide sufficient lighting for office environment using fluorescent light fixtures with lenses energized by wall switches. Provide separate switches just inside exterior doors for the main area, inside of offices and inside the restroom.
 2. Provide outside security lighting.
 3. Provide three duplex receptacles in each office and five duplex receptacles in remainder of building at locations designated by Construction Manager.
- D. Provide an electric heating and cooling system for the field office capable of maintaining the following conditions:
1. Heat to a minimum of 75 deg. F inside when outside temperatures are 10 deg. F.
 2. Cool to a minimum 72 deg. F inside temperature when outside temperatures are 105 deg. F.
 3. Maintain relative humidity between 48 to 54 percent.
- A. Provide sanitary facilities at the Site from the commencement of the Project until project conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.
- E. Provide an electric water cooler and a supply of bottled water.
- F. Provide furnishings at the field office as follows:

Qty.	Furnishing
2	2'-6" x 5'-0" office desks with credenzas
2	Fabric covered cushioned arm chairs with swivel/tilt/roll capabilities
8	Folding chairs (Lifetime Commercial Grade white granite)
2	3'-0" x 8'-0" folding tables (Lifetime Commercial Grade white granite)
1	Legal size, four-drawer metal filing cabinets
1	6" X 48" x 12" book shelves
1	Full-size drafting/plan table
2	Plastic waste cans for office
2	Large waste cans for open area and restroom

- G. Provide internet service at the field office with the following features:
1. Minimum 10 Mbps download, 3 Mbps upload speed;
 2. Maximum file transfer size of 100 MB; and
 3. Unlimited email/storage size.
- H. Provide wireless router for internet services with adequate range to reach all areas of the office.
- I. Provide color copier with the following capabilities:
1. Provide service and maintenance agreement throughout the Project. Provide toner, paper supply for the duration of the Project, and other supplies as needed to operate the copier.
 2. Ability to scan to email/file/folder.

3. Ability to print, sort and collate.
 4. Produce up to 45 copies per minute in black and white.
 5. Ability to scan and print in black and white, grayscale, or color.
 6. Ability to auto feed and auto duplex.
 7. Provide a minimum of two paper trays with 500-sheet capacity.
 8. Reduction and enlargement capability with range from 25 to 400 percent.
 9. Ability to scan, copy, and print up to 11 x 17 format.
- J. Provide a fire extinguisher and commercially serviced first aid kit.
 - K. Furnish a microwave unit with a minimum cooking volume of 1.5 cubic feet.
 - L. Furnish a refrigerator/freezer with minimum storage capacity of 3.5 cubic feet.
 - M. Furnish and maintain office supply stock, including but not limited to, pens, pencils, markers, staples, notepads, paper, posted notes, CD-WR computer disks, file folders, paper clips, binder clips, etc., for duration of Project. Pay for OPT's office supply purchases up to \$50 per month.
 - N. Field office and furniture will remain the property of the Contractor.
 - O. Provide access to reserved parking spaces for six vehicles adjacent to the OPT's field offices. Provide a durable parking area surface to prevent erosion, mud, dust, or rutting caused by vehicles. Provide a minimum of 4 inches of flexible crushed limestone base material. The parking surface shall have adequate drainage to allow for access and prevent ponding during rain events.

2.02 CONTRACTOR'S FIELD OFFICE

- A. Furnish a field office of adequate size for Contractor's use.
- B. Subcontractors may provide their own field offices only when space is available on the Site and the OPT agrees to its size, condition, and location.

2.03 TEMPORARY STORAGE BUILDINGS

- A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

2.04 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities at the Site for the entire duration of the Project. Maintain these facilities in a clean and sanitary condition at all times and comply with the requirements of the local health authority. Provide portable toilets at such locations so that no point at the Site will be more than 600 feet from a toilet.
- B. Use these sanitary facilities. Do not use restrooms within existing or Owner-occupied buildings.

2.05 TEMPORARY HEAT

- A. Provide heating devices needed to protect buildings during construction. Provide fuel needed to operate the heating devices and attend the heating devices at all times they are in operation, including overnight operations.

2.06 TEMPORARY UTILITIES

- A. Provide the temporary utilities for administration, construction, testing, disinfection, and startup of the Work, including electrical power. Pay all costs associated with furnishing temporary utilities.
 - 1. Provide all power for heating, lighting, operation of Contractor's plant or equipment, or for another use by Contractor.
 - 2. Provide and pay for power service from utility sources as required. Provide temporary electric feeder and electrical service as required.
 - 3. Provide separate metering for cost of energy used as required.
 - 4. Provide electrical pole and service connections that comply with Laws and Regulations and the requirements of the power company.
 - 5. Provide power for construction and storage. Provide power to energize space heaters for stored electrical equipment.

2.07 WATER FOR CONSTRUCTION

- A. Provide, maintain, and pay for suitable quality water service required for construction operations.
- B. The only water source currently available at the job site is reservoir water. Contractor shall determine the suitability of reservoir water for construction purposes.

PART 3 - EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

- A. Locate temporary facilities in areas approved by the Construction Manager. Construct and install signs at locations approved by the Construction Manager. Install informational signs so they are clearly visible.

3.02 TEMPORARY LIGHTING

- A. Provide temporary lighting inside buildings once buildings are weatherproof.
- B. Provide exterior security lighting.
- C. Provide lighting that is adequate to perform Work within any space. Temporary lights may be removed once the permanent lighting is in service.
- D. Provide portable flood lights at any time that Work will be performed outside the structure at night. Provide adequate lighting at any location Work is being performed.

3.03 DRINKING WATER

- A. Provide all field offices with potable water. Provide a dispenser and cooling apparatus if bottled drinking water is provided.
- B. Pay for water services and maintain daily.

3.04 CONSTRUCTION FENCE

- A. Install and maintain a chain-link construction fence around the Site and off-site storage yards. Fence must be a minimum 6 feet high. Provide gates with padlocks.
- B. Provide barriers around all excavations or obstructions to prevent accidents and protect Work, apparatus, equipment, and material from theft and accidental or other damages, and make good any damages thus occurring at no cost to the Owner.
- C. Protect non-owned vehicular traffic, stored materials, site and structures from damage
- D. Provide measures to protect Owner's personnel and public from Work activities including, but not limited to, safety fence surrounding the work and staging, storage and stockpile areas.

3.05 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished condition in accordance with the Drawings.
- B. Remove informational signs upon completion of construction.
- C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

3.06 MAINTENANCE AND JANITORIAL SERVICE

- A. Provide janitorial service for the OPT's field office on a weekly basis or as requested. Empty trash receptacles daily or as needed.
- B. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.
- C. Repair any damage to Work caused by placement or removal of temporary signage.
- D. Service, maintain, and replace, if necessary, the field office computer equipment throughout the Project as required by the OPT including replacement cartridges for all office equipment.

3.07 TEMPORARY WORK PLATFORM

- A. Design, fabricate, install, and maintain temporary work platforms for work on the gated and overflow spillways. All platforms to be designed by a Registered Professional Engineer licensed in Oklahoma. The platform shall be designed, fabricated, and erected under the direction of an engineer licensed to practice in Oklahoma.
- B. The existing bridge may be incorporated as part of the Contractor's access provided there is an initial inspection and report by a Registered Professional Engineer licensed in Oklahoma

assessing the allowable loading conditions, and a joint inspection is conducted by the Owner and Contractor before and after use.

- C. The purpose of the platform is to provide a base for the Contractor to work from and to contain all liquid and solid materials used or generated in the process of completing this Work.
- D. All platform materials and connections to existing structures shall be removed at completion of the Work. Connections to existing structures shall be made in a manner that does not negatively impact the integrity of the existing structures. While the platform is not in use the Contractor shall remove the platform and all its connections and store them at an on-site location to be determined by the Owner.
- E. Design, fabricate, and erect the temporary work platform according to the applicable local, state, and federal laws and regulations for the type of Work.
- F. Remove temporary anchor bolts and grout holes flush with the concrete with an approved non-shrink grout placed in a dry-pack consistency and tamped in lifts as approved by the Owner. As an option, the Contractor may cut the anchor bolts flush with the concrete if the embedded bolt material is stainless steel.

END OF SECTION

01 57 23 TEMPORARY STORMWATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish labor, materials, equipment, and incidentals necessary to provide stormwater pollution prevention for the duration of the construction period including furnishing, installing, and maintaining erosion and sediment control structures and procedures and properly removing the features when no longer required.
- B. Develop, implement, and maintain a stormwater pollution prevention plan (SWPPP) in compliance with local, state, and federal Laws and Regulations. Provide preventive measures to keep sediment, drill cuttings, and other pollutants from the construction activity from entering any water system, including Lake Eucha and Spavinaw Creek. Comply with the Oklahoma Department of Environmental Quality General Permit (OKR10) for storm water discharges from construction activities under the Oklahoma Pollutant Discharge Elimination System (OPDES) program.
- C. This Section provides guidelines and Best Management Practices information for the Contractor to use in adhering to all local, state, and federal environmental Laws and Regulations with respect to stormwater pollution prevention during construction activities.

1.02 DOCUMENTATION

- A. Documentation must be provided in accordance with Section 01 33 00 "Document Management."
- B. Submit copies of required notices and reports to the Construction Manager as Product Data in accordance with Section 01 33 03 "Product Data." Retain copies of these documents at the Site for review and inspection by the OPT or regulatory agencies at all times.
- C. Submit copies of required notices to local, state, and federal authorities and any other entity as required by the General Permit and applicable Laws and Regulations.
- D. Post a copy of required notices at the Site in a location where it is readily available for viewing by the general public and local, state, and federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- E. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the SWPPP required under the General Permit.
- F. Provide schedules in accordance with Paragraph 3.05.

1.03 QUALITY ASSURANCE

- A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Drawings are not intended to be prescriptive but rather to convey the intent to provide complete water pollution prevention for the Project.
- B. The Contractor shall develop and implement a storm water pollution prevention plan in accordance with ODEQ General Permit OKR10 prior to the beginning of construction activity.

- C. Contractor must develop and implement a SWPPP in accordance with the General Permit prior to the beginning of construction activity.
- D. Contractor assumes sole responsibility for implementing, updating, and modifying the General Permit per Laws and Regulations for the SWPPP and Best Management Practices.
- E. Stormwater pollution prevention measures must be established prior to the beginning of construction and maintained during the entire length of construction until final completion of anchor drilling and installation operations.
- F. Install measures to prevent solids from drilling operations, concrete demolition, and spillage from grouting and concreting operations from entering adjacent water bodies.
- G. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain adequate treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other stormwater pollutants at the time of completion of the Work.
- H. Coordinate with Construction Manager on acceptable on-site disposal locations for dewatered drill cuttings and concrete demolition debris.

1.04 JOB CONDITIONS, CODES AND ORDINANCES

- A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional stormwater pollution prevention measures during construction beyond those required by state and federal Laws and Regulations, the Contractor must provide such measures at no additional cost.

1.05 STANDARDS

- A. The applicable provisions of the following standards apply as if written here in their entirety:

1. ASTM International (ASTM):

ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds
ASTM D3786	Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min)
ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials used for stormwater pollution prevention must meet the minimum design and specification requirements identified below for commonly used sediment loss prevention . The Contractor must use appropriate control devices to protect against stormwater pollution from construction site activities.

- B. Erosion control blankets (ECBs) to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following design criteria:
1. The type and class of erosion control mat must be specified as appropriate for the slope of the area to be protected, the flow rate (sheet flow on cut/fill slopes) or velocity (concentrated flow in swales) of stormwater runoff in contact with the ECB, and the anticipated length of service.
 2. Erosion control blankets must meet the applicable Oklahoma Department of Transportation (ODOT) Erosion and Sediment Controls as provided in Stormwater Management Plan for requirements for erosion control mats or blankets.
- C. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following design criteria:
1. If 50 percent or less soil by weight passes the U.S. Standard sieve No. 200, select the apparent opening size (A.O.S.) to retain 85 percent of the soil.
 2. If 85 percent or more of soil by weight passes the U.S. Standard sieve No. 200, silt fences must not be used unless the soil mass is evaluated and deemed suitable by a soil scientist or geotechnical engineer concerning the erodibility of the soil mass, dispersive characteristics, and the potential grain-size characteristics of the material that is likely to be eroded.
 3. Silt fence fabric must meet the following minimum criteria:
 - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds.
 - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds.
 - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi.
 - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min).
 - e. Ultraviolet Resistance, ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus. Minimum 70 percent.
 4. Filter stone for an overflow structure must be 1-1/2-inch washed stone containing no fine material. Angular shaped stone is preferable to rounded shaped stone.
 5. Fence posts must be galvanized steel or equivalent and may be T-section or L-section, 1.3 pounds per linear foot minimum, and 4 feet in length minimum. Wood posts may be used depending on anticipated length of service and provided they are 4 feet in length minimum and have a nominal cross-section of 2 inches by 4 inches for pine or 2 inches by 2 inches for hardwoods.
 6. Silt fence must be supported by galvanized steel wire fence fabric as follows:
 - a. 4-inch by 4-inch mesh size, W1.4/1.4, minimum 14-gauge wire fence fabric;
 - b. Hog wire, 12-gauge wire, small openings installed at bottom of silt fence;

- c. Standard 2-inch by 2-inch chain link fence fabric; or
 - d. Other welded or woven steel fabrics consisting of equal or smaller spacing as that listed herein and appropriate gauge wire to provide support.
- D. Inlet protection used in new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following design criteria:
1. Filter fabric protection must be designed and maintained in a manner similar to a silt fence.
 2. Where applicable, filter fabric, posts, and wire backing must meet the material requirements specified in Paragraph 2.01.C.
 3. Filter gravel must be 3/4-inch washed stone containing no fines. Angular shaped stone is preferable to rounded shapes.
 4. Concrete blocks must be standard 8-inch by 8-inch by 16-inch concrete masonry units.
 5. When organic filter tubes are used, the designer must specify the type of material to be used (or excluded) on a particular site:
 - a. Straw filter material must be Certified Weed Free Forage. The straw must be in good condition, air-dried, and not rotten or moldy.
 - b. Wood chips must be 100 percent untreated chips and free of inorganic debris, such as plastic, glass, metal, etc. Wood chip size must not be smaller than 1 inch and must not exceed 3 inches in diameter. Shavings must not be more than 5 percent of the total mass.
 6. Bags used to secure inlet protection devices on pavement must be filled with aggregate, filter stone, or crushed rock that is less likely than sand to be washed into an inlet if the bag is broken. Filled bags must be 24 to 30 inches long, 16 to 18 inches wide, and 6 to 8 inches thick. Bags must be polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 ounces per square yard and meet the following criteria:
 - a. Greater than 300 psi Mullen Burst Strength using ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
 - b. Greater than 70 percent UV Stability using ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare a SWPPP in accordance with applicable permit requirements for construction activity. Develop the SWPPP in conformance with OPDES General Permit (OKR10) for Storm Water Discharges from Construction Activities and any applicable Local requirements.
- B. Prepare and implement the SWPPP prior to the beginning of construction activity in accordance with local, state, and federal Laws and Regulations.

- C. OPT may require Contractor to install stormwater pollution prevention devices and/or practices during construction in addition to those required under the approved SWPPP. Contractor must remain solely responsible for complying with all local, state, and federal Laws and Regulations.

3.02 INSTALLATION

- A. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following installation criteria:
 - 1. Construct fences along a line of constant elevation (along a contour line if possible).
 - 2. Maximum drainage area must be 0.25 acres per 100 linear feet of silt fence.
 - 3. Maximum flow to any 20-foot section of silt fence must be 1 cfs.
 - 4. Maximum distance of flow to silt fence must be 200 feet or less. If the slope exceeds 10 percent, the flow distance must be less than 50 feet.
 - 5. Maximum slope adjacent to the fence must be 2:1.
 - 6. Stone overflow structures or other outlet control devices must be installed at all low points along the fence or spaced at approximately 300 feet if there is no apparent low point.
 - 7. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel to prevent bypass of runoff under the fence. Fabric must overlap at abutting ends a minimum of 3 feet and must be joined such that no leakage or bypass occurs. If soil conditions prevent a minimum toe-in depth of 6 inches or installation of support post to depth of 12 inches, silt fences must not be used.
 - 8. Sufficient room for the operation of sediment removal equipment must be provided between the silt fence and other obstructions in order to properly maintain the fence.
 - 9. The last 10 feet (or more) at the ends of a line of silt fence must be turned upslope to prevent bypass of stormwater. Additional upslope runs of silt fence may be needed every 200 to 400 linear feet, depending on the traverse slope along the line of silt fence.
- B. Stabilized construction exits for sites in which significant truck traffic occurs on a daily basis are subject to the following installation criteria:
 - 1. Limit site access to one route during construction, if possible; two routes for linear and larger projects.
 - 2. Prevent traffic from avoiding or shortcutting the full length of the construction exit by installing barriers. Barriers may consist of silt fence, construction safety fencing, or similar barriers.
 - 3. Design the access point(s) to be at the upslope side of the construction site. Do not place construction access at the lowest point on the construction site.
 - 4. Stabilized Construction Exits are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on-site with provisions for storage, proper filtration, and removal of wash water.

5. The exit must be sloped away from the paved surface so that stormwater is not allowed to leave the Site onto roadways.
6. Minimum width of exit must be 15 feet.
7. Vehicles must not be permitted to track or drop sediment onto paved roads, streets, or parking lots. When necessary, vehicles must be cleaned to remove sediment prior to exit onto paved areas. When washing is required, it must be done on a constructed wheel wash facility that drains into an approved sediment trap or sediment basin or other sedimentation/filtration device.
8. Minimum dimensions for the exit must be as follows:

Tract Area	Min. Width of Exit	Min. Length of Exit
<1 Acre	15 feet	20 feet
≥ 1 acre but <5 Acres	25 feet	50 feet
≥5 Acres	30 feet	50 feet

- C. Install pollution control devices in a manner consistent with their designed intent.

3.03 MAINTENANCE

- A. Maintain pollution prevention control structures and procedures in full working order at all times during construction. This must include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment and other pollutants which accumulate in pollution control devices as necessary to maintain the intended design efficiency for the pollution prevention measure.
- B. Dispose properly of trash, debris, and other pollutants.
- C. Place sediment material in approved earth spoil areas or return the sediment material to the area from which it eroded.
- D. Maintain pollution prevention structures and procedures until construction is complete for the area protected and until the Site achieves final stabilization. Unless more stringently defined by local, state, or federal requirements, final stabilization is defined as achieving 70 percent of background vegetative cover or placement of permanent cover, such as concrete or asphalt.
- E. Upon completion of construction and achievement of final stabilization, properly remove the temporary pollutant control structures and complete the area as indicated. Pollution control devices made of organic materials designed to degrade naturally in place will not require removal, unless specifically required by the OPT.
- F. Erosion control blankets must be inspected regularly (at least as often as required by the OPDES Construction General Permit) for bare spots caused by weather related events. Missing or loosened blankets must be replaced or re-anchored. Also check for excess sediment deposited from runoff. Remove sediment and/or replace blanket as necessary. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion.
- G. Silt fences must be inspected regularly (at least as often as required by the OPDES Construction General Permit) for buildup of excess sediment, undercutting, sags, and other failures. Sediment should be removed when it reaches approximately one-half the height of

the fence. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion. If the fabric becomes damaged or clogged, it must be repaired or replaced as necessary.

- H. The stone outlet sediment trap should be inspected regularly (at least as often as required by the OPDES Construction General Permit) to check for clogging of the void spaces between stones. If the filter stone appears to be clogged, such that the basin will not completely drain, then the filter stone will require maintenance. If the filter stone is not completely clogged it may be raked with a garden rake to allow the water to release from the basin. If filter stone is completely clogged with mud and sediment, then the filter stone will have to be removed and replaced. Failure to keep the filter stone material properly maintained will lead to clogging of the stone riprap embankment. When this occurs, the entire stone rip-rap structure will need to be replaced. If the aggregate appears to be silted in such that efficiency is diminished, the stone should be replaced. Trash and debris should be removed from the trap after each storm event to prevent it from plugging the rock. Deposited sediment must be removed before the storage capacity is decreased by one-third, or sediment has reached a depth of 1 foot, whichever is less. The removed sediment must be stockpiled or redistributed in areas that are protected with erosion and sediment controls.
- I. Sediment basins should be inspected regularly (at least as often as required by the OPDES Construction General Permit) to check for damage and to ensure that obstructions are not diminishing the effectiveness of the structure. Sediment must be removed and the basin must be re-graded to its original dimensions when the sediment storage capacity of the impoundment has been reduced by 20 percent. The removed sediment may be stockpiled or redistributed on-site in areas that are protected by erosion and sediment controls. Inspect temporary stabilization of the embankment and graded basin and the velocity dissipaters at the outlet and spillway for signs of erosion. Repair any eroded areas that are found. Install additional erosion controls if erosion is frequently evident.
- J. Check dams should be inspected regularly (at least as often as required by the OPDES Construction General Permit). Silt must be removed when it reaches approximately one-third the height of the dam or 12 inches, whichever is less. Inspectors should monitor the edges of the dam where it meets the sides of the drainage ditch, swale, or channel for evidence of erosion due to bypass or high flows. Eroded areas must be repaired. If erosion continues to be a problem, modifications to the check dam or additional controls are needed. Care must be used when taking out rock check dams in order to remove as much rock as possible. Loose rock can create an extreme hazard during mowing operations once the area has been stabilized.
- K. Stabilized construction exits should be inspected regularly (at least as often as required by the OPDES Construction General Permit). The stabilized construction exit must be maintained in a condition that prevents tracking or flow of sediment onto paved surfaces. Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the exit from diminishing. The rock must be re-graded when ruts appear. Additional rock must be added when soil is showing through the rock surface. Additional controls are needed if inspections reveal a properly installed and maintained exit, but tracking of soil outside the construction area is still evident. Additional controls may be daily sweeping of all soil spilled, dropped, or tracked onto public rights-of-way or the installation of a wheel cleaning system.

3.04 FIELD QUALITY CONTROL

- A. In the event of conflict between the specified requirements and stormwater pollution control laws, rules, or regulations or other local, state, or federal agencies, the more restrictive laws, rules, or regulations will apply.

3.05 SCHEDULES

- A. Prior to start of construction, submit schedules to the OPT for accomplishment of temporary and permanent erosion control work in connection with required clearing and grubbing, grading, construction, and paving. Include a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials in the submittal.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Contract.

1.02 DOCUMENTATION

- A. Submit affidavits and releases on forms provided by the Construction Manager.

1.03 SUBSTANTIAL COMPLETION

- A. The following requirements must be met for the Project or a designated portion of the Work to be Substantially Complete per the General Conditions:
 - 1. Work must be fully functional and able to operate in accordance with the Contract Documents without special or extraordinary efforts on the part of the Owner.
- B. Conduct inspections with superintendent, Subcontractors, and Suppliers for the Work or a designated portion of the Work prior to calling for a Substantial Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for Substantial Completion. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- C. Correct the identified deficiencies prior to calling for a Substantial Completion inspection.
- D. Notify the Construction Manager that the Work or a designated portion of the Work is Substantially Complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered for Final Completion.
- E. OPT will visit the Site to observe the Work within a reasonable time after notification is received to determine the status of the Project.
- F. Construction Manager will notify the Contractor that the Work is either Substantially Complete or that additional Work must be performed before the Project will be considered Substantially Complete.
 - 1. Construction Manager will notify the Contractor of items that must be completed before the Project will be considered Substantially Complete.
 - 2. Correct the noted deficiencies in the Work.
 - 3. Notify the Construction Manager when the items of Work in the Construction Manager's notice have been completed.
 - 4. OPT will revisit the Site and repeat the process.
 - 5. Construction Manager will issue a Certificate of Substantial Completion to the Contractor when the OPT considers the Project to be Substantially Complete. The

certificate will include a tentative list of items to be corrected before Final Payment will be recommended.

6. Review the list and notify the Construction Manager of any objections to items on the list within 10 days after receiving the Certificate of Substantial Completion.

1.04 CLOSEOUT REQUIREMENTS

A. Provide the following before Final Completion:

1. Record Documents per Section 01 31 13 "Project Administration";
2. Warranties;
3. Shop Drawings, Product Data, and other documentation required by the Contract Documents;
4. Evidence of continuing insurance and bond coverage as required by the Contract Documents; and
5. Final videos and photographs per Section 01 33 06 "Graphic Documentation."

1.05 WARRANTIES AND BONDS

- A. Provide warranties and bonds required by Section 01 33 00 "Document Management" or by the individual Sections of the Specifications and General Conditions.
- B. Compile warranties and bonds and review these documents for compliance with the Contract Documents.
1. Each document is to be signed by the respective Supplier or Subcontractor.
 2. Each document is to include:
 - a. The product or Work item description;
 - b. The firm name, with the name of the principal, address, and telephone number;
 - c. Scope of warranty or bond;
 - d. Date, duration, and expiration date for each warranty or bond;
 - e. Procedures to be followed in the event of a failure; and
 - f. Specific instances that might invalidate the warranty or bond.
- C. Submit digital copies of the documents to the Construction Manager for review.
- D. Submit warranties and bonds within 10 days of Construction Manager's notice of substantial completion.

1.06 FINAL COMPLETION

- A. Conduct inspections with Superintendent, Subcontractors, and Suppliers prior to calling for a Final Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for the Final Completion inspection. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort;

however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.

- B. Identify, list, and correct deficiencies prior to calling for a Final Completion inspection. The Project at the call for Final Completion represents the Contractor's interpretation of a project completed in conformance with the Contract Documents and reflects the Contractor's representation of a quality project meeting the Owner's expectations.
- C. Notify the Construction Manager when:
 - 1. Work has been completed and complies with the Contract Documents;
 - 2. Work is complete and ready for final inspection;
 - 3. Final documentation for all outstanding Modifications and Claims (other than those listed on the Certificate of Final Completion) have been processed and are ready for incorporation into the final Application for Payment; and
 - 4. Closeout requirements in Paragraph 1.04 have been completed.
- D. OPT will visit the Site to determine if the Project is complete and ready for final payment within a reasonable time after the notice is received.
- E. Construction Manager will notify the Contractor that the Project is complete or will notify the Contractor that Work is Defective.
- F. Take immediate steps to correct Defective Work. Notify the Construction Manager when Defective Work has been corrected. OPT will visit the Site to determine if the Project is complete and the Work is acceptable. Construction Manager will issue a Certificate of Final Completion to the Contractor when the Project is complete or will notify the Contractor that Work is Defective.
- G. Submit the request for final payment with closeout documentation described in Paragraph 1.04 if notified that the Project is complete and the Work is acceptable.

1.07 REINSPECTION FEES

- A. Owner may impose a set-off against the Application for Payment in accordance with the General Conditions to compensate the OPT for additional visits to the Project if additional Work is required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

03 30 00.01 CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 SUMMARY

- A. This Section specifies normal weight, cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Product Data and Material Certifications: For each product or material indicated in Part 2.00 "Products," excluding formwork.
- B. Design Mixture: For each concrete mixture submit:
 - 1. Mix design proportions and characteristics.
 - 2. Certifications indicating conformance of aggregate and cementitious materials.
 - 3. Admixture data sheets.
 - 4. Field test data or trial batch mixture data to validate specified compressive strength in accordance with ACI 301, latest edition.
 - 5. Aggregate, conforming to ASTM C33, including the test reports for soundness and abrasion resistance.
 - 6. Cement chemical analysis indicating that the total alkali content is acceptable per section 2.03.C.3.
 - 7. Reinforcing bar layout drawing with bar lists clearly marked and referenced to the Drawings.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
- B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."

- D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.00 PRODUCTS

2.01 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.
 - 1. Form ties shall leave no material within 1-1/2 inches of concrete surface.
 - 2. For fluid bearing and below grade walls, provide single tie rods with midpoint washer to prevent water seepage. Systems that result in a through wall hole are not permitted.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.
- C. Supports:
 - 1. Unexposed Surface: CRSI Class 3 – No Protection.
 - 2. Exposed Surface: CRSI Class 1 – Maximum Protection – uniform high density polyethylene (plastic) or fiberglass reinforced plastic (FRP). Plastic protected wire bar supports are not allowed.

2.03 CONCRETE MATERIALS

- A. Cementitious Material:
 - 1. Portland Cement:
 - a. Type I or I/II Portland cement, conforming to ASTM C150.
 - b. Type IL blended hydraulic cement, conforming to ASTM C595.
 - B. Supplementary Cementitious Materials (SCM):
 - 1. Fly Ash/Pozzolans: Conforming to ASTM C618, Class F fly ash; used in all classes of concrete. No more than 25 percent of the cement may be replaced with fly ash. If fly ash is not available, then provide a straight cement mix.
- C. Aggregates
 - 1. Coarse Aggregate:
 - a. In conformance with ASTM C33, uniformly graded, with a maximum size as indicated in "Concrete Mixtures."
 - b. Class: Moderate weathering region, but not less than 3S.
 - 2. Fine Aggregate: Washed and screened natural sands or sands manufactured by crushing stones; conforming to ASTM C33.
 - 3. If the fine and/or coarse aggregates test "Potentially Reactive", in accordance with ASTM C1567, then a low alkali cementitious material shall be used. A low alkali

cementitious material shall be such that, the Sodium Oxide Equivalent ($N_{a_2O_{eq}}$) shall not exceed 0.6 percent of the total cementitious material content.

D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.

2.04 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.

2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

7. Shrinkage Reducing Admixture: ASTM C495, Type S.

2.05 RELATED MATERIALS

A. Non-Shrink Grout: Pre-packaged, non-metallic, precision, non-shrink grout conforming to ASTM C1107/C1107M.

2.06 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Waterproof Sheet: In accordance with ASTM C171.

D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.

E. Membrane-Curing Compound: ASTM C309, Type 1-D, Class B.

2.07 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

Use	Min. 28-Day Compressive Strength (psi)	Max. Size of Coarse Aggregate	Max. Water/Cement Ratio	Max Slump (in.)
General	4000	1"	0.45	5* (+/- 1")
*Slump may be increased to 8 inches with the addition of a HRWR.				

- C. Air Content:
1. Air entrain exposed concrete within range permitted by ACI 301 for Exposure Class F2.
 2. Do not allow entrapped air to exceed 3 percent in floor slabs to receive troweled finish.
- D. Admixture:
1. Shrinkage reducing admixture shall be SikaControl-75, ASTM C494; no substitutions will be accepted.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

2.09 POST-INSTALLED REINFORCING DOWELS

- A. Cartridge Injection Adhesive Anchors: reinforcing dowels and epoxy adhesive injection system.
1. Reinforcing dowels shall be ASTM A615 Grade 60, size indicated on Drawings.
 2. Post-installed reinforcing dowels shall consist of the following epoxy adhesive anchor types as provided by Hilti, INC.
 - a. HILTI HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum system for anchor and rebar anchorage to concrete, ICC ESR-3814.

3.00 EXECUTION

3.01 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Fabricate reinforcement steel to provide lapped connections, bends, and transitions in reinforcement as required for continuity of the typical reinforcement specified on the Drawings.

2. Unless otherwise detailed, intersecting wall and/or beam reinforcement shall extend to the far face and terminate in a standard hook. Reinforcement at the outside face of corners shall be continuous or provide tension lap splices at each side of the corner.

B. Do not weld reinforcement.

3.03 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Purposefully roughen joints to a 1/4-inch amplitude and clean.

B. Construction Joints: Locate joints as indicated or as approved by Owner's Representative.

3.04 CONCRETE PLACEMENT

A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.

B. Additional water may only be added to concrete prior to placement and only at Project Site. Slump shall be evaluated prior to and after the addition of all water. Do not take strength cylinders until after addition of all water.

1. Quantity of water shall not exceed the amount withheld at the batch plant. Quantity withheld shall be indicated on the batch ticket. Addition of water shall not result in a slump or water-cement ratio greater than that specified.

C. Do not allow concrete to free fall more than 5 feet. With HRWR concrete may free fall a maximum of 10 feet.

D. Consolidate concrete with mechanical vibrating equipment.

E. Cold Weather:

1. If air temperature has fallen to, or is expected to fall below 40 F during the protection period (a minimum of 48 hours but not less than that required by ACI 306.1), then cold weather concreting shall be performed in accordance with ACI 306.1.

2. In cases where the temperature drops below 40 F after the concreting operations have been started, sufficient canvas and framework or other type of housing shall be furnished to enclose and protect the structure, in accordance with the requirements of ACI 306.1. Sufficient heating apparatus to provide heat shall be supplied, and heating source and protection from combustion gas shall be in accordance with ACI 306.1. The concrete shall be protected when placed under all weather conditions. Should concrete placed under such conditions prove unsatisfactory, remove and replace the concrete at no cost to the Owner.

3. When the air temperature is above 30 F:

- a. The minimum concrete temperature at the time of mixing shall be 60 F unless other requirements of ACI 306.1 are met, which may allow for a lower mix temperature.
- b. The minimum concrete temperature at the time of placement and during the protection period shall be 55 F unless other requirements of ACI 306.1 are met, which may allow for a lower temperature.

4. The means used to heat a concrete mix shall be in accordance with ACI 306.1.

5. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to preventing freezing. Calcium chloride is not permitted.

F. Hot Weather:

1. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity that impairs the quality of the concrete. Hot weather concreting shall be in accordance with ACI 305.1. Concrete shall be placed in the forms without the addition of any more water than that required by the design (slump). No excess water shall be added on the concrete surface for finishing. Control of initial set of the concrete and extending the time for finishing operations may be accomplished with the use of approved water reducing and set retarding admixture, as specified.
2. Maximum time intervals between the addition of mixing water and/or cement to the batch, and the placing of concrete in the forms shall not exceed the following (excluding HRWR admixture use):

Concrete Temperature	Maximum Time from Water Batch to Placement
Non-Agitated Concrete	
Up to 80 F	30 Minutes
Over 80 F	15 Minutes
Agitated Concrete	
Up to 75 F	90 Minutes
75 F to 89 F	60 Minutes

- a. The use of an approved set-retarding admixture will permit the extension of the above time maximums by 30 minutes, for agitated concrete only.
- b. The use of an approved high range water reducing (HRWR) or hydration-controlling admixture will allow placement time extensions as determined by the manufacturer.
3. The maximum temperature of fresh concrete at time of discharge shall not exceed 95 F. The temperatures of the mixing water shall be reduced by the use of chilled water or ice.
4. The maximum temperature of fresh concrete with high range water reducing admixture shall not exceed 100 F at time of discharge.
5. On days when the predicted high temperature is 90 F or higher, the initial curing of test specimens shall be according to ASTM C31 except that the means of maintaining moisture and temperature shall be limited to the following options:
 - a. Immersion of molded specimens with plastic lids in water saturated with calcium hydroxide.
 - b. Suitable moisture loss control combined with a temperature-controlled environment.
 - c. Other methods as approved by the Engineer.

6. Under extreme heat, wind, or humidity conditions, concreting operations may be suspended if the quality of the concrete being placed is not acceptable.

3.05 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface. Do not further disturb surfaces before starting finishing operations.
- C. Float Finish: Apply float finish to surfaces to receive trowel finish or nonslip broom finish. Except as indicated below, apply a final "light float" finish to the surface as the concrete hardens. Surface shall have a uniform granular texture and shall meet the straightness requirements.
- D. Trowel Finish: Apply a normal steel trowel finish to interior surfaces exposed to view and grouted surfaces in junction boxes.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete sidewalk and ramp surfaces. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.06 FINISHING FORMED SURFACES

- A. No Finish: After forms are removed, repair or patch tie-holes and defects. Otherwise, no additional finish is required. Apply to surfaces which are not visible from the inside or outside of the completed structure or less than 12 inches below finish grade (i.e. back of retaining walls below embankment, etc.).
- B. Smooth-Formed Finish: As-cast surface texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch. Apply to surfaces exposed to view and 12 inches below finish grade.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.07 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301. Additionally, comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least 7 days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - a. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 MISCELLANEOUS CONCRETE ITEMS

- A. Vapor Barrier:
 - 1. Install in accordance with manufacturer's recommendations including seams, penetrations, and repairs.
 - 2. At perimeter of concrete, secure vapor barrier to concrete with Stego Crete Claw.

3.09 POST-INSTALLED REINFORCING DOWELS

- A. Install in accordance with manufacturer's installation instructions.
- B. Drilled anchor holes must be brushed with a wire brush and subsequently cleaned to remove dust prior to anchor installation.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.
- B. Tests: Perform according to ACI 301.
 - 1. General:
 - a. Testing Frequency: One sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - b. Tests shall be required throughout the Work to monitor the quality of concrete. Samples shall be taken in accordance with ASTM C172.

- c. Engineer may waive these requirements on concrete placements of 10 cubic yards or less. However, evidence shall be furnished showing a design mix which meets the Specifications.
 - d. Unless noted otherwise, testing of the materials, ready mix, transit mix, or central plant concrete will be by an independent testing agency. The Contractor will select and pay for this service. A summary of all tests performed will be available. No concrete shall be placed without a representative present at either the plant or at the Site.
 - e. Unless the Owner's laboratory is on the Site, provide housing for the curing and storage of test specimens and equipment.
2. Slump Test: Slump tests, in accordance with ASTM C143, shall be used to indicate the workability and consistency of the concrete mix from batch to batch. Generally, a slump test shall be made at the start of operations each day, at regular intervals throughout a working day, and at any time when the appearance of the concrete suggests a change in uniformity.
 3. Air Content Test: Tests for the concrete's air content shall be made in accordance with ASTM C231 or ASTM C173, at the point of delivery of concrete, prior to placing in forms. The test shall be made frequently to monitor a proper air content uniform from batch to batch.
 4. Temperature Test: Test for the concrete's temperature in accordance with ASTM C1064 and as follows: the temperature of the concrete to be placed shall be taken with a thermometer immediately before placement, with the point of measurement being in the chute or bucket. Temperature test shall be performed for each truck. Record temperatures on batch ticket.
 5. Compression Test:
 - a. Compression test specimens shall be 6-by-12-inch concrete cylinders made and cured in accordance with ASTM C31. If the maximum aggregate size is no larger than 1 inch, 4-by-8-inch concrete cylinders are acceptable. No fewer than two 6-by-12-inch or three 4-by-8-inch specimens shall be made for each test Sample. Samples shall be taken at a minimum of every 50 cubic yards of concrete for each class placed. At least one set of test specimens per day shall be made for each class of concrete used that day. Initial cure of specimens shall be in a temperature and moisture controlled environment as specified in ASTM C31. Initial cure shall be in an enclosure such that the temperature is uniform and can be monitored. The temperature range of initial curing shall be recorded using a maximum-minimum thermometer. See "Hot Weather" section of this specification for additional requirements. Final cure of specimens shall be under laboratory conditions specified in ASTM C31. Additional concrete cylinders may be required for curing on the job under actual job curing conditions. These Samples could be required when:
 - 1). There is a possibility of the air temperature surrounding the concrete falling below 40 F, or rising above 90 F.
 - 2). The curing procedure may need to be improved and/or lengthened.
 - 3). It is necessary to determine when the structure may be put into service.

- b. Compression strength tests shall be made on the laboratory-cured and job-cured concrete cylinders at 7 and 28 days, in accordance with ASTM C39. The value of each test result shall be the average compressive strength of all of the cylinders in the test Sample. All cylinders within a test Sample shall be taken at the same time from the same batch of concrete. For the 28-day cylinders, the strength level shall be satisfactory if the averages of all sets of three consecutive strength test results exceed the required design compressive strength, and no individual strength test result falls below the required compressive strength by more than 500 psi. The method of initial curing and maximum and minimum initial curing temperatures shall be included on concrete compression test reports.
6. Failure to Meet Requirements:
- a. Should the 28-day strengths shown by the test specimens fall below the required values, additional curing shall be performed on those portions of the structures represented by the test specimens at the Contractor's expense. Test cores shall be obtained and tested in accordance with ASTM C42. If additional curing does not give the strength required, the Owner reserves the right to require strengthening, replacement of those substandard portions of the structure, or additional testing, at the Contractor's expense.
 - b. Upon receipt of the Contractor's written request, substandard concrete work may be reexamined in place by nondestructive testing methods or core Samples, in accordance with ACI 301. The services of an independent testing laboratory shall be retained and all expenses paid without compensation from the Owner. Laboratory results shall be evaluated by the Engineer, and Engineer shall make the final decision on acceptability of the concrete in question. Core Sample holes shall be repaired.
 - c. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Engineer.
- C. The Owner may withhold payment for any section of concrete which does not meet the requirements of the Specifications. Withheld payment shall be based upon the unit prices established for concrete and reinforcing steel. Payment shall be withheld until the unacceptable concrete has been refinished, removed and replaced or otherwise brought into conformance with the Specifications.

END OF SECTION

09 96 00.01 HIGH-PERFORMANCE COATINGS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to apply protective coatings to material and equipment as specified herein, including the preparation of surfaces prior to application of coatings.
- B. Protective coatings shall be applied to the following surfaces:
 - 1. Anchor Bearing Plates and Trumpet
- C. Contain, treat, and dispose of any dust, spray, drainage, or spillage resulting from coating operations. It shall be the Contractor's responsibility to determine if the materials to be disposed of are classified as hazardous waste. Disposed waste, hazardous or otherwise, shall be in accordance with applicable regulations. The Contractor shall be aware of and understand the regulations concerning disposal of waste generated by coating operations.

1.02 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Products which comply with the Contract Documents and are manufactured by the following companies will be acceptable:
 - a. Tnemec Company, Inc.
 - b. Carboline.
 - c. PPG Protective & Marine Coatings.
 - d. The Sherwin-Williams Company.
 - e. Akzo Nobel / International Paint, LLC.
 - f. ICI Devoe High Performance Coatings.
 - g. Plasite Protective Coatings.
 - 2. It is desired that the paint products be furnished by as few manufacturers as possible to meet the requirements of the Specifications. Coating products of the same type must be supplied by the same manufacturer. Do not mix products from different sources.
- B. Applicator's Qualifications: Applicators must be qualified in this line of work and have a minimum of 5 years of experience in the application of the protective coatings of the types specified herein. Submit a list of recent projects and names of references for those projects.
- C. Product Quality:
 - 1. Use only the coatings specified in this Section. Use only those thinners and solvents recommended by the manufacturer, only in the amounts necessary to produce the manufacturer's recommended spreading rate, and in amounts not exceeding the maximum quantities stated in the manufacturer's literature.

2. The coating material must not show excessive settling in a freshly opened full can and must be easily re-dispersed with a paddle to a smooth, homogeneous state. It must show no curdling, livering, caking, or color separation and must be free of lumps or skim surfaces.
- D. Inspection:
1. Inspect and provide substrate surfaces prepared in accordance with the Contract Documents and the printed directions and recommendations of paint manufacturer whose product is to be applied.
 2. Contractor is solely responsible for testing for this Section, at no further cost to the Owner. Engineer may also make such tests if it is considered necessary.
- E. Testing Equipment: Furnish the testing apparatus necessary for testing coatings, including the following:
1. One set of U.S. Department of Commerce thickness calibration plates, certified by the National Bureau of Standards, to test dry film thickness.
 2. Wet-film thickness gauges. Give one to Owner's representative. Each painter must keep one to test paint as it is applied.
 3. One electronic dry-film thickness gauge capable of measuring 0-200 mils with calibration standards approved by the Bureau of Standards.
 4. One Elcometer 319 Dewpoint Meter or approved equal.
 5. One Tinker and Razor Model M 1 Holiday Detector and recommended wetting agent and/or High Voltage Holiday Detector if required for coating thickness specified.
 6. One set of SSPC-VIS 1, 3 and 4 - Visual Standards as applicable.
- F. Testing Reports: Submit an inspection report for each coating applied on the Project. The testing report must be completed on a form furnished by the Engineer and must bear the signature of the Contractor and the Owner's representative.

1.03 SUBMITTALS

- A. Submittals must be in accordance with Section 01 33 00 "Document Management" And shall include:
1. Manufacturer's product data sheet for each paint type, including surface preparation requirements, recommended spreading rates, application procedures, recommended primers, and other instructions.
 2. Color charts of each paint type.

1.04 STANDARDS

- A. The applicable provisions of the following standards apply as if written here in their entirety. Adhere to the latest standards and codes published by the following organizations.
- B. In the event of a conflict between the published standards, codes, and this Section, the more stringent requirement govern as interpreted by the Engineer.

1. NSF International (NSF) / American National Standards Institute (ANSI):

NSF/ANSI Standard 61	Drinking Water System Components – Health Effects
NSF/ANSI/CAN 600	Health Effects Evaluation and Criteria for Chemicals in Drinking Water

2. ASTM International (ASTM):

ASTM D523	Standard Test Method for Specular Gloss
ASTM D610	Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D3359	Standard Test Methods for Rating Adhesion by Tape Test
ASTM D4214	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating
ASTM D4259	Standard Practice for Abrading Concrete
ASTM D4260	Standard Practice for Liquid and Gelled Acid Etching of Concrete
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4285	Standard Test Method of Indicating Oil and Water in Compressed Air
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tester
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ASTM D5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Pull-Off Adhesion Testers
ASTM D7682	Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
ASTM E337	Standard Practice Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

3. American Water Works Association (AWWA):

AWWA C210	Liquid-Epoxy Coating and Linings for Steel Water Pipelines
AWWA C222	Polyurethane Coatings and Linings for Steel Water Pipe and Fittings

4. Consumer Product Safety Act, Part 1303.

5. Environmental Protection Agency (EPA).

6. International Concrete Repair Institute (ICRI):

Technical Guideline No. 03732	Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers and Polymer Overlays
Standard 310.2	Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair with CSP Chips

7. NACE International (NACE):

NACE TPC2	Coating and Lining for Immersion Service: Chapter Safety, Chapter 2 Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection
NACE SP0178	Design Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE SP0178	Surface Finishing of Welds Prior to Coating; Weld Replica Only to be used with NACE SP0178
NACE RP0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape

8. National Association of Pipe Fabricators (NAPF):

NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
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9. Occupational Safety & Health Administration (OHS):

1915.35 Standards - 29 CFR	Painting
1926.62 Standards - 29 CFR	Lead

10. The Society for Protective Coatings (SSPC):

SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC-VIS 3	Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaning
SSPC Vol. 1	Good Painting Practices
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-AB 3	Ferrous Metallic Abrasives
SSPC-AB 4	Recyclable Encapsulated Abrasive Media in a Compressible Matrix
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 11	Bare Metal Power Tool Cleaning
SSPC-SP I6	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

SSPC-PA 1	Shop, Field and Maintenance Painting of Steel
SSPC-PA 2	Determining Compliance to Required DFT
SSPC-PA 10	Guide to Safety and Health Requirements for Industrial Painting Projects
SSPC-PA 17	Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
SSPC Guide 6 (CON)	Containment of Debris
SSPC Guide 12	Illumination of Painting Projects
SSPC Guide 15	Retrieval and Analysis of Soluble Salts

11. SSPC/NACE International Joint Standards:

SSPC-SP 5/NACE 1	White Metal Blast Cleaning
SSPC-SP 6/NACE 3	Commercial Blast Cleaning
SSPC-SP 7/NACE 4	Brush - Off Blast Cleaning
SSPC-SP 10/NACE 2	Near - White Metal Blast Cleaning
SSPC-SP 13/NACE 6	Surface Preparation of Concrete

1.05 DELIVERY AND STORAGE

- A. Storage of coatings and other products must be in accordance with the manufacturer's requirements. Coatings that have been damaged or not stored properly must not be applied and must be removed from the jobsite.
- B. All products and coatings that are not approved for the Project must be removed from the jobsite and must not be stored at the jobsite.

1.06 ENVIRONMENTAL CONDITIONS

- A. Do not apply coatings under conditions that are unsuitable for the production of good results. Remove trash and debris from enclosed buildings and thoroughly clean prior to application of coatings. Do not begin application of coatings in areas where other trades are working, or where construction activities result in airborne dust or other debris. Do not apply coatings in conditions which do not conform to the recommendations of the coatings manufacturer.
- B. Coatings must only be applied when conditions fall within the parameters listed in the manufacturer's printed data.
- C. Contractor must provide dehumidification equipment sized to maintain dew point temperature 5 deg F or more above surface temperature of metal surfaces to be prepared and coated.
- D. Do not apply any coatings when weather conditions are unfavorable. In the event that climatic conditions are not conducive for best results, postpone application of coatings until conditions conform to the manufacturer's recommendations and the provisions of this Section.
- E. Do not apply coatings to a wet or damp surface in wet or damp weather conditions, or when there is dust in the air. Surfaces exposed to direct sunlight must be shaded by awnings or

other protective devices while coatings are being applied, if recommended by coating manufacturer. When necessary, provide temporary heating devices of a type that produces no fumes or water vapor which will discolor the paint system.

F. Heating and Dehumidification:

1. Dehumidification equipment must be used to control the environment during surface preparation, rehabilitation, coating application and coating curing at no additional cost to the Owner, if acceptable environmental conditions cannot be met.
2. If the Contractor cannot meet the required environmental conditions to apply the interior coating system per this Section and the coating manufacturer's written recommendations, Contractor will cease operations until approved dehumidification equipment has been provided and acceptable environmental conditions are achieved.
3. If coating system is applied without dehumidification or in conditions not acceptable by this Section and by the coating manufacturer's written requirements, Contractor must fully remove coating system applied and replace per the Engineer's direction.
4. Contractor must furnish all labor, materials, equipment, fabrication and quality control inspections, and all other incidentals required to control and maintain the environment within the parameters stated in this Section and must incorporate these and any other expenses into its bid.
5. It is the Contractor's responsibility to provide adequate dehumidification equipment to meet this specification and the coating manufacturer's requirements of this Section and coating manufacturer's requirements. The coating manufacturer's limits will govern, if more stringent than the requirements stated within this Section.

1.07 WORKING CONDITIONS

- A. Provide adequate lighting at any location that coatings are being applied or testing is performed. Illumination must be of sufficient intensity to achieve good results. Provide explosion-proof lighting when required.

1.08 WARRANTY/GUARANTEE

- A. Protective coating must be guaranteed for a period of 1 year from the date of the Owner's acceptance of the Project.

2.00 PRODUCTS

2.01 GENERAL COATING REQUIREMENTS

- A. All coatings must be free of heavy metals such as arsenic, barium, chromium, selenium, silver, lead, mercury and cadmium.
- B. All coatings in contact with potable water must meet the applicable requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61, including the most current health effects criteria for xylenes, toluene and ethylbenzene for the application and volume of tank on the Project.
- C. All coatings submitted or used on this Project must comply with the EPA's Clean Air Act for maximum VOC (volatile organic compound) limits.

D. Finish coatings must be from the same batch.

2.02 MATERIALS

A. Coating products are to be as follows:

Type B - Epoxy-Polyamide Primer	
Manufacturer	Approved Coating
Tnemec	Series 66
Sherwin-Williams	Macropoxy 240
Akzo Nobel / International Paint, LLC	Intergard 251; Intergard 269 for valves and gates, submerged structural steel and misc. metals, and submerged piping
Devco Coatings	Devran 201V Series
Carboline	890
PPG	Amercoat 385

Type G - Epoxy-Polyamide Coatings	
Manufacturer	Approved Coating
Tnemec	Series 66
Sherwin-Williams	Macropoxy 646 Epoxy
Akzo Nobel / International Paint, LLC	Intergard 475HS; Interseal 670HS for valves and gates, PVC pipe and conduit, submerged structural steel and misc. metals, and submerged piping
Devco Coatings	Bar-Rust 235
Carboline	Carboguard 60
PPG	Amerlock 385

2.03 COLOR SELECTION

- A. The color chart must include the complete available range of colors, including tints and shades. Owner will select the colors during construction.
- B. Use a multi-color system coating for any surface receiving more than one coat. Each coat must be tinted differently from the preceding coat in a manner that will allow the various coats to be easily distinguished. Colors must generally be from light to dark shades, but the Contractor may have the option to select tint shades to insure coats will receive adequate coverage without bleeding or otherwise showing through the preceding coat.

3.00 EXECUTION

3.01 GENERAL

- A. All coatings must be applied in strict conformance with the coating manufacturer's published specifications, this Section, or as approved by the Engineer.

- B. Surfaces which will be inaccessible after installation must be coated prior to installation or must be coated and approved in stages as the Work is installed.
- C. At least 7 days or as required by the coating manufacturer, must be allowed for drying of finished surfaces before any machinery can be placed into service.
- D. The number of coats called for in this Section are considered the minimum required. If more coats are required to provide the specified dry film thickness or for complete coverage and uniform appearance, they must be provided at no additional cost to the Owner.

3.02 STEEL SURFACE PREPARATION

- A. The adequacy of the preparation of steel surfaces will be determined by comparing the surface with SSPC VIS 1 "Pictorial Surface Preparation Standards for Painting Steel Surfaces" and SSPC VIS 3 "Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaning." Prepare surfaces in accordance with the following requirements:
 - 1. SSPC-SP 1 — Solvent Cleaning.
 - 2. SSPC-SP 2 — Hand Tool Cleaning.
 - 3. SSPC-SP 3 — Power Tool Cleaning.
 - 4. SSPC-SP 5 / NACE 1 — White Metal Blast Cleaning.
 - 5. SSPC-SP 6 / NACE 3 — Commercial Blast Cleaning.
 - 6. SSPC-SP 7 / NACE 4 — Brush-Off Blast Cleaning.
 - 7. SSPC-SP 10 / NACE 2 — Near-White Blast Cleaning.
 - 8. SSPC-SP 11 — Power Tool Cleaning to Bare Metal.
- B. The resulting surface profile must be in accordance with the coating manufacturer's recommendations.
- C. "Solvent Cleaning" must be performed prior to subsequent surface preparation, including abrasive blast cleaning.
- D. All sharp edges and welds must be ground smooth to a rounded contour and all weld splatter must be removed prior to abrasive blasting. Edges of metal to be coated must be rounded to a minimum of 1/16-inch radius or chamfered a minimum of 1/16 inch at an angle of 45 degrees.
- E. Welds and adjacent areas:
 - 1. Prepared such that there is:
 - a. No undercutting or reverse ridges on the weld bead.
 - b. No weld spatter on or adjacent to the weld or any other area to be painted.
 - c. No sharp peaks or ridges along the weld bead.
 - d. Grind embedded pieces of electrode or wire flush with the adjacent surface of the weld bead.
 - 2. Weld profiles must conform to NACE RP0178, Profile 'D'.

3.03 SURFACE PREPARATION

- A. Clean and degrease surfaces prior to abrasive blasting by solvent cleaning as specified using solvents, detergent/water, emulsions, and steam. Proposed method must be documented in the coating plan.
- B. Shop Surface Preparation:
 - 1. Prepare surfaces by abrasive blasting as specified and apply shop prime coat. Shop primed steel plates must not have primer extended within 4 inches along all edges to be welded. All primer within 4 inches of an area to be welded must be removed prior to welding. Welding of painted surfaces will not be allowed.
- C. All pre-assembled shop primed items must be prepared in accordance with these specifications and inspected by the Owner's representative before and after priming.
- D. Abrasive Blasting:
 - 1. Prior to commencing abrasive blasting operations, the Contractor must perform a test blast to verify that the surface cleanliness and profile meet the requirements of this Section and meet the coating manufacturer's requirements for the coating to be applied. If the test section does not meet the requirements, the Contractor must make changes to the abrasive materials and/or methods to provide suitable blast.
 - 2. Abrasive blast only the amount of surface area which can be primed the same day or before any rust starts to form, whichever occurs first. Areas which are not painted the same day must be re-blasted on the day the prime coat is applied.
 - 3. Shrouding or recovery of all blast material will be mandatory during all exterior blasting.
 - 4. Where abrasive blast cleaning will not remove or properly prepare metal surfaces, hand and/or power tool cleaning must be used to remove such conditions as weld splatter, laminations and radius-sharp edges. Hand tool or power tool must be used on areas less than 2 feet in diameter or smaller or on corners and edges.
 - 5. All abrasive blast equipment must be equipped with, including but not limited to the following:
 - a. Noise reducing devices.
 - b. Hose coupling safety devices.
 - c. Electrical grounding devices.
 - d. Moisture traps and filters.
 - e. Fresh air hoods for all blasters.
 - f. "Dead Man" switches on all blast hoses.
 - g. Air dryers.
- E. Surface profile must be in accordance with manufacturer's printed requirements.
- F. The adequacy of the preparation of surfaces must be determined by comparing the surface with SSPC-VIS 1, SSPC-VIS 3, NACE RP0178 and ICRI Surface Finish Comparators.

- G. Adequate surface preparation must be verified throughout surface preparation per SSPC-PA 17. Minimum testing requirements:
1. Test the surface profile within the first 15 minutes and one additional time during each work shift or 12-hour period, whichever is shorter for each gun or blasting apparatus used or at any time the process producing the acceptable profile indicated above is changed.
 2. Select a minimum of three 6-inch square locations and take two readings. The average to the two readings is a "profile measurement." The group of three locations is the "location average." The location average must be within the specified profile range.
 3. Contractor must report the location averages (lowest location average and highest location average, and the profile measurement for each surface preparation apparatus.
 4. If the substrate has been previously coated, an existing profile may exist. Contractor must adjust blast media size to ensure that the resulting surface profile meets the profile required.
- H. Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", or "blast cleaning", or similar words of equal intent are used in the Specifications or in paint manufacturer's specifications, they are understood to refer to the applicable specifications indicated.
- I. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacuum-blasting methods may be required. Coating manufacturer's recommendations for wet blast additives and first coat application will apply.
- J. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wiped with a tack cloth.

3.04 PREPARATION OF EXISTING COATED OR SHOP PRIMED SURFACES

- A. To Be Recoated or Final Coated:
1. Solvent clean.
 2. Perform touch-up repairs of existing coating.
- B. Touch-Up Repairs:
1. Clean loose, abraded, or damaged coatings to substrate by power tool to bare metal per SSPC-SP 11 and/or NAPF 500-03-03 "Power Tool Cleaning."
 2. Feather surrounding intact coating.
 3. Apply one spot coat of the specified primer to bare areas overlapping the prepared existing coating.
 4. Apply one full finish coat of the specified primer or finish coat(s) overall.
- C. Application of a Cosmetic Coat:
1. The exact nature of shop-applied coatings is not known in all cases.
 2. Check compatibility by application to a small area prior to starting the coating.

3. If lifting or other problems occur, request disposition from the Engineer.

3.05 APPLICATION

- A. Contractor and painting technicians are responsible for the application of the coating system and must have current applicator approvals from the coating manufacturer, as required.
- B. After abrasive blast cleaning, dust and spent abrasive must be removed from the surfaces by vacuum process or with clean, dry, oil-free compressed air.
- C. The prime coat must be applied as soon as possible after the blasting and surface cleaning is completed, inspected and approved by the Inspector. Blasted surfaces must be coated before rust forms on the surface. No prepared surface will be allowed to receive a coating if "rust bloom" or surface discoloration has occurred. All blasted surfaces must be coated to within 6 inches of the edge of a blasted area. No visible rust must be coated under any circumstances, including rust bloom or if discoloration has occurred, regardless of elapsed time between blasting and coating. Leave an uncoated strip of exposed metal to clearly identify where abrasive blasting was halted.
- D. Provide mist coat if recommended by the coating manufacturer.
- E. All weld seams, gaps, edges, bolts and difficult areas to coat must receive a stripe coat. Stripe coat must be a contrasting color. Stripe coat may be applied with intermediate or finish coating, but must be applied prior to the installation of the finish coat.
- F. Contractor must apply each coat at the rate and in the manner specified by the coating manufacturer, except as may be modified herein. If material has thickened or must be diluted for application, coating must be built up to achieve the dry film thickness as specified for each coat of the complete system.
- G. Maximum and minimum DFT must be per the supplied coating manufacturer's printed requirements and as required by this Section. DFT will be measured per SSPC-PA 2, Level 2 with an allowable measurement of spot DFT of:
 - 1. Minimum DFT, as specified.
 - 2. 120 percent of maximum DFT specified.
- H. Contractor and painting technicians are responsible for the application of coating system and must have current applicator certifications from the coating manufacturer. Submit certifications with coating submittal.
- I. Coatings which have an expired shelf or pot life may not be used and must be removed from the jobsite.
- J. Coating must be applied by skilled workmen and must be brushed out or sprayed evenly, without runs, crazing, sags, or other blemishes.
- K. Sand between coats to remove over spray and dry fall.
- L. Apply the first coat to the surface, including cutting in around edges, before the second coat is applied. The second coat and any successive coats must not to be applied before notifying the Owner's field representative and obtaining approval. Each coat must be tested before the successive coat is applied.

- M. The coating curing period must be adjusted to compensate for less than adequate weather conditions, as recommended by the coating manufacturer, for complete curing of the entire coating system. The full curing time recommended by the manufacturer must be provided.
- N. Coating must be continuous and must be accomplished in an orderly manner to facilitate proper inspection control.
- O. Where a roller or brush is used to apply the coating, additional coats may be necessary to achieve the recommended dry film thickness and/or to achieve total coverage of the underlying surface. Coated surfaces must be totally free of all roller nap, roller marks, brush bristles and brush marks.
- P. When using conventional coating spray equipment for coating operations, effective oil and water separators combined with after coolers or deliquescent dryers must be used in compressed air lines to remove detrimental oil and moisture from the air. Separators must be placed as far as practical from the compressor. Compressors must be tested periodically by the Contractor for oil and water contamination of compressed air. Testing must follow ASTM D4285 "Standard Test Method of Indicating Oil and Water in Compressed Air." All compressor units found to produce unacceptable amounts of oil and or water, as determined by results of ASTM D4285 test data must be replaced with a compressor that is acceptable.

3.06 DAMAGED COATINGS, PINHOLES, AND HOLIDAYS

- A. Feather edges and repair in accordance with the recommendations of the paint manufacturer.
- B. Repair fusion bonded coatings to be as recommended by the original applicator. Applicator must provide liquid repair kits for this purpose as recommended by the coating manufacturer.
- C. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.07 UNSATISFACTORY APPLICATION

- A. If the item has an improper finish color, or insufficient film thickness, clean and topcoat surface with specified paint material to obtain the specified color and coverage. Obtain specific surface preparation information from the coating manufacturer.
- B. Hand or power sand visible areas of chipped, peeled, or abraded paint and feather the edges. Follow with primer and finish coat in accordance with the Specifications. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required.
- C. Evidence of runs, bridges, shiners, laps, or other imperfections are cause for rejection.
- D. Repair defects in coating system per written recommendations of coating manufacturer.

3.08 COATING INSPECTION

- A. General:
 1. All coats will be subject to inspection by the Engineer and the coating manufacturer's representative.

2. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
 3. Give particular attention to edges, angles, flanges, and other areas where insufficient film thicknesses are likely to be present and ensure proper millage in these areas.
- B. Coating Thickness Testing:
1. Owner's representative may conduct coating thickness testing as necessary and without limitation.
 2. Measure coating thickness specified in mils with an electronic type dry film thickness gauge.
 3. Check each coat for the correct millage.
 4. Tests for concrete coating thickness may be taken using a Tooke Gauge or gauge approved for testing coatings over concrete substrates. Contractor must repair coating after thickness testing, if required.
- C. Coating Continuity (Holiday) Testing: Owner's representative will witness holiday testing performed by the Contractor.

3.09 SCHEDULE

- A. Protective coatings must be applied in accordance with the following paint schedule. If additional or alternate primers, etc. are recommended by the coating manufacturer for any of the coatings specified, they must be provided at no additional cost to the Owner to provide a complete and compatible coating system, as approved by the Engineer.

PROTECTIVE COATINGS PAINT SCHEDULE

Syst em	Surface Description	Application	Surface Prep	Vehicle Type	Sheen	No. of Coats	Product Type	DFT/Coat (mils)
No. 1	Anchor Bearing Plates and Trumpets	Brush or Spray	SSPC-SP 10/NACE 2 Near- White Blast Cleaning	Epoxy Polyamide	Gloss	1	TYPE B	2.0
						2	TYPE G	5.0
						3	TYPE G	5.0
Total Minimum Dry Film Thickness								12.0 mils

END OF SECTION

31 23 19.01 CARE OF WATER DURING CONSTRUCTION

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to install and operate flashboards, cofferdams, pumps, piping and other facilities to assist in the control and removal of surface water, waves, lake water, tailwater, and flood water as necessary to perform the required work. Build and maintain the necessary temporary impounding works, cofferdams, berms, diversions and flashboards. Remove the temporary works, equipment, and materials after completion in accordance with this Section and the applicable Drawings.
- B. Contractor shall be responsible for Lockout Tag Out protection plan for work on the gated section.
- C. Coordinate Care of Water plans with any temporary facilities and work platforms needed for the performance of the work such as to minimize exposure to surface water, waves, lake water, tailwater, and flood water.
- D. Provide erosion and sediment controls as part of care of water in accordance with specifications, drawings, and Stormwater Pollution Prevention Plan (SWPPP).

1.02 SUBMITTALS

- A. Care of Water submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Plans and procedures for handling flood flows, overtopping flows, waves, surface water, lake water, leakage, and tailwater.
 - 2. Layout and design details of flashboard and cofferdam system, if used, across top of uncontrolled overflow spillway section and spillway gates, prepared by licensed Professional Engineer.
 - 3. Emergency Action Plan during Construction to address communications with the Owner during increased river flows, gate operations, and possible evacuations.
 - 4. Coordinate work requirements with City of Tulsa's Eucha Dam Superintendent.
 - a. Ronnie Wiese
918-253-4957
- B. Review of submittals does not relieve the Contractor of full responsibility and liability for care of water during construction.

1.03 JOB CONDITIONS

A. GENERAL

- 1. Eucha Dam, Lake Eucha, outlet works, and spillways will continue in operation for the duration of the project. Operation of the Tainter gates on the gated spillway and control valves in the outlet works are under direct control of the Owner. Emergency flood operations, as determined by the Owner, will require the operation of spillway

gates and/or use of the uncontrolled overflow spillway subject to the Owner's Gate Operation plan and guidelines of this specification.

B. HEADWATER

1. Normal headwater of Lake Eucha is at or near the crest of the overflow spillway at El. 778 ft and varies by the magnitude of river flow coupled with discharge of the spillways and outlet works.
2. Normal river flow first goes over the existing uncontrolled overflow spillway. Tainter gate operations occur when river inflow and headwater levels are expected to increase significantly above normal headwater levels.
3. Owner will continue to first pass river flow over the uncontrolled overflow spillway to control headwater elevation in Lake Eucha during Contractor operations on the gated spillway and non-overflow sections, as further described in Section 1.05 of this specification.
4. Owner will attempt to maintain the headwater elevation in Lake Eucha at elevation 774± ft during Contractor operations on the uncontrolled overflow spillway, as further described in the Execution section of this specification. Contractor shall be responsible for determining the need for flashboards on the overflow section and the extents (up to 300 ft along the crest) and height thereof. The flashboards shall be removed or laid-over when Owner notifies Contractor of an impending flood release. Flashboards shall conform with section D.1.

C. TAILWATER

1. Tailwater elevations in Spavinaw Creek below the spillways and outlet works section of the dam are determined by rainfall, river flow, and spillways/outlet works releases.
2. Owner must maintain a minimum flow and tailwater elevation for environmental reasons. When the lake level is below the overflow spillway, the minimum flow and tailwater levels are controlled by either operations of valves in the outlet works or a radial gate in the gated spillway.

D. WAVE ACTION

1. Lake Eucha is subject to wave action which may result in waves that can splash or overtop the uncontrolled overflow section and spillway gates. Provide flashboards as deemed necessary for controlling waves from creating nuisance conditions and work delays. Flashboards shall not impose additional loads to stoplogs and/or Tainter gates beyond allowable stress levels per AISC standards and USACE ETL 1110-2-584 Design of Hydraulic Steel Structures for stoplogs and Tainter gates. Repair all damage to steel or coatings at no cost to Owner.

1.04 HISTORICAL STREAM FLOW GAUGE DATA

- A. Historic stream flow and elevation data upstream and downstream of Eucha Dam is available through the U.S. Geologic Survey on their web site @ WWW.USGS.GOV. The following USGS gages are applicable to the project:

1. Inflow:

- a. Beaty Creek near Jay, OK: <https://waterdata.usgs.gov/monitoring-location/07191222/#parameterCode=00065&period=P7D>
- b. Spavinaw Creek near Colcord, OK: <https://waterdata.usgs.gov/monitoring-location/071912213/#parameterCode=00065&period=P7D>
- c. Brush Creek at Brush Creek Road near Jay, OK:
<https://waterdata.usgs.gov/monitoring-location/07191265/#parameterCode=00065&period=P7D>

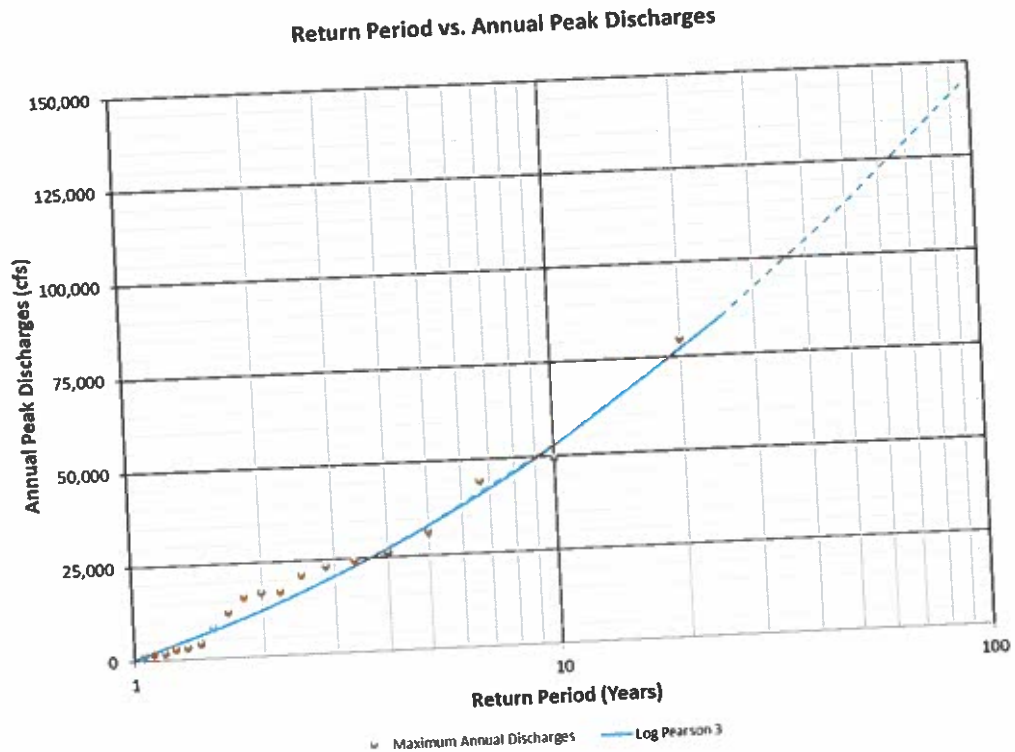
2. Outflow:

- a. Spavinaw Creek near Eucha, OK: <https://waterdata.usgs.gov/monitoring-location/07191288/#parameterCode=00065&period=P7D>

3. Lake Level:

- a. Lake Eucha near Eucha, OK: <https://waterdata.usgs.gov/monitoring-location/07191285/#parameterCode=00065&timeSeriesId=112291&period=P7D>

B. The following graph provides a frequency distribution for yearly peak flows in Spavinaw Creek at the bridge downstream of the dam for reference. Contractor shall make its own river flow and water level analyses and interpretation for bid and preparation of care of water plan. Gage data for Spavinaw Creek below Eucha Dam began approximately 19 years ago.



- C. For the years between 2002 and 2021, the historical estimated maximum average and minimum peak daily flow rates downstream of the dam site (USGS Gage 07191288) are:

Month	Maximum Peak Daily Flow Rate (cfs)	Average Peak Daily Flow Rate (cfs)	Minimum Peak Daily Flow Rate (cfs)
January	2763	369	14
February	2050	298	19
March	3460	532	58
April	5278	664	53
May	4581	779	78
June	1776	366	90
July	1858	271	72
August	701	182	49
September	731	157	25
October	3038	281	14
November	1284	197	17
December	3567	323	13

1.05 OWNER'S RIVER CONTROL DURING CONSTRUCTION

- A. During sequence of work on the overflow spillway, the Owner will attempt to keep the lake with a water surface elevation of 774 ft± through gated spillway and outlet works releases for inflows up to 25,000 cfs. During this period, Contractor will be allowed to work seven days per week to minimize the time that Lake Eucha is lowered.
- B. During sequence of work on the gated spillway, Owner will resume allowing river flow passage first over the uncontrolled spillway and then supplemented by gate operations as necessary. During work at the gated spillway, the Owner requires that only one spillway gate be out of service at a time. During this period, Contractor will be allowed to work six days per week.
1. Stoplogs must be in place before work can begin on a given gate. Owner will install and move stoplogs.
 2. Contractor will be responsible for sealing stoplog leaks and removing water leakage downstream of stoplogs as necessary to provide acceptable work area.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION

3.01 GENERAL

- A. Secure, operate, move, or otherwise take action to protect all equipment, materials and supplies. Handle leakage flows, surface water runoff, waves, or any other water encountered during the progress of work. Build, maintain and operate cofferdams,

channels, flumes, sumps, flashboards, and other temporary works as needed to protect the project site. Full responsibility for the successful dewatering and protection of the work areas rests with the Contractor. Remove temporary protective works, after they have served their purpose, in a manner satisfactory to the Owner's resident representative.

- B. Contractor's means for care of water shall not adversely impact the hydraulic performance of the dam.

During Contractor operations on the overflow spillway and gated spillway, provide and maintain flashboard system to protect the work against waves overtopping the work. At any time during operations on the overflow spillway, the flashboard system shall not extend greater than 300 feet along the top of the overflow section in order to allow flood flows and/or discharges from Lake Eucha to pass over the spillway around the flashboard system. Flows up to 25,000 cfs will be passed through spillway flood gates. If river flows are expected to, or do increase beyond this level, headwater levels will be allowed to rise for releases to occur over the uncontrolled overflow spillway.

3.02 EVACUATION OF SITE DURING INCREASED FLOWS AND FLOODING CONDITIONS

- A. Protect and/or remove all equipment, materials, personnel, and incomplete anchors upon notification of impending flood releases. In the event of any damage or loss of equipment, materials, or incomplete anchors as a result of lake levels rising above the spillway, the Contractor may request use of additional allowance for repair upon Owner's approval. The requested amount is not to exceed the bid allowance item price. The Owner shall not be liable for any damages or costs associated with Contractor's failure to adequately protect the work areas or to move equipment, personnel, and materials.
- B. Contractor is responsible for monitoring weather conditions, river flows, and lake levels during construction. Owner will endeavor to provide the Contractor, when possible, a 24-hour weather forecast for possible flood and/or emergency operations if incoming flows could reach or overtop the spillway. Evacuation of that section of the dam may be required.
- C. The Owner may request that the Contractor evacuate the work areas during lake levels above 778 ft. If the Contractor cannot work due to increased lake level conditions above 778 ft for a period of two or more consecutive days, the Contractor shall be paid standby time beginning on the third day the elevation remains above 778 ft for the same occurrence and ending when the water surface elevation drops below 778 ft.

END OF SECTION

31 51 19 POST-TENSIONED MULTI-STRAND TENDON ANCHORS

1.00 GENERAL

1.01 WORK INCLUDED

- A. This work consists of furnishing all material, equipment, and labor for detailing, fabricating, drilling, installing, stressing, and testing fully-grouted post-tensioned multi-strand tendon anchors as shown on the Contract Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

ASTM A 36	Specification for Carbon Structural Steel
ASTM A 370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A 416	Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
ASTM A 572	Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 981	Standard Test Method for Evaluating Bond Strength for 0.600-in. [15.24-mm] Diameter Steel Prestressing Strand, Grade 270 [1860], Uncoated, Used in Prestressed Ground Anchors
ASTM C 31	Test Practice for Making and Curing Concrete Test Specimens In the Field
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
ASTM C 144	Specification for Aggregate for Masonry Mortar
ASTM C 150	Specification for Portland Cement
ASTM C 172	Practice for Sampling Freshly Mixed Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 494	Specifications for Chemical Admixtures for Concrete
ASTM D 1248	Specification for Polyethylene Plastic Extrusion Materials for Wire and Cable
ASTM D 1784	Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds

B. American Welding Society (AWS)

D1.1	Structural Welding Code- Steel
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- C. Post-Tensioning Institute (PTI) Recommendations
 "Recommendations for Prestressed Rock and Soil Anchors" Post-Tensioning Institute
 (2014)
- D. American Concrete Institute (ACI) Standards
- E. American Association of State Highway Transportation Officials (AASHTO):
 M252 Standard Specification for Corrugated Polyethylene Drainage
 Tubing

1.03 DEFINITIONS

- A. Performance Test: Incremental progressive cyclic loading and unloading of an anchor to the Test Load. This permits the residual movement of the anchor after each cycle maximum to be measured and the true elastic movement at each cycle maximum to be calculated.
- B. Test Load (TL): Maximum load to which the anchor is subjected during testing. The Test Load for each anchor is shown on the Drawings.
- C. Lock-off Load: Anchor load after completion of stressing, wedge seating, and addition of shims if required. The Lock-off Load for each anchor is shown on the Drawings. Also known as "Transfer Load".
- D. Design Load (DL): Anticipated final maximum effective load in the anchor after allowance for time dependent losses or gains.
- E. Alignment Load (AL): A nominal minimum load applied to an anchor during stressing and testing to keep the equipment correctly positioned.
- F. Test Anchor: The anchor(s) constructed in accordance with the Anchor Test Program described in Paragraph 3.02. Location of the test anchor is shown on the Drawings.
- G. Production Anchor: Anchors installed at locations shown on the Contract Documents.
- H. Tendon: An assembly consisting of prestressing steel, spacers, anchorage, corrosion protection, bond breakers and centralizers.

1.04 QUALITY CONTROL

- A. The Contractor's anchor system shop drawing submittal shall be prepared under seal of a qualified licensed Professional Engineer. Submittals, calculations, drawings and documents shall be directly supervised, signed and sealed by the Contractor's Professional Engineer.
- B. Verification of Material Quality: Provide certified test results and certificates of compliance for all materials used in the work. Submit samples for observation and verification by the Owner's Resident Project Representative.
- C. Contractor shall be responsible for quality control of grout in accordance with the specifications including designing grout mixes, taking grout samples, transporting samples to the laboratory, and performing strength tests. In addition to the Contractor's tests, the

Owner may perform field quality assurance tests as determined necessary by the Owner's Resident Project Representative.

- D. Anchor Test Program: Conduct an anchor test program, described in Paragraph 3.02, prior to beginning any production anchor fabrication, drilling, installation, or testing to demonstrate ability to provide production anchors in accordance with the Contract Documents.
- E. Anchor Load Testing: All post-tensioned anchors shall be load tested by performance testing under the observation of the Contractor's Anchor Engineer and the OPT. All anchors must satisfy all acceptance criteria as specified in Section 3.09C prior to final acceptance. Notify Owner's Resident Project Representative five (5) working days before beginning any load tests.
- F. Monitoring: Contractor shall monitor and record load and extension data for all anchor stressing operations and load testing. All data shall be recorded in the specified format and copies of the records shall be furnished to the Owner's Resident Project Representative on a daily basis. The Owner's Resident Project Representative will witness all load tests.
- G. Load Loss Evaluation Period: After applying the Lock-off Load and prior to cutting the strand tails, each post-tensioned anchor shall be checked for load loss using a lift-off test after a period of no less than 72 hours following lock-off. All records of monitoring shall be furnished to the Owner's Resident Project Representative. Any anchors showing amounts or rates of load loss greater than allowed by ASTM A416 for stress relieved strand shall be restressed and rechecked using a lift-off test after an additional 72-hour period at no additional cost to the Owner. No strand tails shall be cut prior to Construction Manager approval.
- H. Equipment: Contractor shall be responsible for ensuring that anchor stressing and load testing equipment is compatible with the anchor and associated anchor head hardware and that the equipment is properly calibrated as specified herein.

1.05 ANCHOR SYSTEM DESIGN CRITERIA

- A. Required post-tensioned anchor lock-off loads are shown on the Drawings. Anchor sizes shown are based on the use of 7-wire uncoated strand tendons meeting the requirements of ASTM A416. Bond zone and free lengths are shown on the plans.
- B. The anchor design is based on a transfer (lock-off) load equivalent to 70 percent of the guaranteed minimum ultimate tensile strength (GUTS) of the steel. Maximum test loads are equivalent to 80 percent of the guaranteed minimum ultimate tensile strength of the steel.
- C. Minimum corrosion protection for all anchors shall be provided to meet PTI 2014 standards for Class I corrosion protection, except that epoxy coated epoxy filled strand will not be permitted.

1.06 PRE-CONSTRUCTION GROUT TO FOUNDATION TESTING

- A. Pre-construction anchor bars shall be installed, grouted, and pulled to confirm design grout-to-rock bond strength.
- B. Install three pre-construction anchors at locations shown on the plans. Proof anchors shall be constructed as follows:
 - 1. Anchor hole shall extend 10 feet into rock.

2. Anchor hole diameter shall be 4 inches.
 3. Anchor bar shall be 1.25-inch diameter, ASTM 722, Grade 150, uncoated. Hex nut should be installed on the embedded end of the anchor bar. Plastic centralizers shall be used to keep bar centered.
 4. Grout should be installed at the bottom of the hole for a length of 8-inches, 10-inches, and 12-inches in the three respective holes. Measure approximate drill hole depth and measure depth to cured grout for each respective bar.
 5. Grout mix and installation procedures shall match that proposed by the Installer for production anchors.
- C. After grout has cured for at least three (3) calendar days and has gained sufficient strength, but not less than 3,500 psi compressive strength, test the anchors to failure.
1. Proof tests shall consist of incrementally loading the anchor. The loading shall be continuously observed to note precise failure load. Pause loads and load schedule shall be as follows:
 - a. 9 kips
 - b. 16 kips
 - c. 32 kips
 - d. 48 kips
 - e. 64 kips (Proof design load (PDL))
 - f. 77 kips
 - g. 84 kips
 - h. If after completion of the prescribed loading procedure the anchor has not failed, then incrementally increase the applied load at a rate of 10 percent of the PDL every 3 minutes until bond failure occurs.
 - i. Test load applied shall not exceed 115 kips.
- D. Report results to Owner's Representative for verification of project design assumptions. Adjustments to production anchor length and/or diameter may be required contingent on testing results.
- E. Anchor hole shall be grouted following the completion of testing.
- 1.07 SUBMITTALS
- A. All submittals shall be in accordance with Section 01 33 00 "Document Management". The Contractor shall not begin Work until the required submittals in Paragraph B below have been reviewed and the Owner's Resident Project Representative indicates that the

- submittals have been accepted. Modifications to materials and procedures already approved by the Owner shall be addressed through the RFI documentation process.
- B. Submit the following information within 28 calendar days after Notice of Award, but no less than 30 calendar days prior to beginning any anchor drilling, fabrication, or installation work:
1. Shop Drawing - Drilling Equipment and Procedures Plan: Describe plan for handling and disposing of all drill cuttings and fluids, method for accessing holes and accurately locating drill, types of drills and bits proposed, down hole alignment survey equipment and procedures, and other information relevant to hole preparation, drilling, cleaning, and water pressure testing. Submittal shall show and describe waste material collection system, including location of temporary detention facilities. Details of temporary anchorage of construction equipment to the existing concrete structures shall be prepared under seal of a qualified, licensed Professional Engineer.
 2. Shop Drawing - Bore Hole Plug/Cover Design and Installation Details: Plan shall include drawing and installation details of temporary plugs/covers for open drill holes.
 3. Shop Drawing - Tendon Equipment and Anchorage Hardware Shop Drawings: Strands, anchor head, bearing plate, shims, centralizers, spacers, trumpet, etc.
 4. Record Data - Bearing plate calculations to show compliance with specified design requirements. Calculations shall be prepared by a qualified, licensed Professional Engineer.
 5. Shop Drawing - Tendon Handling and Installation Plan: Describe plan for handling, storage, and insertion of tendons into holes.
 6. Shop Drawing - Grouting Equipment and Procedures Plan: Include grout mix designs and laboratory test results, grout tubes, and placement procedures. Plan shall include procedures for containing, collecting, and disposing of excess and waste grout.
 7. Shop Drawing - Anchor Stressing Equipment and Procedures Plan: Describe stressing jack, chair, jack and gauge calibrations, displacement measurements, stressing procedures, lock-off procedures, and shimming procedures.
 8. Record Data - Calibration certificates for stressing equipment. Calibration certifications shall at a minimum include the following information:
 - a. Identification number, model, load capacity, type, and serial number of stressing jack
 - b. Name and signature of person and organization performing the calibration
 - c. Date calibration was performed and recalibration due date
 - d. Calibration procedure and test results
 - e. Conversion tables or curves from hydraulic gage pressure to jack load
 9. Shop Drawing - Anchorage concrete cap and anchor vault shop drawings
 10. Shop Drawing - Concrete mix design for anchorage concrete cap
 11. Record Data - Qualifications of Contractor's proposed QC testing laboratory including resumes

12. Record Data - Pressure Grouting Plan: Describe plan for pressure grouting (consolidation grouting) anchor holes that do not meet water tightness criteria. Include grout mix design, grout placement methods and practices, proposed maximum grout pressures, and other information relevant to hole grouting and re-drilling.
 13. Record Data - Material sample and compliance documentation of corrugated sheathing, anchor strand, strand spacers, centralizers, anchor head, and wedges.
 14. Record Data - Corrosion Protection Plan and Details including installation, testing, and grouting procedures for corrugated sheathing and watertight bottom cap. Plan shall describe procedures for repairing any holes, gouges or abraded areas in the corrugated sheathing.
 15. Record Data - Procedures in the event of equipment failure including jacks, drills, etc.
 16. Record Data – Installation, testing, and assessment procedures for test anchors and permanent anchors.
 17. Shop Drawing- water containment system and procedures.
- C. Submit in accordance with Section 01 33 00 "Document Management":
1. Certified Test Reports - Certified mill test reports for anchor strand material and other steel materials (bearing plates, cap, wedge plates, wedges). For each coil or pack of strand, submit reports to the Owner's Resident Project Representative at least 14 days prior to fabrication. The reports shall include the following information:
 - a. Identification of heat number
 - b. Guaranteed ultimate tensile strength
 - c. Yield strength
 - d. Elongation at failure
 - e. Modulus of elasticity
 - f. Diameter, weight per linear foot, and net area of strand
 - g. Time-dependent creep and load relaxation properties
 - h. Prestressing Strand Bond Capacity Tests in accordance with PTI Recommendations, 2004.
 2. Certified Test Reports – Results of grout sample strength, stability, and other quality control testing.
 3. Record Data – Anchor test program results including: anchor stressing and testing reports; anchor hole drilling logs, grouting, and watertightness testing reports; corrugated sheathing leakage testing report
 4. Record Data - Weekly check of pressure gauge calibration against master gauge.
 5. Record Data – Anchor stressing and testing reports.
 6. Record Data – Anchor hole drilling logs, grouting, and water tightness testing reports.
 7. Record Data – Corrugated sheathing leakage testing reports.

8. Record Data - Submit post-tensioned anchor record drawings upon completion of anchor installation.

1.08 QUALIFICATIONS AND PROJECT EXPERIENCE

- A. All work related to this specification section shall be performed by a qualified anchor Contractor. The Contractor's site superintendent, drill operator, on-site anchor engineer, and quality control staff shall meet the specific qualifications and experience requirements submitted as a condition of project award. No substitutions of Contractor's staff shall be made without prior written approval of the Construction Manager. No work related to drilling, on-site fabrication, installation, and testing of post-tensioned anchors shall proceed without the Contractor's Anchor Engineer present to observe, test, and inspect the Work.
- B. The Anchor Contractor/Subcontractor shall submit a list containing all, with a minimum of five projects completed within the last five years, where the Contractor has installed permanent, post-tensioned, multi-strand anchors in rock foundations. A brief description for each project shall be included for each project. The projects submitted for experience qualifications shall demonstrate the qualifications of the staff proposed on this project. For each project description submitted, the project description shall identify the name of the Contractor's on-site engineer, the on-site anchor installation superintendent(s), and the drill operator to assist in evaluating the qualifications of the Contractor's proposed staff. If Contractor proposes to separately subcontract the drilling work specified in the bid from the anchor installation work, the Contractor's drilling subcontractor shall also submit a statement of relevant experience as specified in this Paragraph.
- C. The Anchor Contractor/Subcontractor is required to provide a qualified post-tensioned anchor engineer to observe, test, evaluate, and certify the work related to drilling, fabrication, installation, and testing of post-tensioned anchors. No work related to drilling, fabrication, installation and testing of post-tensioned anchors shall proceed without the Contractor's Engineer on-site to observe, test, and inspect the work. Contractor's On-Site Engineer shall have a minimum of five years experience observing, testing, evaluating, and certifying the installation of permanent, multiple-strand, Class 1 corrosion protected, post-tensioned anchors in rock foundations on at least three projects. Contractor's Engineer can be the same person as the Quality Control Manager, provided he/she meets the qualifications of both positions.
- D. The Contractor's/Drilling Subcontractor's drill Operator(s) shall have a minimum of three years experience installing post-tensioned anchors on a minimum of two projects of similar size and scope. The quality of Contractor's experience and the relevance of the experience to the Work specified herein shall be determined solely by the Owner's Project Team. The OPT will approve or reject the Contractor's qualifications and staff prior to commencement of Work.

1.09 STORAGE OF MATERIALS

- A. Store materials in designated areas in a manner that will keep them clean, dry, and free from weather damage. Coordinate on-site storage locations with the Construction Manager.
- B. Coil, transport, and store tendons in a manner to minimize twisting.
- C. Store materials above ground on clean, dry, non-contaminating surfaces.

1.10 MATERIALS TESTING FOR QUALITY CONTROL

- A. Anchor strand tests: Perform two tensile tests on lengths of single anchor strand prior to start of work, or provide Manufacturer's certificate of test performed. Conform to applicable sections of ASTM A 370.
- B. Grout Mix Testing: Retain a laboratory to design and test grout mixes in accordance with the following guidelines:
 - 1. ASTM C 109 for sampling and preparation and strength testing of grout samples.
 - 2. Trial Batch Tests: The laboratory shall test three (3) specimens at seven (7) days and three (3) at 28 days for unconfined compressive strength, bleed, and density from a trial batch of the Contractor's proposed mix. The same materials, equipment, and procedures used in production shall be used in the trial batch.
 - 3. Field Tests: The laboratory shall make and test six (6) grout test specimens for each sampling event. Sampling events shall occur on the basis of not less than one (1) for each day's grout placement or one (1) for every anchor, whichever provides the greater number of samples.
 - 4. If any test indicates deficient grout strength, deficient or excess density, or bleed in excess of two percent (2%), the Contractor shall immediately adjust the mix to increase the strength and/or stability of subsequent mixes. If any grout specimen fails to meet mix design requirements, the affected anchor may be utilized at reduced allowable load as determined by the Owner's Resident Project Representative. If an anchor is utilized at a reduced load, a supplemental anchor shall be installed by the Contractor to compensate for the deficient anchor at no additional cost to the Owner.
- C. Grout-to-strand bond strength test: Perform tests to evaluate the bond strength of the strand to cement grout in accordance with ASTM A981.

2.00 PRODUCTS

2.01 TENDON COMPONENTS

- A. Anchor Strands: Uncoated 0.6-inch nominal diameter low-relaxation strand, consisting of 7 stress-relieved wires with a minimum ultimate tensile strength of 270 ksi, in accordance with ASTM A 416. Wires shall be full length without splices or couples, unkinked, and free from nicks, pits, abrasions, loose flaky rust, or any grease or lubricant with the potential to reduce the grout to steel bond.
- B. Post-Tensioned Anchor Assembly: Parallel strands, centralizers, spacers, ties, bearing plate, wedges, trumpet, anchor head, grout pipes, and any other hardware required for a successful installation. Steel for the anchor head hardware package shall conform to ASTM A 411 or A 572 and shall be Grade 50 or better. Metal components shall be compatible so as not to cause corrosion by electrolysis between dissimilar metals.
- C. Anchorages: Shall be capable of developing a minimum of 95 percent of the ultimate tensile strength of the anchors, and shall conform to the static strength requirements of the Post-Tensioning Institute "Guide Specification for Post-Tensioning Materials." Anchor heads shall be designed to accept individual strand loads, seat the wedges, and transfer the entire

anchor load onto the bearing plate. The wedge seats in the anchor heads shall be machined to provide a smooth bearing surface for seating the wedges.

- D. Wedges: Use wedges specifically designed and manufactured for use with uncoated strands and with the anchor heads. Wedges shall be designed to hold a minimum of 95 percent of the ultimate tensile strength of the anchor strands. The wedge seating surfaces shall be machined to provide a smooth bearing surface for seating the wedges.
- E. Bearing Plates: Conforming to ASTM A 36. Provide a 1/8" minimum recess and/or lugs to center the anchor head on the bearing plate.
 - 1. All surfaces of the bearing plates shall be prepared and primed in accordance with Section 09 96 00.01 "High Performance Coatings" prior to delivery to the jobsite.
 - 2. All surfaces of the bearing plate and the trumpet shall be painted in accordance with Section 09 96 00.01 "High Performance Coatings" prior to installation. The trumpet shall be seal welded to the bearing plate prior to painting.
 - 3. Stresses in the bearing plate shall not exceed the allowable values contained in the "Steel Construction Manual, Thirteenth Edition" (AISC, 2006). Stresses in the concrete beneath the bearing plate at the test load (80% GUTS) shall not exceed the allowable bearing stress of 1500 psi. Sizing of the bearing plate shall be based on the bearing surface from the edge of the drilled concrete hole to the edge of the bearing plate.
- F. Centralizers and Spacers: Centralizers and spacers shall be plastic. Wood shall not be used. Centralizers shall be designed to withstand lateral pressures from the tendons due to the hole slope or curvature. Spacers and centralizers shall not restrict upward flow of grout, and shall be fixed in place so they will not move up or down strands during installation or grouting.
 - 1. Spacers in the bond length shall separate the tendon strands so that the surface of each strand can be surrounded by grout and so that individual strands have minimum clearances of 0.2 inch from each other. Spacers and internal centralizers shall provide a minimum clearance of 0.5 inch between the pre-stressing steel and the corrugated sheathing.
 - 2. External centralizers for corrugated sheathing shall provide a minimum 0.5 inches of grout cover between the corrugated sheathing and the bore hole wall.
- G. Trumpet: A 36 steel, minimum thickness 3/16" inches, seal welded to bearing plate, prepare, prime and paint in accordance with Section 09 96 00.01 "High Performance Coatings".
- H. Shims: Conforming to ASTM A 36
- I. Corrugated sheathing shall consist of high-density polyethylene (HDPE) tubing conforming to AASHTO M252, heavy-duty highway grade and a minimum 60 mils wall thickness. Contractor shall provide thickness adequate to resist the loads imposed by the Contractor's installation methods and to prevent crushing of the corrugated sheathing during installation, testing, and grouting. Acceptable manufacturers are Prinsco (Prinsburg, MN 320-222-6800), or approved equal. Corrugated sheathing shall be one continuous piece, cut from a single coil, extending from the bottom of the anchor hole to above the top of the trumpet as detailed on the Drawings. Splicing of corrugated sheathing shall not be allowed. Each corrugated sheathing of the anchor assembly shall be fitted with a permanent,

watertight bottom cap. The cap, and any penetrations through the cap, shall be capable of withstanding internal pressures up to 40 psi without water loss.

2.02 ANCHOR CEMENT GROUT MATERIALS AND MIXTURES

A. Portland Cement:

1. Type II Portland cement, conforming to ASTM C150.
2. Type IL blended hydraulic cement, conforming to ASTM C595.
3. Cement shall have a Blaine value between 3.86 and 5.14 square yards per pound.

B. Water:

1. Clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious substances. Water suitable for drinking or for ordinary household use shall be accepted for use without testing.
2. Water for concrete from shallow, muddy, or marshy sources shall not be used.
3. When comparative tests are made with water of known, satisfactory quality, in accordance with ASTM C94, any indications of unsoundness, marked change in the time of set, or reduction of more than 5% in mortar strength shall be cause for rejection.
4. Contractor shall maintain water temperature to prevent quick setting of grout.

C. Sand: Shall pass a 600 micron screen with not more than 10% passing a 150 micron screen and conforming to ASTM C 144.

D. Admixtures:

1. Water-reducing and set-controlling admixtures, ASTM C 494, Type A, D or E at Contractor's option.
2. Anti-washout agent shall be Master Builder (Master Builders Inc., Cleveland, OH 216-839-7500) UW-450 anti-washout agent; no substitutions will be accepted.

E. Sand Cement Grout Mixture: Nonshrink, nonbleed mix of Portland cement, sand, and water. Sand shall be added to the mixture to enhance the void-filling properties of the grout. Water-reducing and set-controlling admixture may be used. Mix in proper quantities to provide specified strength and adequate workability.

1. Design compressive strength of grout: 4,000 psi at 28 days.
2. Water/cement ratio shall not exceed 0.72 by weight.
3. Sand/cement ratio shall be one part sand to one part cement by weight.
4. Provide anti-washout admixture dosage range of 4-20 fl oz/cwt of cement by weight of cement.
5. Grout shall not be gas forming, nor contain chloride, gypsum or other corrosive materials.
6. Bleed shall not exceed 2%.

- F. Neat Cement Grout Mixture: Nonshrink, nonbleed mix of Portland cement and water. Water-reducing and set-controlling admixture may be used. Mix in proper quantities to provide specified strength and adequate workability.
 - 1. Minimum compressive strength of grout: 3,500 psi at 7 days and 5,000 psi at 28 days.
 - 2. Water/cement ratio shall not exceed 0.45 by weight.
 - 3. Grout shall not be gas forming, nor contain chloride, gypsum or other corrosive materials.
 - 4. Bleed shall not exceed 2%.

2.03 GROUT LEVELING PAD FOR BEARING PLATE

- A. Grout leveling pad shall be a minimum of 1" thickness.
- B. Master Builders 713 Grout. No substitutions will be accepted. Provide manufacturer's certification that the grout has not exceeded the manufacturer's established shelf life.
- C. Compressive strength shall be a minimum of 5,000 psi at 28 days.

2.04 STRUCTURAL CONCRETE CAP AND REINFORCING

- A. Concrete materials and mix shall conform with the requirements of Section 03 30 00.01 "Cast-In-Place Concrete" and as shown on the Drawings.

2.05 EQUIPMENT

- A. Drilling:
 - 1. Drilling methods shall be at the Contractor's discretion and approval to proceed from the Owner's Resident Project Representative. Select the drilling method and procedures to in no way compromise the integrity of the dam and/or foundation.
 - 2. Drilling method shall produce holes to depths and of size, alignment, and quality required for anchor installations. The alignment tolerances shall be in accordance with Paragraph 3.03. The Contractor shall enlarge the hole sizes as required to accommodate the Contractor's methods, materials, and equipment. The hole sizes indicated on the plans are the specified minimum hole diameters. Limit hole sizes to prevent damage to the integrity of the dam.
 - 3. Equipment and bits shall be of condition and capacity to accomplish work at rate which will not result in delays or cause damage to the existing structure or foundation.
- B. Grout Mixer and Equipment: The mixer shall be a high-speed, colloidal-type mixer equipped with a high-speed, diffuser-type centrifugal mixing pump operating at 1,500 to 2,000 rev/min during mixing. The mixer shall be equipped with an accurate meter, reading cubic feet to tenths of a cubic foot, for controlling the amount of mixing water used in the grout. A holdover mechanical agitator tank, sized at least three (3) times larger than the volume of the mixer, shall be provided. The grout pumps shall be connected directly to the holdover mechanical agitator tank. Suitable provisions shall be made for passing the grout through a 0.125-inch size screen as it is discharged from the mixer. Pump rating curves and complete

mixer details, including photographs of the proposed mixing equipment, shall be submitted as required.

1. The grouting system shall be equipped with a flow meter, or an approved equivalent method of measurement, to measure the volume and discharge pressure of grout injected into a hole at any time during the grouting process.
 2. Provide all necessary casing, casing tees, packing glands, stuffing boxes, valves, pressure gates and pipe or hosing required for effectively mixing and agitating the grout and forcing it into the anchor holes in a continuous, uninterrupted flow at the specified pressure.
- C. Grout Pump: Positive displacement helical-screw rotor type pump capable of pumping grout under a pressure of at least 100 psi gauge and capable of delivering a minimum of 35 gpm of grout. A standby grout pump shall be included as a part of the grout plant.
- D. Anchor Stressing and Testing Equipment:
1. Calibrated hydraulic jack and appropriate pressure gauge shall be used. Jack shall be capable of tensioning all strands equally, axially, and simultaneously. Jack and gauge shall have been calibrated as a unit by an independent laboratory immediately prior to the first testing at the project site. The gauge shall be a six-inch (6") diameter or larger, oil-filled, test-quality gauge and shall permit reading of the hydraulic pressure in the jack to the nearest 50 psi or less, as necessary to determine actual tendon load within ten (10) kips at all times during stressing operations. The jack shall have sufficient stroke for the anticipated total elongation of the anchors at Test Load and sufficient thrust capacity to carry out load tests to no less than 90 percent of the guaranteed minimum ultimate tendon capacity. Each time the jack leaves the project site, the jack and gauge shall be re-calibrated as a unit immediately prior to returning to the project site.
 2. A monostrand jack with appropriate pressure gauge shall be used to tension each strand individually to the Alignment Load before tendon stressing. Jack and gauge shall have been calibrated as a unit immediately prior to the first testing at the project site. The gauge shall permit reading of the hydraulic pressure in the jack as necessary to determine actual alignment load within one (1) kip. Pressure gauge shall be a minimum four-inch (4") diameter, oil-filled, test-quality gauge.
 3. Tendon movement measurement equipment shall consist of calibrated dial gauge, capable of reading to the nearest 0.001 inch. The measurement equipment shall be capable of reading up to the maximum anticipated tendon movement measurement without resetting. Measurement equipment shall be mounted on a rigid frame supported in a location and manner that will be unaffected by tendon stressing. Mounting on the jack body may be acceptable provided the jack, chair, and bearing plate bear directly on the dam concrete, and that true tendon movement is actually measured. Provide a minimum of two (2) dial gauges to provide a backup in the event that one gauge slips or resets during stressing operations.
 4. Furnish a temporary strain-gauge type load cell to record loads during anchor stressing operations. The load cell shall have been calibrated and certified immediately prior to the first testing at the project site.
 5. All measuring devices shall be calibrated and recalibrated as necessary for accurate measurements. The pressure gauge shall be checked weekly against a calibrated master

gauge kept on site. Weekly calibration reports shall be submitted to Owner's Resident Project Representative.

6. If the stressing equipment leaves the project site at any time during the duration of the project, all measuring devices shall be recalibrated to the stressing equipment by a calibration firm previously approved in writing. A damaged jack shall be repaired and recalibrated as a unit by a certified testing firm approved in writing by the Owner's Resident Project Representative.
- E. Water Flushing Equipment: Independent or standby water flushing equipment for the purpose of hole cleaning and flushing out any grout that is unwanted during grouting operations such as blockage or partial grout column due to an equipment breakdown. This equipment shall conform to the following requirements:
 1. Immediately available if the need arises.
 2. Maximum injection pressure, as measured at the top of the hole, shall be 100 psi.
 3. Draws from a different power supply than the grouting equipment.

3.00 EXECUTION

3.01 GENERAL

- A. Corrosion-Protection System: All surfaces of the anchor strands and anchor head hardware packages shall be protected against corrosion at all times, including the exposed ends of the strands, the bearing plates, and all other internal and external portions of the anchor assemblies. Corrosion protection measures for individual elements shall be as follows:
 1. Anchor Strands: The tendon shall be grouted in corrugated polyethylene sheathing. The corrugated sheathing shall extend the entire length of the tendon, fully enclosing the end of the tendon from the bottom of the tendon extending up into the trumpet as detailed on the Drawings. The exterior of the corrugated sheathing shall be fully grouted in the borehole with centralizers prior to installation of the tendon and shall have the minimum grout cover between the corrugated sheathing and the borehole wall as specified and shown on the Drawings. The corrugated sheathing shall have a waterproof cap on the bottom end. Each strand shall be installed with grease filled polyethylene sheath extending from the top of the bond zone to the bottom of the trumpet as indicated on the Drawings.
 2. Trumpet: After stressing and testing operations, fill remaining voids in the trumpet area with grout and/or grease.
 3. Anchor Head: After stressing, cover anchor head with a permanent concrete cap to be installed for protection.
- B. Handling, Shipment and Storage: Handling, shipping, and storage shall be conducted in a manner that protects all tendon assemblies and hardware from mechanical damage, abrasion, corrosion, chemical attack, and dirt. Each tendon shall be tagged and identifiable at all times. Provide proper storage facilities onsite for the time between delivery and installation of the anchor assemblies. Storage facilities shall be dry and shall protect strands

and tendon assemblies. Improper handling, shipment, or storage will be sufficient cause for rejection of anchor assemblies.

1. Special care shall be taken to prevent damage to the anchor tendon. Padding shall be placed at all contact points and strapping bands shall be installed at a maximum spacing of ten feet (10'). Strapping bands shall be padded to prevent damage.
2. Handling: Anchor assemblies or coils shall not be stacked on each other during fabrication, transport, or storage unless adequately separated, protected, and supported by pallets, pads, or containers. The anchor head shall be installed on the tendon prior to shipment and shall remain on the anchor tendon at all times throughout storage, installation, stressing, and testing. Anchor heads shall be properly secured above the wedge gripping location prior to shipment to prevent damage to the tendon. Anchors that are shipped without the heads installed will be rejected upon delivery. To prevent damage to the tendons, chains or metal cables shall not be used to handle anchor coils. The grout tubes shall be protected from crushing or cutting at all times. Under no circumstances shall anchor assemblies or coils be dropped or dragged.
3. Marking: Each anchor tendon and/or coil shall be tagged with the following information:
 - a. Anchor location designation
 - b. Tendon or coil number
 - c. Diameter of strands
 - d. Strand quantity per anchor
 - e. Total length of anchor tendon
 - f. Heat number of prestressing steel
 - g. Coil number (if applicable)

Tags shall be catalogued following installation and submitted to Owner's Resident Project Representative on a weekly basis.

C. Anchor Observation and Acceptance for Installation:

1. The Owner's Resident Project Representative and Engineer may observe the anchor tendon assemblies at the fabricator's facilities prior to shipment to the project site for the first shipment of anchor tendons. Contractor shall provide the Construction Manager a minimum of fourteen (14) calendar days written notice prior to the date of observation.
2. The Contractor's Quality Control Representative shall inspect the anchor tendon assemblies at the fabricator's facilities prior to shipment to the project site for the first shipment of anchor tendons. In addition, the Contractor's Quality Control Representative shall inspect all anchor tendons immediately on delivery to the project site and immediately prior to insertion to ascertain the suitability and acceptability of the tendon for insertion into the holes. Contractor shall submit documentation of all anchor tendon inspections, identifying deficiencies and corrective measures required.
3. Damage to any anchor, including but not limited to abrasions, kinks, welds, weld splatters, and cuts, shall be cause for rejection. Anchors shall be free of dirt, grease, oil, detrimental rust, pitting, and all other deleterious substances prior to insertion. Anchors

with damage or contamination shall be rejected. All repairs shall be observed by Construction Manager and Contractor's Quality Control Manager prior to installation of the anchor.

4. Gouges and abraded areas in the corrugated sheathing shall be repaired in accordance with the Contractor's Corrugated Sheathing Repair Plan, subject to acceptance by the Owner's Resident Project Representative, or if beyond repair in the Owner's opinion shall be cause for rejection of the corrugated sheathing. All repairs shall be inspected by the Owner's Resident Project Representative and Contractor's Quality Control Manager prior to installation of the sheathing. Duct tape or other tapes shall not be an acceptable means of repairing corrugated sheathing.
5. Anchor assemblies rejected by the Owner's Resident Project Representative shall not be incorporated into the work unless, and until, the corrective action proposed by the Contractor and accepted in writing by the Owner's Resident Project Representative has been performed, inspected by the Contractor's Quality Control Manager, and observed and approved by the Owner's Resident Project Representative.
6. Water Containment: Provide an onsite containment system to control all discharges of run-off including water generated during drilling, grouting, concrete backfill, and concrete placement. All water draining from the drilling and/or installation operation shall be collected and directed to temporary water quality facilities consisting of skid mounted tanks and other appropriate controls of discharges, provided by the contractor. Discharge from all drilling and grouting operations shall be collected by a field collar at the top of the drill hole and shall be transferred to the detention facility enclosed conduits or pipe. A minimal amount of core drilling will be allowed without a containment system in order to set the collar and establish a seal. Provide water quality facilities for settling, filtration and screen of discharge from drilling and other water discharges

3.02 ANCHOR TEST PROGRAM

- A. The Contractor shall conduct an anchor test program which shall precede all anchor installation and drilling work and shall utilize equipment proposed for all project anchors. This program shall be designed and conducted by the Contractor to demonstrate the Contractor's ability to install, test, and complete the anchors in accordance with the plans and specifications and to demonstrate the Contractor's use of appropriate construction methods and quality control practices. This program shall consist of the installation of one (1) 33-strand anchor in the Left Non-Overflow Section as noted in the Drawings. The Contractor shall not begin any other tendon fabrication, installation, grouting, or stressing work until the test anchor has been drilled, installed, grouted, stressed, tested, observed

through the seven (7) day strand slippage period, and accepted in writing by the Owner's Resident Project Representative.

- B. Submit anchor test program plan and results.

3.03 ANCHOR HOLE DRILLING AND PREPARATION

- A. Hole Layout: Field locate and mark all anchor holes for approval by the Owner's Resident Project Representative prior to beginning any drilling.
- B. Set up and drill hole within two inches (2") of location shown on the Drawings and within two degrees (2°) from the vertical orientation shown on the Drawings.
- C. No more than four (4) holes shall be open or unfilled at any time and the holes shall be spaced a minimum of thirty feet (30') apart. A filled hole is a hole that meets one of the following criteria:
 - 1. The hole is filled completely with sand cement grout which has cured for at least twenty-four (24) hours.
 - 2. The hole is filled completely with neat cement grout which has cured for at least twenty-four (24) hours.
 - 3. The corrugated sheathing has been installed and the annular space between the borehole wall and the corrugated sheathing grouted and cured for at least twenty-four (24) hours.
- D. Monitor all open or unfilled holes during all drilling, grouting, water pressure testing, or re-drilling of any other anchor holes. If communication between holes is observed, modify the drill sequence and spacing, or reduce the number of open holes, to eliminate the cross communication.
- E. Contractor shall provide down hole survey of drill hole alignment for each anchor hole following procedures in the approved submittal. Drill hole alignment shall not deviate by more than two (2") inches in ten feet (10') from the alignment shown on the Drawings. Drill holes that deviate by more than the specified amount over the length of the hole shall be grouted and re-drilled by the Contractor at no additional cost to the Owner.
- F. Over drill hole vertically by a minimum of two feet (2') to account for slough or debris accumulation during installation. The over-drill length shall not be considered part of the total anchor length shown on the drawings.
- G. Install temporary plugs for anchor hole in all open holes upon completion of drilling to prevent entry of foreign material, and to prevent charging of the foundation in the event of flood and/or emergency conditions. Plugs shall remain in place until anchor tendons are installed and the head is secured to the bearing plate.
- H. Maintain detailed drill logs of each drilled hole, recording as a minimum the penetration rate per five foot interval, flush return characteristics, drill action, and the presence of

anomalous zones. Submit drill log of each hole prior to proceeding with pre-grouting of the hole.

3.04 GROUTING OF ANCHOR HOLES

- A. All holes shall be water pressure tested (Paragraph 3.05) following the first drill. Holes that fail the initial water pressure testing shall be pressure grouted using a neat or sand cement grout mixture having a water to cement ratio between 0.45 and 0.55 by weight. Re-drilling shall be completed between 16 and 36 hours after re-grouting. The hole shall then be water pressure tested again and subjected to additional phases of grouting, re-drilling, and water pressure testing until the water pressure testing criterion is met, or as otherwise determined by the Owner's Resident Project Representative.
- B. Monitor existing foundation drain system, where applicable, for connections during anchor grouting and water pressure testing. Any connection with the underdrain system shall not be grouted.

3.05 WATER PRESSURE TESTING

- A. All anchor holes shall be water pressure tested following the first drilling and after each subsequent pressure grouting and re-drilling phase (if occurs). Water pressure testing shall be carried out in accordance with the Contractor's Drilling Equipment and Procedure's Plan. Each hole shall be flushed and cleared of drill cuttings prior to water pressure tests. Water pressure tests shall be performed on the full-length tendon holes. Any portion of an anchor hole that does not meet the water tightness criterion shall be pressure grouted in accordance with the Contractor's Pressure Grouting Plan, re-drilled, and retested until the specified criteria are met.
- B. Following each subsequent re-grouting phase, the entire length of each anchor hole shall initially be water tested to the criterion specified in this Section. If the water loss for the anchor hole exceeds the specified criteria, a packer or packers shall be used to progressively isolate water loss zone(s). Water pressure tests to isolate water loss zones shall, at minimum, be conducted for the following depth zones in each hole:
 - 1. five (5) feet above the base of dam to the top of the bond zone.
 - 2. five (5) feet above the top of the bond zone to bottom of the anchor hole.
- C. Procedures and Criteria: Water pressure tests shall be conducted by progressively isolating the interval with a packer or packers, and then subjecting it to pressure of five (5) psi in excess of the hydrostatic head for at least ten (10) minutes, or until the flow rate stabilizes, whichever is longer. This criterion also applies for the initial test on the entire anchor hole. The results of each water pressure test shall be assessed based on a) the leakage rate in gallons per minute, b) the pressure, and c) the test interval length in feet. If, for any test, the water loss over a ten (10) minute period exceeds 9.5 liters (2.5 gallons) of water, the test interval shall be pressure re-grouted in accordance with the Contractor's Pressure Grouting Plan, re-drilled, and retested.

3.06 CORRUGATED SHEATHING

- A. Prior to installing the corrugated sheathing into the anchor hole, install end cap and perform water tightness testing. Cut the sheathing to length, and fill with water. Raise one end of the

sheathing by crane to provide 5 psi head and investigate for any leaks. Repair leaks and repeat test until no leaks are observed.

- B. Immediately upon meeting the anchor hole water pressure testing criterion (Paragraph 3.05), flush the anchor hole and measure the depth, then insert the sheathing into the hole. Prior to grouting the annular space between the borehole wall and the corrugated sheathing, each corrugated sheathing shall be tested for water tightness. Simultaneously fill anchor hole and interior of corrugated sheathing with water to the top of the hole. Apply five (5) psi excess pressure to the corrugated sheathing measured at the top of the hole. If leakage from the corrugated sheathing over a ten (10) minute period exceeds 9.5 liters (2.5 gallons) of water, then the corrugated sheathing shall be removed and replaced.
- C. If the Contractor elects to postpone installation of the corrugated sheathing and annulus grouting, monitor any open or unfilled holes during all drilling, grouting, water pressure testing, and re-drilling of any other anchor holes for communication or interhole connections. If communication or interhole connection is observed, the open holes shall be again water pressure tested and subjected to additional phases of grouting, re-drilling, water pressure testing until the water pressure testing criterion is met at the Contractor's expense and at no additional cost to the Owner.
- D. After completion of grouting the annular space between the borehole wall and the corrugated sheathing as described in Paragraph 3.07, measure and record the depth of the hole from the top of hole to the corrugated sheathing end cap.

3.07 GROUTING

- A. Grouting shall be performed in accordance with the Contractor's Grouting Equipment and Procedures Plan. The number of grout tubes indicated on the drawings is a minimum; the actual number and size of grout tubes shall be entirely at the Contractor's discretion. The annular space between the corrugated sheathing and the borehole wall shall be grouted using a neat cement grout mixture and allowed to harden before the tendon is installed.
- B. Grout the annular space between the corrugated sheathing and the borehole wall from the bottom of the hole, including the overall length, to the top of the sheathing by pumping grout through tremie tubes. A minimum of two tremie tubes shall be used; at least one tube shall extend to the bottom of the anchor hole and another tube shall be located farther up the borehole to allow the Contractor to grout the annular space in stages. Grouting shall be performed in a manner that prevents crushing, misalignment, or flotation of the corrugated sheathing. Contractor shall take all necessary precautions to maintain the alignment, size, and integrity of the corrugated sheathing during grouting.
- C. After grouting of the annular space between the corrugated sheathing and the bore hole wall and after insertion of the tendon into the borehole, then grout each anchor by pumping neat cement grout to the bottom of the tendon through tremie tubes or other method as submitted in the Contractor's Grouting Equipment and Procedures Plan. The grout shall fully surround the strands, so it can provide load transfer from the strands to the surrounding corrugated sheathing and also prevent strand corrosion. The top of the grout zone shall be near or within the trumpet allowing sufficient control on the strands to complete anchor

assembly installation and testing without damaging the tendons. Measure and record the depth from the top of the hole to the top of the grout zone.

- D. Grout the remaining grout zone length of each anchor to the top of the bearing plate using a neat cement grout mixture only after stressing and testing of the anchor including load loss testing, by pumping grout through tremie tubes or other method as submitted in the Contractor's Grouting Equipment and Procedures Plan.
- E. Except as otherwise specified, grouting operations shall conform to the requirements of the "Recommended Practice for Grouting of Post-Tensioned Prestressed Concrete" in the "Post-Tensioning Manual" published by the Post-Tensioning Institute. Grouting methods shall ensure complete encapsulation of the entire length of the tendon.
- F. Water or air test the tremie tubes prior to grouting to verify that the tubes are free of obstructions.
- G. The grout shall be mixed with an approved high-speed mixer for a minimum of two (2) minutes, but not longer than five (5) minutes. The grout may be held in the agitation tank for up to 45 minutes or 75 percent of the initial set time, whichever is less, after addition of cement and water.
- H. Grout not injected into hole within 45 minutes or 75 percent of initial set time shall be removed from mixer, tank, pump, and delivery lines and wasted. Waste material shall be disposed by Contractor at an approved off-site location.
- I. Grout shall be injected with the bottom of the grout pipe (tremie tube) remaining below the top of the grout column at all times during grouting. The grouting operation shall be continuous. Grouting pressure at the collar shall be consistent with efficient tremie procedures. Control water return to maintain pressure in hole.
- J. Grout strength, density, and bleed will be determined by grout specimens. Grout samples will be taken from the grout mixer prior to pumping into the tendon hole. A minimum of six (6) specimens shall be taken by the Contractor for each sample of grout on a basis of not less than one (1) sample for each day's grout placement or one (1) sample for each anchor, whichever provides the greater number of samples.
- K. The dam shall be kept clean and free of grout during the grouting operations. Grout and water spillage or return from the holes shall be controlled and contained and shall be transported to a designated disposal site. No discharge of water or grout from the work into the reservoir, Spavinaw Creek, or Owner's land is acceptable under any circumstances. Uncontrolled water or grout pumping or flushing will be sufficient cause for the Owner's Resident Project Representative to immediately stop the work.
- L. Grouting equipment and piping shall be thoroughly cleaned immediately before and after grouting at designated cleaning area. Debris shall be collected and disposed in accordance with Section 01 31 00 "Project Management and Coordination".

3.08 TENDON INSERTION

- A. Tendons shall be inserted into the sheathing in accordance with the procedures in the approved submittal. Tendon insertion shall be accomplished by Contractor's personnel,

trained and qualified in this type of work. The Owner's Resident Project Representative will be present during each installation.

- B. Each tendon assembly shall be inspected and accepted by the Contractor's Quality Control Manager and Anchor Engineer and shall be observed by the Owner's Resident Project Representative prior to insertion in accordance with Paragraph 3.01C.
- C. The tendons shall be handled and protected during insertion in a manner that prevents physical damage and sharp bends and protects the corrosion protection elements. Special measures shall be taken to prevent abrasion of the strands at the borehole collar. The tendons shall be thoroughly cleaned as they are lowered into the anchor hole to remove any dirt or debris that has accumulated.
- D. Tendons shall be fitted with a protective "bullet" or nose cone as shown on the drawings prior to insertion to keep individual strand tips from catching on the corrugated sheathing

Tendons shall be suspended at all times and shall not be allowed to bear on the bottom of the corrugated sheathing and end cap.

3.09 ANCHOR STRESSING AND TESTING

A. General:

1. All anchors shall be installed and grouted prior to stressing. Grout shall have cured for at least three (3) calendar days and shall have achieved a minimum compressive strength of at least 3,500 psi prior to stressing.
2. Immediately prior to stressing and testing, the anchor head shall be raised to allow thorough cleaning of the anchorage. Power wash the head and wipe the exposed strands with a cloth before placing the jack over the anchor tendon for stressing.
3. A monostrand jack shall be used to tension each strand individually to the Alignment Load before tendon stressing. Alignment Load shall be between 7-1/2% to 15% of the Design Load indicated on the Drawings.
4. During stressing and prior to lock-off, each anchor shall be performance load tested as specified to eighty percent (80%) of the guaranteed minimum ultimate tensile strength of the anchor tendon.
5. Thoroughly clean anchor strands, head, and other exposed anchor components with a pressure washer or approved equivalent method prior to transfer of load from the stressing ram to the permanent anchorage system.
6. After load testing, anchor loads shall be transferred from the stressing ram to the permanent anchorage system. The anchor load, after transfer, shall be as indicated on the Drawings ("lock-off" load). Shims shall be available on site to achieve the required lock-off load in the event of excessive seating loss. Subsequent adjustments in anchor load shall only be done by adding shims as required. The anchor design loads (DL) for effective long-term conditions, based on a 50-year estimated service life and after allowance for all relaxation losses, are sixty percent (60%) of the guaranteed minimum ultimate tensile strength.
7. After tensioning and load lock-off in the permanent anchorage, but prior to removal of the hydraulic jack, a lift-off reading shall be made to verify the load in each anchor as

specified. If shims are required, take additional liftoff readings after the shims are installed.

8. Anchor stressing methods, testing methods, and equipment shall be as specified and in accordance with the Contractor's Anchor Stressing and Testing Plan. If a jack chair is used, it should be self-centering and shall be bolted to the bearing plate to maintain centering and perpendicularity to the bearing plate.
9. Anchors shall not be tensioned until the compressive strength of new concrete mortar or new concrete beneath the bearing plate has reached at least 2,500 psi.
10. The Contractor shall provide full-time, on-site, experienced and qualified supervision during all tensioning operations as described in Paragraph 1.08 and Project Experience. No anchor stressing and tensioning shall proceed without the Contractor's Anchor Engineer present.
11. The anchor tendon manufacturer shall be on-site to observe the stressing and testing of the Test Anchor and the first two (2) permanent anchors installed.
12. The tensioning process shall be conducted in a manner that allows accurate measurements of elongation (to the nearest 1/1000 inch of tendon elongation) and of tensioning load. If conflicting readings are obtained between the Contractor's hydraulic jack load readings and the calibrated load cell readings, the Owner's Resident Project Representative will determine which values to use. Recalibration of the hydraulic jack with the master gauge supplied by the Contractor may be ordered at any time by the Owner's Resident Project Representative due to misuse, poor maintenance, inadequate repairs, or inaccuracies; and shall be performed at the minimum intervals given in the Anchor Stressing and Testing Plan.
13. Tensioning operations shall not be undertaken without the Owner's Resident Project Representative being present. The Contractor shall record jack load and tendon extension readings during tensioning and shall furnish the raw data and the reduced data to the Owner's Resident Project Representative on a daily basis.
14. The Contractor shall take precautions at all times to avoid hydraulic fluid spills from equipment or hoses that may rupture or leak during stressing operations. Any such spill or leak shall be contained immediately and cleaned up in accordance with Section 01 31 00 "Project Management and Coordination".
15. Hydraulic fluid spills shall be sufficient cause for the Owner's Resident Project Representative to stop the work, including interruption of any anchor stressing in progress, until the source of the leak or spill is addressed and all spilled material is cleaned up by the Contractor.
16. All post-tensioned anchors shall be evaluated for load loss during the 72-hour period after stressing as specified in Paragraph 1.04G.

B. Performance Testing

1. Performance tests shall be conducted on each permanent anchor. Test results shall be submitted to the Owner's Resident Project Representative at the end of each shift during which performance testing is performed.

2. Performance tests shall consist of incrementally loading and unloading the anchor in cycles, in accordance with Table 31 51 19-1 at the end of this specification. The load at the end of each cycle shall not be decreased to less than the Alignment Load (AL). The elongation of the tendon shall be recorded at each load increment to the nearest 0.001 inch with respect to an independently fixed measurement reference. Elongations shall be recorded at the end of each cycle to measure residual movement of the anchor, including the final cycle to 1.33 DL.
 3. Unless specified otherwise, the load shall be held at each increment just long enough to obtain the movement reading. No movement readings need to be taken during unloading of the cable, except for the residual movement readings at AL.
 4. For the ten (10) minute test hold times at 1.33 DL, total movements with respect to a fixed reference point shall be recorded at 1, 2, 3, 4, 5, 6, and 10 minutes.
 5. For the maximum test load (1.33 DL), the test load shall be held for an additional 50 minutes if the total movement between one (1) and ten (10) minutes exceeds 0.04 inches. Additional total movement readings shall then be recorded at 15, 20, 30, 40, 50, and 60 minutes.
 6. After completion of the performance test, follow the specified lock-off procedures.
- C. Performance Test Acceptance Criteria: The Contractor's Engineer and the Owner's Resident Project Representative will independently evaluate performance test results for each anchor. The Owner's Resident Project Representative will determine acceptance based on the following criteria:
1. The elastic movement component shall be greater than eighty percent (80%) of the theoretical elastic elongation of the free length and shall be less than the theoretical elongation of the free length plus fifty percent (50%) of the bond length.
 2. The creep rate shall not exceed 0.04 inch per logarithmic cycle of time during the final logarithmic cycle of time, regardless of the tendon length and load. The creep rate will be evaluated by plotting the linear variation of movement in inches versus a logarithmic (base 10) variation of time in minutes.
 3. If the extended creep rate exceeds 0.04 inch per logarithmic cycle, the observation period shall be extended up to a total of 300 minutes. Readings for creep total movement shall be made at 75, 90, 100, 120, 150, 180, 210, 240, 270, and 300 minutes. Any tendon displaying a creep rate exceeding 0.08 inch per logarithmic cycle after 300 minutes of observation is subject to rejection by the Owner's Resident Project Representative.
 4. Any anchor failing to meet specified acceptance criteria will be rejected and shall be replaced, or may be accepted at reduced capacity and supplemented by additional anchors at the Owner's discretion. Contractor shall propose remedial measures through the RFI process. Required supplemental and replacement anchors shall be installed and tested at no additional cost to the Owner.
 5. Owner's Resident Project Representative will evaluate performance test results and determine acceptability within 96 hours of receiving final testing data from the Contractor.

- D. Anchor Lock-off: Upon Successful completion of the required load test, the anchor shall be tensioned to not more than eighty percent (80%) of its ultimate strength to achieve lock-off at seventy percent (70%) of its ultimate strength. The strand wedges shall be seated mechanically by a self-contained seating ram within the tensioning jack. Wedges shall not be seated by any other method. Subsequent adjustments in anchor load shall only be done by adding or removing shims as required. Furnish adequate personnel during all anchor stressing and lock-off operations as necessary to ensure that the power seating is properly conducted in a manner to eliminate damage breakage, or slippage of the strand.
- E. Liftoff Readings:
1. Take liftoff readings on each anchor immediately after transferring the load to the anchor head and again after a minimum of 72-hours following transfer of the load to the anchor head. If shims are required, take supplemental liftoff readings after addition of each shim.
 2. The liftoff reading shall be within +5 percent and -2 percent of the specified lock-off load. If the liftoff load reading is greater than the specified lock-off load, do not unload. The load may be reduced by the removal of shims, if provided. Any anchor with a liftoff load greater than five percent (5%) above the design lockoff load is subject to rejection by the Owner's Resident Project Representative. If liftoff reading is less than ninety-eight percent (98%) of the specified lock-off load, the anchor shall be increased by addition of shims and another liftoff reading shall be taken.
 3. The lift-off readings will be considered a final supplemental check of temporary load cell readings prior to the specified evaluation period. In addition, the lift-off readings will be used to verify that the load indicated on the hydraulic jack was adequately transferred to the tendons.

3.10 COMPLETING ANCHOR INSTALLATIONS

- A. Tendons shall be suspended at all times and shall not be allowed to bear on the bottom of the corrugated sheathing and end cap. After the completion of grouting, the anchors shall be observed for a period of seven (7) calendar days for signs of strand movement. Cut the anchor strand only after curing of grouting as specified, after the required seven (7) calendar day evaluation period, and after receiving written approval by the Owner's Resident Project Representative
- B. Tendon protrusions shall be cut in accordance with the strand manufacturer's recommendations and as submitted in the Contractor's Anchor Handling and Installation Plan. Cutting of strands by torch burning shall not be allowed. Care shall be taken not to damage the anchorage. The strands shall be cut so as to provide no less than the minimum strand protrusion shown on the Drawings
- C. All strand tails shall be stored and catalogued for the duration of the project.
- D. All remaining void space between the strands inside the trumpet shall be filled with grout where the plastic sheathing is present. After cutting strand protrusions, the wedge plate

shall be covered by a temporary cap or cover. All exposed metal surfaces shall be coated with approved paint.

- E. Install protective concrete as shown on the Drawings. Concrete shall be placed in accordance with Section 03 30 00.01 "Cast-In-Place Concrete".

3.11 FINAL ACCEPTANCE

- A. The Owner's Resident Project Representative shall acknowledge in writing the acceptability of each anchor after the Contractor has supplied all documentation, including As-Built data of each anchor. An acceptable anchor shall meet the following criteria:
 1. Certifications of materials and manufacturing meet project specifications.
 2. Anchor is locked-off in specified ranges as proven by 72 hour lift-off.
 3. Long term, 50 year, anticipated relaxation, based on the initial lock-off and the 72 hour lift-off, will provide at a minimum, the specified Design Load.
 4. Corrosion protection meets specified requirements.
 5. Load extension criteria and short-term creep test criteria are met.
 6. Anchor is installed at location and orientation as required on the Drawings.
 7. There is no evidence of strand slippage after the 72-hour lift-off and after the seven (7) day strand movement evaluation period.

TABLE 31 51 19-1 PERFORMANCE TEST LOAD INCREMENTS

Load	Total Movement	Residual Movement	Load Hold Time
AL 0.25 DL	X X		N/A <1 minute
AL 0.25 DL 0.50 DL		X	N/A <1 minute <1 minute
AL 0.25 DL 0.50 DL 0.75 DL	X	X	N/A <1 minute <1 minute <1 minute
AL 0.25 DL 0.50 DL 0.75 DL 1.00 DL	X	X	N/A <1 minute <1 minute <1 minute < 1 minute
AL 0.25 DL 0.50 DL 0.75 DL 1.00 DL 1.20 DL	X	X	N/A <1 minute <1 minute <1 minute <1 minute < 1minute
AL 0.25 DL 0.50 DL 0.75 DL 1.00 DL 1.20 DL 1.33 DL AL	X	X X	N/A <1 minute <1 minute <1 minute <1 minute <1 minute 10 minutes N/A

- Notes:
- 1) AL = Alignment Load
 - 2) DL = Design Load
 - 3) Reloading to lock-off load will follow return to AL after creep testing at 1.33DL.

END OF SECTION

