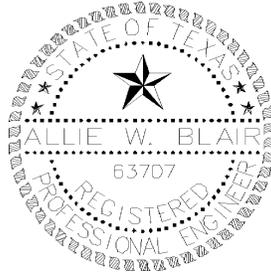


EL PASO COUNTY WATER IMPROVEMENT DISTRICT NO. 1 (DISTRICT)  
FRANKLIN CANAL LINING PHASE 2: EL PASO ZOO SECTION  
CONSTRUCTION SPECIFICATIONS DOCUMENT FOR TWDB GRANT 2013582447

Version 2025\_12\_25



A handwritten signature in black ink, appearing to read "Allie Blair".

A.W. Blair, PE. District Engineer  
August 12, 2025

**Texas Water  
Development Board**

**Reviewed:** \_\_\_\_\_

**Approved:** \_\_\_\_\_

**Date:** \_\_\_\_\_

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SECTION 01010 TWDB Grant and other Requirements

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Grant Requirements  
Engineering Drawing Requirements

1.02 Summary

This Section includes identifies specific construction requirements of the Texas Water Development Board Grant 2013582447 for the shotcrete lining of a portion of the Franklin Canal El Paso Zoo Section in El Paso County, Texas. These requirements are also listed on Sheet 2 “Note” of the project engineering drawing.

1.03 Related Sections

None

1.04 Grant Requirements

A. Contractor shall submit a trench safety plan meeting OSHA and Texas Health & Safety Code Section 756.022 and obtain written approval of Project Engineer prior to any construction of trenches in excess of 5 feet in depth.

B. This project is subject to the U.S. Iron and Steel (U.S. I&S) requirements of Texas Water Code § 17.183 and/or Texas Government Code, Chapter 2252, Subchapter G, as amended by SB 1289, 85th Legislative Session, as applicable. All iron and steel products used in project construction must be produced in the United States.

C. Consistent with the Endangered Species Act of 1973 as amended, the Migratory Bird Treaty Act, and Texas Parks and Wildlife Code Chapter 64, if migratory birds are found nesting on or adjacent to the project area, vegetation clearing must be excluded during the general bird nesting season, March 15 through September 15; or if clearing at these times is unavoidable, the area proposed for disturbance should be surveyed, during the nesting period, to identify occupied nests. If occupied nests are found, the area around each nest should remain undisturbed until the eggs have hatched and the young have fledged. State and federal regulations as currently interpreted do not permit incidental take.

D. Consistent with the Texas Parks and Wildlife Code Section 68.015, the District must inform construction workers and other field personnel regarding the potential occurrence of state listed species in the project area. Prior to beginning work each day, open trenches and excavation areas must be checked to ensure no wildlife species have been trapped. If state listed species are encountered, the animals must be allowed to leave the area safely. State listed species may be handled only by persons with authorization obtained through the Texas Parks and Wildlife Department. Disturbed areas must be reseeded with native grasses by hydromulching, hydroseeding, or seed broadcasting

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techniques. If erosion control blankets or mats are used, the District must avoid the use of plastic mesh matting or netting.

1.05 Other Requirements

- A. The contractor shall first, comply with the notes and requirements of the project drawings. The contractor shall in a timely manner bring to the attention of the project engineer any conflict between this Construction Specifications Document and the engineering drawings or any conflicts within the drawings or document.
- B. In the event of a conflict between the requirements of the engineering drawings (plans) and the requirements of the specifications, the more restrictive requirement shall govern. The Engineer shall determine which requirement is more restrictive.
- C. Contractor shall submit a shotcrete mixture and placement design for the canal pavement and obtain written approval of Project Engineer prior to any placement of shotcrete. The mixture and placement design shall include, at a minimum: 1) applicability, 2) min/max payment thickness, 3) fiber type and amount, 4) fly ash, superplasticizer, and air entrainment %, 5) slump, 6) final mix design from plant, 7) minimum 7 day cure strength of 3,500 psi, 8) and any other information impacting strength, applicability, and placement, and curing of the concrete.

END OF SECTION

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SECTION 01020

PART 1 PROJECT DESCRIPTION

1.01 Section Includes

Summary  
Related Sections  
Project Description  
Role of District Engineer  
Role of District Maintenance and Construction Department

1.02 Summary

This Section describes the project partially funded by the Texas Water Development Board Grant 2013582447 for the shotcrete lining of a 1200 linear foot portion of the Franklin Canal in El Paso County, Texas.

1.03 Related Sections

None

1.04 Role of District Engineer

The District Engineer is the Project Engineer and the Engineer-of-Record for this project.

1.05 Role of District Maintenance and Construction Department

A. This project was designed by the District and shall be constructed by the District Maintenance and Construction Department.

B. The CONTRACTOR for this Project shall be the Maintenance and Construction Department of the District, and such department shall perform all responsibilities required of the Contractor.

C. The CONTRACTOR shall notify all authorized inspectors, superintendents, or persons in charge of utilities affected by his operations before the commencement of work. Required permits, if any, will be obtained by the District Licensing Department.

D. CONTRACTOR shall adhere to all construction requirements cited in the Texas Water Development Board Contract No. 2013542447.

1.06 Sub-Contractors Prohibited

No subcontractor shall be used on this project, with the exception of geophysical engineering related to testing soil and concrete materials. All construction work shall be performed by the District.

END OF SECTION

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SECTION 01040 COORDINATION

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Preconstruction Conference  
Progress Meetings  
Coordination With Others  
Utility Coordination  
Submittals  
Protection and Relocation of Existing Utilities

1.02 Summary

This Section includes the required coordination of the Contractor to ensure efficient and orderly sequencing of construction elements.

1.03 Related Sections

None

1.04 Pre-construction Conference

The District will schedule a pre-construction conference at EPCWID Office in Clint, El Paso County, Texas. Attendance is required by the Contractor.

1.05 Progress Meetings

The District will arrange and conduct monthly progress meetings. The meetings shall include a representative of the District, the Contractor, and the Licensee. The purpose of these meetings shall be to analyze the progress of the work of the Contractor, resolve conflicts, and in general, coordinate the operation of all organizations active at the project site. The District may call other meetings on an "as needed" basis.

1.06 Coordination With Others

The Contractor shall be responsible for ascertaining the nature and extent of any simultaneous, collateral, and essential work by others.

1.07 Utility Coordination

A. For all utilities identified in these Contract Documents, the District will be held harmless from claims of any nature arising out of or connected with damage to the utilities encountered during construction, damage resulting from disruption of service, and injury to persons or damage to public or private improvements resulting from the negligent, accidental, or intentional breaching of the facility. For utilities not so located in these Contract Documents, the Contractor shall proceed in accordance with the terms of the contract clause in Section I entitled Differing Site Conditions.

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- B. The Contractor shall be responsible for coordination with all utility companies and shall bear all costs associated with same. The Contractor shall coordinate all related construction activities with each utility owner. Owners of various utilities on or near the project site may include, but are not limited to:

Utility	Owner
Overhead electric lines	El Paso Electric Co. El Paso Water Utilities Time Warner Cable Texas Natural Gas

1.08 Submittals

- A. The Contractor shall submit to the District, seven (7) calendar days prior to work on affected utilities or improvements, a plan of proposed methods and schedule for dealing with protection and /or relocation of existing utilities.
- B. The Contractor shall submit to the District, within twenty-four (24) hours of issuance, a copy of notices sent to property and utility owners.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 Protection and Relocation of Existing Utilities

The Contractor shall notify and make arrangements with all utility owners, seven (7) calendar days in advance of beginning construction.

END OF SECTION

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SECTION 01050 FIELD ENGINEERING

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Surveying Information Provided by the District  
Surveying Provided by the Contractor  
Survey Accuracy  
Survey Records  
Survey Staking  
Survey Submittals  
Materials and Equipment

1.02 Summary

This Section describes the survey work and conditions under which the survey work is to be provided by the Contractor.

1.03 Related Sections

Section 01040 - COORDINATION  
Section 01300 - SUBMITTALS  
Section 02200 - GRADING, EXCAVATING, BACKFILLING and COMPACTING

1.04 Surveying Information Provided by the District

- A. The District has established primary control monuments to be used by the Contractor for establishing lines and grades required for the work. All horizontal and vertical controls are on USBR datum.
- B. The primary control monuments consist of vertical and horizontal control points in the vicinity of the work as shown on the survey control map drawings.
- C. The District will provide the pipeline or canal centerline control coordinates to be used by the Contractor for establishing the alignment of the project.

1.05 Surveying Provided by the Contractor

- A. Survey work shall be under the supervision and direction of a registered professional land surveyor licensed in the State of Texas with a minimum of two (2) years experience as person-in-charge of construction surveys for construction similar in nature to that required by these Contract Documents. All survey work performed by the Contractor shall be certified by the Registered Land Surveyor and shall be subject to field and office review by the District.
- B. From the District-established primary control monuments, the Contractor shall establish all lines and grades necessary to control the work, and shall be responsible for all measurements that may be required for execution of the work to the tolerances prescribed in these Contract Documents.

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- C. The Contractor shall preserve and maintain primary control points. Primary control points damaged or destroyed due to construction by the Contractor will be reestablished by the Contractor at the Contractor's expense.
- D. The Contractor shall establish, place, and replace as Required, such additional stakes, markers, and other controls as may be necessary for control, intermediate checks, and guidance of construction operations.
- E. The Contractor shall perform such surveys and computations as are necessary to determine quantities of work performed or placed during each progress payment period.

1.06 Survey Accuracy

- A. Horizontal Control Survey Accuracy. Transverse surveys shall be surveyed to second order accuracy which is 1 part in 10,000, unless otherwise specified.
- B. Vertical Control Survey Accuracy. Differential leveling shall be surveyed to second order accuracy which is 0.035 feet multiplied by the square root of the distance surveyed in miles, unless otherwise specified.
- C. Survey calculations shall include an error analysis to demonstrate the required accuracy.

1.07 Survey Records

The Contractor shall record survey data in accordance with recognized professional surveying practices. All original field notes, computations, and other surveying data shall be recorded in hard-cover field books. The Contractor shall provide one book for each type of survey. Field books shall be organized by type of survey, each with a Table of Contents. The names of survey crew and the task of each person shall be included on each Survey. If electronic data collectors are used by the Contractor, Surveying Data Recorder (SDR) files shall be provided, as well as printed, bound, hard-copy which is identified on the cover with the date, survey location, type of survey work and names of survey crew and task of each person. Illegible notes or data, or erasures on any page of a field book or SDR file will be considered sufficient cause for rejection by the District. Copied notes or data are not permitted; therefore, rejection of part or all of a field book will necessitate resurveying. Corrections by ruling or lining out errors will be satisfactory.

1.08 Survey Staking

The Contractor shall observe the following construction surveying guidelines for this project.

- A. Alignment staking - Each 50 feet on tangent.
- B. Slope staking - Each 50 feet on tangent.
- C. Structure - Stake out and checkouts for structures prior to and during construction.

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1.09 Survey Submittals

- A. The Contractor shall submit to the District, seven (7) calendar days prior to beginning surveying work, a complete plan of the work required in this Section, including methods and schedules for establishing lines and grades, and quantity surveys.
- B. The Contractor shall submit to the District, seven (7) calendar days prior to beginning surveying work, resumes of qualifying experience for the registered land surveyor who will be responsible for the supervision and direction of Contractor survey work. During the course of the work, a resume shall be submitted for each new registered land surveyor working on the project.
- C. The Contractor shall provide to the District, within two (2) working days after completing and reducing notes of a survey or portion of survey, a copy of such notes. The District may request a copy of each day's field notes at the conclusion of that day.
- D. The Contractor shall provide to the District, within ten (10) calendar days after completion of each field survey book or SDR file, the original field survey book or SDR file for review and filing by the District. The registered land surveyor shall sign and seal each field book or SDR file. The Contractor shall submit field survey book or SDR file with a cover letter signed by the registered land surveyor certifying that elevations, locations, or improvements conform to the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 Materials and Equipment

The Contractor shall provide all materials and equipment required for surveying work, including, but not limited to, instruments, stakes, spikes, steel pins, templates, field books, platforms, and tools, and except as required to be incorporated in the work or left in place, all such materials and equipment shall remain the property of the Contractor. Instruments shall be accurate and shall be inspected by the Contractor at all times to assure accuracy. The Contractor shall adjust, replace, or repair defective instruments promptly.

END OF SECTION

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SECTION 01300 SUBMITTALS

PART 1 GENERAL

1.01 Section Includes

Related Sections  
Submittal Procedures  
Submittal Review  
Schedule for Submittals  
Construction Photographs  
Addresses  
Record Drawings

1.02 Related Sections

Section 01040 - COORDINATION  
Section 01400 - QUALITY CONTROL  
Section 01700 - CONTRACT CLOSEOUT

1.03 Submittal Procedures

- A. The Contractor shall provide all materials and perform all work required for furnishing submittals to the District.
- B. Submittals for each type of material mentioned in each Section shall include test results performed on that material for this project, along with a letter certifying compliance with the contract documents.
- C. The word "submittals" shall be interpreted to include shop drawings, data, manuals, certifications, samples, color chips or charts, brochures, schedules, photographs, and other items furnished by the Contractor for review, information, and other purposes.
- D. The Contractor shall submit only complete sets of material/information for review unless otherwise advised by the District. The Contractor shall check and approve all submittals prior to transmitting them to the District to determine if they comply with requirements of the Contract Documents. Submittals which are incomplete or are not in compliance with the Contract Documents will not be accepted for processing by the District.
- E. The Contractor shall schedule, prepare, and submit all submittals to allow suppliers and manufacturers sufficient time to fabricate, manufacture, inspect, test, and deliver their respective products to the project site in a timely manner so as to not delay the complete performance of the work. Specific submittal requirements are located in appropriate Sections of these Contract Documents.
- F. The Contractor shall submit complete hard copy and electronic sets of required Submittal or other descriptive data together with copies of the Transmittal Document to the Project Engineer for review. The original set of Submittals shall be considered as the hard copy of the complete sets required to be submitted. The transmittal document contain the following:

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1. The date transmittal was submitted to the Project Engineer.
  2. The name of Project.
  3. The number of complete sets.
  4. The Contract number.
  5. The Transmittal number.
  6. The Contract Documents section number and paragraph number.
  7. The name of Contractor.
  8. The description of items submitted including numbers and titles.
  9. Identification if the Submittal is a new transmittal or resubmittal.
  10. A written statement of any variations and requests for approval of any departures from the Contract documents.
  11. Contractor Use Code.
  12. The Contractor's Representative name and signature certifying that the Contractor has reviewed the Submittal and coordinated the work of all trades involved and that the item will fit in the space specified and is in strict conformance with the Contract Documents. The Contractor's signature of certification shall constitute a representation that all quantities, dimensions, field construction criteria, materials, catalog number, performance criteria, and similar data have been verified and that the Submittal fully meets the requirements of the Contracts Documents.
- G. Manufacturer's data for commercial products or equipment, such as catalog cut sheets, shall be clearly marked to indicate the item(s) to be furnished. The data shall be sufficiently comprehensive to identify the manufacturer's name, type, model, size, and characteristics of the product or equipment, and fully demonstrate that the product or equipment meets the requirements of the Contract Documents.
- H. Each submittal shall be numbered consecutively and shall accurately and distinctly present the following:
1. All working and erection dimensions.
  2. Arrangements and sectional views.
  3. Necessary details, including complete information for making connections between work outside the project or to be performed by others, and work under these Contract Documents.
  4. Kinds of materials and finishes.
  5. Parts lists and description thereof.
- I. Each drawing or page shall include:
1. Submittal date, revision dates, and transmittal number.
  2. Project name.
  3. Detailed Contract Document section number and paragraph number.
  4. Name of Contractor and Subcontractor.
  5. Name of supplier and manufacturer.
  6. Relation to adjacent structure or material.
  7. Field dimensions, clearly identified.
  8. Standard, code, test, or Contract Document references.
  9. Identification of deviations from the Contract Documents.

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10. Contractor's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract Documents.
  11. Location at which the equipment or material is to be installed. Location shall mean both physical location and location relative to other connected or attached material.
  12. Contractor's or Supplier's title.
  13. Drawing Number.
  14. Drawing shall be in ACAD DWG or ACAD DXF format compatible with ACAD 2020. Digital versions of drawings shall be provided to the Project Manager and Project Engineer.
- J. Stock or standard drawings will not be accepted for review unless full identification and supplementary information is shown thereon in ink or typewritten form.

1.04 Submittal Review

- A. The District will return unchecked any submittal which does not contain complete data on the work and full information on related matters. The time required for review of submittals furnished as specified herein will begin after Notice to Proceed and the date after the District receives complete sets of all the submittal materials. Submittals that require changes or revisions shall be revised and resubmitted for review, and shall indicate changes and revisions made. All requirements specified for the initial submittal shall apply to any resubmittals required. Unless otherwise specified, all submittals which are to be resubmitted shall be resubmitted by the Contractor within seven (7) calendar days after the Contractor has received the District's comments.
- B. Except as otherwise provided in these Contract Documents for specific submittals, the District will require seven (7) calendar days for review of submittals or resubmittals. This review period will begin the date after the submittal(s) are received by the District and will extend through the date of return mailing to the Contractor. This review period will apply to each separate submittal or resubmittal whether compliance is confirmed or the submittal or resubmittal is returned for revision.
- C. If the District uses time in excess of the above-stated number of calendar days for review of any submittal or resubmittal, additional time, not to exceed the excess time, will be added to the time allowed the Contractor for completion of the work affected by such excess time, to the extent it is demonstrated that the excess time caused delay. If the District's review of two or more separate submittals or resubmittals is late and results in concurrent days of excess time, such days will be counted only once in computing an extension of the completion date. Further, if the Contractor fails to make submittals in the sequence within the time period specified in these Contract Documents, and thus precludes the District from reviewing such submittals within the foregoing seven (7) calendar day period, then the Contractor shall not be entitled to an extension of time allowed for completion of the work.
- D. If the submittals show departures from the requirements of the Contract Documents, the Contractor shall make specific mention on the transmittal

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document, otherwise confirmation of compliance of such submittals by the District shall not constitute approval of the departure. Any departure not noted by the Contractor in the Contractor's letter of transmittal may cause rejection of the work. Compliance confirmation of the submittals shall refer to the subject matter thereof only and not to any structure, material, equipment or apparatus shown or indicated.

- E. The review of submittals will only be for compliance with the information given in the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. Compliance confirmation shall not relieve the Contractor of responsibility for the accuracy of such submittals, nor for the proper fitting and construction of the work. No work called for by the submittals shall be done until compliance has been confirmed by the District.
- F. The procedure for review of the shop drawings or submittals shall be as follows:
1. The District will mark each transmitted document "Compliance Confirmed," "Compliance Confirmed as Noted," "Examined and Returned for Corrections," "Incomplete Submittal," or "Unacceptable" and one copy of the submittal with a letter of transmittal from the District will be mailed to the Contractor at an address designated by the Contractor.
  2. If a transmitted document is marked "Compliance Confirmed as Noted," the Contractor shall make the corrections indicated and process the corrected Submittal.
  3. If a transmitted document marked "Examined and Returned for Correction," or "Incomplete Submittal," or "Unacceptable," the Contractor shall make the necessary corrections and resubmit the documents as required in Article 1.03. All resubmittals shall be identified by the original submittal number followed by an "A" for the first resubmittal, a "B" for the second resubmittal, and so on.
  4. If any corrections, other than those noted by the District, are made on a shop drawing to be resubmitted, such changes should be pointed out by the Contractor upon resubmittal.
  5. The Contractor shall revise and resubmit the submittal as required, until full compliance thereof is obtained.

1.06 Construction Photographs

- A. The Contractor shall submit monthly digital photographs to the District indicating the relative progress of the work, taking of photographs shall proceed at issuance of Notice to Proceed before the commencement of earthwork operations.
- B. Each photograph shall be identified by a photo number, name of photographer, project name, date and time of photograph, location of photographer (with respect to Stations), and orientation and description of photograph. The above captioned information shall be provided on the attached Log of Photograph Document.

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1.07 Addresses

The Contractor shall provide one copy each all submittals to the addresses listed below:

PROJECT ENGINEER

A.W. Blair, PE  
El Paso County Water Improvement District No. 1  
13247 Alameda Ave.  
Clint, Texas 79836  
phone: 915-872-4000  
cell: 512-415-1421

Electronic or copies to the Project Engineer are acceptable if the information contained in such copies is readable by the Project Engineer. Electronic distribution via e-mail shall be in a "PDF" format and receivable using standard e-mail programs.

1.08 Record Drawings

- A. The Contractor shall keep one current and updated record copy of all specifications, plans, addenda, supplementary drawings, shop drawings, change orders and clarifications at the Contractor's field office. Specifications, plans, supplementary drawings, and shop drawings shall be annotated to show all changes made during the construction process. These shall be available to the District on a monthly basis to inspect for accuracy and completeness. Failure by the Contractor to maintain a current and satisfactory record copy of the aforementioned documents shall result in retainage of an appropriate amount of the monthly pay estimate, as determined by the District.
- B. The Contractor shall submit to the District, seven (7) calendar days prior to the final acceptance inspection of the project, a record copy of the aforementioned Record Drawings for review and approval. If upon review, the Record Drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction at the Contractor's expense.

END OF SECTION

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SECTION 01400 QUALITY CONTROL

PART 1 GENERAL

1.01 Related Sections

Section 01300 - SUBMITTALS  
Section 01700 - CONTRACT CLOSEOUT

1.02 General

The Quality Control System Manager shall be a professional engineering licensed in Texas employed by the District other than the District Engineer.

PART 2 EXECUTION

2.01 General

The District is responsible for quality control and shall establish and maintain an effective quality control system. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the specifications and engineering drawings. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

2.02 Submittals

Submittals shall be made as specified in Section 01300- Submittals. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

2.03 Control

The control that shall be performed prior to beginning work on each definable feature of work and shall include:

1. A review of each paragraph of applicable specifications.
2. A review of the contract drawings.
3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
4. A check to assure that provisions have been made to provide required control inspection and testing.
5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
7. A review of the appropriate activity hazard analysis to assure safety requirements are met.
8. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.

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9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Engineer.
10. The District shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

2.04 Tests

A. Testing Procedures

The District shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Testing includes operation and or/acceptance tests when specified. The District shall procure the services of an approved testing laboratory. The District shall perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the rest will be given. If approved by the Engineer, actual test reports may be submitted later with the reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

B. Testing Laboratories

Capability Check

The District reserves the right to check the laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM D 329.

2.05 Completion of Work Inspections

A. District Inspection

At the completion of all work, the CQC System Manager shall conduct an inspection of the work and develop a "District's punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the District. These inspections and any deficiency

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corrections required by this paragraph will be accomplished within the time stated for completion of the entire work.

B. District Final Acceptance Inspection

The District's Quality Control System Manager, his superintendent or other primary management person and the District will be in attendance at this inspection. The final acceptance inspection will be formally scheduled by the District based upon notice from the District. This notice will be given to the District at least seven (7) calendar days prior to the final acceptance inspection. The notice must include the District's assurance that all items in the district's punch list developed during the District and District Pre-Final Inspection phase have been corrected. Failure of the District to have all contract work acceptably complete for this final acceptance inspection will be cause for the District to cancel the inspection and bill the District for the District's additional inspection costs in accordance with the contract clause in Section I entitled, "Inspection of Construction." This inspection will be considered another District and District Pre-Final Inspection and the District must schedule another District and District Final Acceptance Inspection after all items have been corrected. Otherwise, this inspection will be considered a District and District Final Acceptance Inspection if all items in the District's punch list and all other work are considered acceptably complete by the District.

2.06 Notification of Noncompliance

The Engineer will notify the District of any detected noncompliance with the foregoing requirements. The District shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the District at the worksite, shall be deemed sufficient for the purpose of notification. If the District fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the District.

END OF SECTION

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SECTION 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Construction Facilities and Staging Area  
Security  
Cleanup and Disposal of Waste Materials  
Prevention of Water Pollution  
Abatement of Air Pollution  
Dust Abatement  
Noise Abatement  
Erosion Control  
Light Abatement  
Surface Water Control  
Access to the Work and Haul Routes  
Traffic Regulation  
Submittals

1.02 Summary

This Section includes information on temporary utilities, facilities, and construction aids required during construction.

1.03 Related Sections

Section 01700 - CONTRACT CLOSEOUT  
Section 02200 - GRADING, EXCAVATING, BACKFILLING, and COMPACTING

1.04 Construction Facilities and Staging Area

A. Field Office

1. The Contractor shall erect, furnish, and maintain a field office with a telephone and sanitary facilities at the field office and construction site prior to commencing construction activities, and during the entire construction period. The Contractor shall keep and have readily accessible a clear and complete set of the Contract Documents at the field office.
2. The Contractor may use property to be identified by the District on or adjacent to the project site for setup of the Project Office.
3. The Contractor shall coordinate with the District for use of District property.
4. The Contractor shall obtain all State and local permits required for the establishment of Contractor's field office. The permits shall include but not limited to sanitary, electrical, and potable water system installation permits.

1.05 Security

The Contractor shall provide means of security of the Contractor's property at the construction area, staging area(s), and field office site on a 24-hour basis during work

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days, weekends, and holidays. The Contract and the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, dated October 1992, cover requirements for public and employee safety.

1.06 Cleanup and Disposal of Waste Materials

A. General

The Contractor shall be responsible for the cleanup and disposal of waste materials and rubbish from the construction site and field office(s) and staging area(s). The disposal of waste materials and rubbish shall be in accordance with applicable Federal, State, and local laws and regulations, and with the requirements in these Contract Documents. Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirements shall apply.

B. The Contractor shall keep records of the types and amounts of waste materials produced, and of the disposal of all waste materials on or off the job site. These records shall be kept current and accurate and shall be available for review by the District.

C. In the event of the Contractor's failure to perform the work required by this Section, the work will be performed by the District, and the Contractor shall be responsible for the cost of such work. The costs for temporary controls provided by the District shall include both direct labor costs and other direct costs associated with the work.

D. Cleanup

1. In accordance with contract clause in Section I entitled "Cleaning Up," the Contractor shall maintain work and storage areas free from accumulations of waste materials and rubbish, and before completing the work, shall remove all temporary facilities, including, buildings, unused materials, concrete forms, and other like materials, which are not a part of the permanent work.
2. Upon completion of the work and following removal of construction facilities and required cleanup, the Contractor shall re-grade work areas to conform to the pre-construction conditions. The Contractor shall be required to conduct an environmental site assessment at the following Contractor use locations:
  - a. All hazardous waste accumulation areas;
  - b. All hazardous material and petroleum dispensing and storage areas where the aggregate storage of hazardous materials or petroleum at the site is or has been over 110 gallons.
3. This site assessment shall be performed by a qualified environmental consultant or equivalent and shall document through appropriate analytical sampling that the site is free of the effects of contamination (i.e., contamination concentrations less than the State of Texas action cleanup levels).

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- E. Disposal of all Hazardous and Non-hazardous Waste and Materials used by the Contractor
1. All hazardous materials or wastes used by the Contractor or discovered in work or storage areas defined as hazardous by 40 CFR 261.3, or other Federal, State or local laws or regulations shall be disposed of by the Contractor in accordance with these Contract Documents and applicable Federal, State, and local laws and regulations. Unknown waste materials that may be hazardous shall be tested, and the test results shall be submitted immediately to the District for review. A copy of all hazardous waste manifests shall also be submitted to the District.
  2. All non-hazardous materials or wastes used by the Contractor to include, but not limited to, refuse, garbage, sanitary wastes, industrial wastes, oil and other petroleum products shall be disposed of by the Contractor in accordance with these Contract Documents and applicable Federal, State, and local laws and regulations. Disposal of materials shall be by removal from the construction site, Contractor's field office, and staging area(s). Disposal of materials by burning or burying will not be permitted. All materials within the construction site, Contractor's field office, and staging area(s) shall be removed prior to completion of the work under these Contract Documents. All materials removed shall become the property of the Contractor.
- F. Disposal of all Hazardous and Non-hazardous Waste and Materials discovered during construction. If waste material is discovered during construction operations, the Contractor shall immediately notify the District. The District may request the Contractor to test the material. The testing and disposal of this waste material, either hazardous or non-hazardous, by the Contractor shall be handled in accordance with the terms of contract clause in Section I entitled "Differing Site Conditions."
- G. TWDB may not fund testing, remediation, removal, disposal, or related work for contaminated or potentially contaminated material. See also guidance in TWDB-0552, Section III.15

1.07 Prevention of Water Pollution

- A. The Contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into the Rio Grande either direct or through existing surface and/or underground drains.
- B. Excavated materials or other construction materials shall not be stockpiled or deposited in the Rio Grande floodplain.
- C. The Contractor shall prevent water or any other fluid originating from the Contractor's operations from entering the Rio Grande without the use of an approved turbidity control method and approved National Pollutant Discharge Elimination System (NPDES) Section 402 permit. If the Contractor plans to discharge construction water into the Rio Grande, the Contractor shall be required to acquire this NPDES permit.

1.08 Abatement of Air Pollution

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- A. The Contractor shall comply with applicable Federal, State, and local laws and regulations, and with the requirements of these Contract Documents concerning the prevention and control of air pollution. Should a conflict exist in the requirements for abatement of air pollution, the most stringent requirement shall apply. The Contractor shall utilize such methods and devices available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.
- B. The Contractor shall not operate equipment and vehicles that show excessive emissions of exhaust gases until corrective repairs or adjustments reduce such emissions to acceptable levels.

1.09 Dust Abatement

- A. The Contractor shall, during the performance of the work required by these Contract Documents, or any operations appurtenant thereto, and whether within the Construction limits of this project or elsewhere, comply with applicable Federal, State, and local laws and regulations regarding the prevention, control, and abatement of dust pollution. Should a conflict exist in the requirements for dust abatement, the most stringent requirement shall apply.
- B. The Contractor shall control dust at all times, including Saturdays, Sundays, and holidays, during both working and nonworking hours. The District has the authority to stop any construction activity contributing to dust levels which are excessive or are in violation of Federal, State, or local laws. All costs resulting from such work stoppage shall be the responsibility of the Contractor, and contract time extensions will not be provided.

1.10 Noise Abatement

The Contractor shall comply with the applicable Federal, State and local laws and regulations, regarding the prevention, control, and abatement of harmful noise levels. Should a conflict exist in the requirements for noise abatement, the most stringent requirement shall apply.

1.11 Erosion Control

- A. The Contractor is responsible for erosion control in the entire construction area. Construction shall be conducted in such a manner, so as to confine soil, silt, and all other construction-related materials within the construction area. Temporary controls shall consist of bales of hay or other means approved by the District.
- B. The Contractor's methods of excavating or stockpiling of earth material shall include preventive measures to control erosion.
- C. The Contractor is responsible for obtaining a Storm Water Discharge Permit from EPA.

1.12 Light Abatement

The Contractor shall exercise special care to direct all stationary lights to shine downward at an angle less than horizontal. These lights shall also be shielded so as not to be a nuisance to surrounding areas. No lighting shall include a residence in its direct beam. The Contractor shall immediately correct lighting problems when they occur.

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1.13 Surface Water Control

- A. The Contractor shall prevent surface water from entering the construction area or damaging adjacent properties. Any damage caused by the entry of surface water to the construction area shall be repaired at the Contractor's expense. The Contractor shall be liable for any damage caused by diversion of surface water from the Contractor operations towards adjacent properties.
- B. The Contractor shall construct and maintain temporary drainage swales, berms, and diversions as required. After above items have served their purpose, the Contractor shall remove them at the Contractor's expense.

1.14 Access to the Work and Haul Routes

- A. The Contractor shall use existing roads subject to existing restrictions. The Contractor shall meet all conditions properly imposed upon the use of existing roads by those having overriding jurisdiction, including seasonal or other limitations or restrictions. All work necessary for access to the construction site shall be performed by the Contractor. The Contractor shall make its own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect transportation and ingress and egress at the construction site. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work. The Contractor shall be responsible for the payment of excess size and weight fees, and the posting of bonds conditioned upon repair of road damage caused by the Contractor. The Contractor shall construct and maintain any haul roads, access roads, bridges, or drainage structures required for construction operations.
- B. The Contractor shall assure that the hauling of sand, gravel, earth material, or other hauling, over public highways, roads, or bridges is in compliance with the applicable local regulations and shall be such as to minimize interference with or congestion of local traffic. Where haul routes cross public highways or roads, the Contractor shall provide barricades, flagmen, and other necessary precautions for safety of the public as specified in Section 01900-SAFETY.

1.15 Traffic Regulation

- A. The Contractor shall prepare a traffic control plan approved by the City of El Paso and the TxDOT. The traffic control plan shall conform with the latest edition of the Texas Manual On Uniform Traffic Control Devices for Streets and Highways as amended by the TxDOT or City of El Paso and as indicated below.
- B. The traffic control plan shall require the Contractor to notify the law enforcement, traffic enforcement, and fire department in whose jurisdiction the project lies, giving the expected starting date, completion date, and the name and telephone number of a responsible person who may be contacted at any hour in the event of a condition requiring immediate attention.
- C. During the period of construction where traffic is directed around or adjacent to the construction area, the Contractor shall provide, erect, maintain, and remove delineators, barriers, suitable and sufficient flasher lights, flagmen, danger signals, signs, and other devices, and shall take all necessary precautions for the protection of the work and the safety of the public as required by the approved traffic control plan for the project. In the event the City Traffic

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Engineer, TxDOT or the District finds the work site to be improperly barricaded or delineated and the Contractor is either unavailable or unresponsive to the requests for improvements, the City of El Paso, State of Texas, or District will furnish and set up barricades and delineators as required. The Contractor shall be responsible for the costs incurred for such work.

- D. The traffic control plan shall require the Contractor to maintain a 24-hour emergency service to remove, install, relocate, and maintain warning devices and furnish to the local authorities names and telephone numbers of three persons responsible for this emergency service. In the event these persons do not promptly respond, or the local authorities deem it necessary to call out other forces to accomplish emergency service the Contractor will be held responsible for the cost of such emergency service at no additional cost to the contract.
- E. The traffic control plan shall include, but not limited to, copies of the notifications to law enforcement, traffic enforcement, and fire departments in whose jurisdiction the project lies, the expected starting date, completion date, the names and telephones numbers of three (3) responsible persons to be contacted at any hour of a condition requiring immediate attention, location of proposed access roads within the construction limits, location of proposed access roads between the construction limits and the public right of ways, location of proposed detour routes, location of all warning signs and temporary ramps.

1.16 Submittals

- A. The Contractor shall submit to the District, seven (7) calendar days prior to the start of construction, a plan indicating the location of the Contractor's field office, staging area(s), to include at a minimum, the size of the proposed area(s), proposed field modifications to the sites, location of all temporary utilities, method of security, and public and employee safety. Any changes to the plan shall be submitted to the District seven (7) calendar days prior to making the field change.
- B. The Contractor shall submit to the District, seven (7) calendar days prior to the start of construction, a plan indicating the method of securing the construction site. Any changes to the plan shall be submitted in writing to the District seven (7) calendar days prior to making the field change.
- C. The Contractor shall submit to the District, on a monthly basis, the records kept of the types of amounts of waste materials produced and disposed.
- D. The Contractor shall submit to the District, within twenty-four (24) hours of shipment, a copy of the hazardous waste manifest to the District for any hazardous materials which are disposed.
- E. The Contractor shall submit to the District, seven (7) calendar days prior to start of construction, a detail plan for prevention of water pollution; method for dust, noise, and light abatement; and a detailed erosion and drainage control plan. Any changes to the plan shall be submitted to the District seven (7) calendar days prior to making the field change.

END OF SECTION

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SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Final Cleanup  
Project Record Documents  
Final Acceptance Inspection

1.02 Summary

This section includes requirements for worksite demobilization and cleanup; submission of project record documents, including survey field books or SDR files, and record drawings; inspection and correction of unsatisfactory conditions, if necessary; and final inspection prior to final progress payment.

1.03 Related Sections

Section 01300 - SUBMITTALS  
Section 01400 - QUALITY CONTROL  
Section 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS  
Section 01050 - FIELD ENGINEERING

1.04 Final Cleanup

Prior to final inspection as provided for herein, the Contractor shall clean the entire worksite as provided in Section 01500-CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

1.05 Project Record Documents

Prior to final inspection as provided for herein, the Contractor shall submit the originals of all survey field books or SDR files in accordance with Section 01050-FIELD ENGINEERING and record drawings in accordance with Section 01300-SUBMITTALS.

1.06 Final Acceptance Inspection

- A. The Contractor shall conduct inspections of the work prior to final acceptance inspection as specified in Section 01400 - QUALITY CONTROL.
- B. The pre-final inspection will be formally scheduled by the Engineer based upon notice from the Contractor as specified in Section 01400 - Quality Control. If all construction required by these Contract Documents is found completed in accordance with these Contract Documents, the District, may accept this inspection as the final acceptance inspection. The Contractor will be notified in writing of this acceptance as of the date of the final inspection.
- C. If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the District will give the Contractor the necessary instructions for correction of the same, and the Contractor shall immediately comply with and execute such instruction. Upon correction of the work, another inspection will be

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made, which shall constitute the final inspection provided the work has been satisfactorily completed. In such event, the District will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of the final inspection.

- D. In no case will the final progress payment be prepared until the Contractor has completed all the requirements set forth and the District has made its final inspection of the entire work and is satisfied that the entire work has been completed in general conformance with the Contract Documents.

END OF SECTION

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SECTION 01900 SAFETY

PART 1 GENERAL

1.01 Section Includes

Summary  
Noncompliance

1.02 Summary

The Contractor shall comply with all provisions of the "U.S Army Corps of Engineers Safety and Health Requirements Manual," EM385-1-1, latest edition; and with all applicable regulations of the Federal Occupational Safety and Health Administration. This safety manual can be procured by the Contractor from the following source:

<https://www.usace.army.mil/Missions/Safety-and-Occupational-Health/Safety-and-Health-Requirements-Manual/>

1.03 Noncompliance

- A. The Contractor is responsible for being cognizant of and ensuring compliance with the requirements set forth in Article 1.02 above. Such responsibility shall apply to both the Contractor's operations and those of the Contractor's subcontractors. When violations of the safety and health requirements contained in these Contract Documents or standards referenced in Article 1.02 are called to the Contractor's attention by the District, the Contractor shall immediately correct the condition to which attention has been directed. Such notice, either oral or written, when served on the Contractor or the Contractor's representative(s), shall be deemed sufficient.
- B. In the event the Contractor fails or refuses to promptly comply with the compliance directive issued under Article 1.03.A above, the District may issue an order to stop all or any part of the work. When satisfactory corrective action is taken, an order to resume work will be issued. The Contractor shall not be entitled to any extension of time nor to any claim for damage or to additional compensation by reason of either the directive or the stop order. Failure of the District to order discontinuance of any or all of the Contractor's operations shall not relieve the Contractor of the Contractor's responsibility for the safety of personnel and property.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 02100 CLEARING AND GRUBBING

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Preservation of Trees, Shrubs, and Other Plant Material  
Clearing and Grubbing

1.02 Summary

This section describes the work included in clearing, grubbing, and otherwise preparing the project site for construction operations. Clearing and grubbing shall consist of removing all natural and artificial objectionable materials within the construction limits. This work shall be performed in advance of excavation operations and in accordance with requirements specified herein.

Existing trees, shrubbery, and other vegetative material are not all shown on the drawings. The Contractor shall inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein.

1.03 Related Sections

Section 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS  
Section 02200 - GRADING, EXCAVATING, BACKFILLING AND COMPACTING

1.04 Preservation of Trees, Shrubs, and Other Plant Material

All plant materials (trees, shrubbery, and plants) beyond the construction limits shall be saved and protected from damage resulting from the Contractor's operations. Plants, trees, and shrubbery flagged within the construction limits to be saved shall be flagged by EPCWID1. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted in this area.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 Clearing and Grubbing

A. Clearing

The Contractor shall clear all natural ground surface within the construction limits to be occupied by permanent construction, to include surfaces required for access to the work, surfaces for detour roads, and surfaces of stockpile and wastepile sites, of all vegetation such as trees,

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shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds; of all rubbish, and of all objectionable materials. Clearing shall extend to the outside of excavation and fill slope lines. Clearing will not be allowed outside of the construction limits.

B. Grubbing

The Contractor shall grub within the same limits of clearing. The ground surface under all embankments and the surface of all excavation that is to be used for embankment shall be cleared and grubbed of all stumps, roots, buried logs, vegetable matter of every kind, and all other objectionable material. All stumps, roots, buried logs, and other objectionable materials which are 1 inch in diameter or larger shall be removed 3 feet below the existing ground or subgrade, whichever is deeper. Grubbing shall extend to the outside of excavation and fill slope lines. Grubbing will not be allowed outside of the construction limits.

C. Disposal of Clearing and Grubbing Debris

The Contractor shall remove and dispose of all cleared and grubbed material from the work site in accordance with all Federal, State, local laws, codes, and ordinances. Removal and disposal of combustible material shall be as specified in Section 01500-CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

END OF SECTION

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SECTION 02000 EMBANKMENT

PART 1 GENERAL

Section Includes

Description

Related Work

Submittals

1.02 Description

This item shall govern the placement and compaction of suitable materials obtained from approved sources for utilization in the construction of street or channel embankments, berms, levees, dikes and structures. Furnish all labor, materials, equipment and incidentals to fully complete work.

1.04 Submittals

The submittal requirements of this specification item include:

A plan identifying source, material type, classification and characteristics (P.I., optimum moisture-density, etc.) of the proposed embankment material, Type and size of equipment proposed to produce the required compaction, and Compaction (Density-moisture, etc) test results for in-place embankment layers.

PART 2 PRODUCTS

2.01 Materials

All authorized borrow shall conform to one of the following classes:

Class A (Select Borrow)

Class A Borrow material shall consist of suitable granular material, free from vegetation or other objectionable matter and reasonably free from lumps of earth. When tested by standard TxDOT laboratory methods Tex-105-E, Tex-106-E and Tex-107-E, the Class A Select Borrow, shall meet the following requirements:

The Liquid Limit shall not exceed	45
The Plasticity Index shall not exceed	15
The bar linear shrinkage shall not be less than	2

Class B (Borrow)

Class B Borrow material shall consist of suitable non swelling [i.e. soils with a plasticity index (P.I.) less than 20] earth material such as loam, clay or other such materials that will form a stable embankment.

Class C (Topsoil)

Class C Borrow material shall consist of approved soils, which shall be clean, friable and capable of supporting plant life. This material shall also be free of stones and all other debris.

PART 3 EXECUTION

Section Includes

General Work

Earth Embankment

Rock Embankment

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3.02 General Work

1. Prior to the placement of any embankment, all tree protection and tree wells and erosion control devices shall be in place and all operations involving "Clearing and Grubbing" shall have been completed for the areas over which the embankment is to be placed. Stump holes or other small excavations encountered within the limits of the embankments shall be backfilled with suitable material and thoroughly tamped by approved methods before commencement of the embankment construction.
2. The area of embankment placement shall be proof and any unstable or spongy areas shall be undercut and backfilled with suitable material or otherwise mechanically manipulated and compacted by approved methods. Where shown on the Drawings or required by the Engineer or designated representative, the ground surface thus prepared shall be compacted by sprinkling and rolling. The surface of the ground, including those plowed and loosened or roughened by small washes, shall be restored to approximately its original slope and the ground surface thus prepared shall be compacted by sprinkling and rolling.
3. Construction equipment shall not be operated within the drip line of trees, unless otherwise indicated. Construction materials shall not be stockpiled under the canopies of trees. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed in accordance with the specification for "Preservation of Trees and Other Vegetation".
4. Unless otherwise indicated on the Drawings and with the exception of rock, the surface of the ground of all unpaved areas, which are to receive embankment, shall be loosened by scarifying or plowing to a depth of not less than 4 inches (100 mm). The loosened material shall be re-compacted with the new embankment as hereinafter specified.
5. The surface of hillsides, which are to receive embankment, shall be loosened, by scarifying or plowing, to a depth of not less than 4 inches (100 mm) and benches constructed before the embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side with partial width layers and increasing the widths of the layers as the embankment is raised. The material, which has been loosened during preparation of the original ground surface, shall be re-compacted simultaneously with the embankment material placed at the same elevation.
6. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 6 inches (150 mm) and the embankment along the roadbed slopes shall be built up in successive layers, as hereinafter specified, to the elevation of the old roadbed. Then, if specified, the top surface of the old roadbed shall be scarified to a minimum depth of 6 inches (150 mm) and re-compacted along with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth, specified hereinafter.
7. Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in embankment.
8. All embankment shall be constructed in layers approximately parallel to the finished grade and unless otherwise indicated. The embankment shall be continuously maintained at its finished section and grade until that portion of the work is accepted.

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After completion of the embankment to the finished section and grade, the Contractor shall proof roll the subgrade or finished grade in accordance with Specification Item No. 236S, "Proof Rolling". Any unstable or spongy areas shall be undercut and backfilled with suitable material or otherwise mechanically manipulated and compacted by approved methods. After acceptance of the embankment, re-vegetation activities shall commence immediately to minimize the soil loss and air pollution.

### 3.03 Earth Embankments

1. Earth embankments shall be defined as embankments composed of soil material other than rock and shall be constructed of acceptable material from approved sources.
2. Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (200 mm) or less in loose measure, for the full width of the individual cross section and in a length that is best suited to the sprinkling and compaction methods utilized.
3. Minor quantities of rocks with a maximum dimension of 4 inches (100 mm) may be incorporated in the earth embankment layers, provided that the rock is not placed immediately adjacent to structures.
4. Each layer of embankment shall be uniform as to material type and classification, density and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be feathered on a slope of 1:20 or the materials shall be so mixed as to prevent abrupt changes in the soil. Any material placed in the embankment by dumping in a pile or windrows shall not be incorporated in a layer in that position. All such piles or windrows shall be incorporated in an embankment layer by blading and mixing or by similar methods. Clods or lumps of material shall be broken down into smaller sizes and the embankment material in a layer shall be mixed by blading, harrowing, discing or similar methods to insure that a uniform material of uniform density is secured in each layer.
5. The water required in sprinkling the layers, to obtain the moisture content necessary for optimum compaction, shall be evenly applied. It shall be the responsibility of the Contractor to secure uniform moisture content throughout the layer by such methods as may be necessary.
6. All earth cuts, whether full width or partial width side hill cuts and which are not required to be excavated below the subgrade elevation, shall be scarified to a uniform depth of at least 6 inches (150 mm) below grade. The material shall be mixed and reshaped by blading, sprinkled and rolled in accordance with the requirements outlined above for earth embankments to the same density required for the adjacent embankment.
7. Compaction of embankments shall conform to Item No. 201S, "Subgrade Preparation". Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. Prior to and in conjunction with the rolling operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.
8. It is the intent of this specification to provide the required density and moisture control for each layer of earth embankment and select material based on the plasticity

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characteristics of the embankment soil. Each layer shall be sprinkled as required and compacted to the extent necessary to provide the density specified below, unless otherwise indicated.

Description	Density, Percent	Moisture
Non-swelling Soils (PI less than 20)	Not less than 95	
Swelling Soils (PI between 20 and 35)	Not less than 95 Nor more than 102	Not less than optimum
Swelling Soils (P.I. greater than 35)	Not less than 95 Nor more than 100	Not less than optimum

9. The Plasticity Index (PI) will be established in accordance with TxDoT Test Methods Tex-104-E, Tex-105-E and Tex-106-E and the density determination will be made in accordance with TxDoT Test Method Tex-114-E, "Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade and Embankment Soil". Field density measurements will be made in accordance with TxDoT Test Method Tex-115-E, "Field Method for Determination of In-Place Density of Soils and Base Materials".
10. After each layer of earth embankment or select material is complete, tests, as necessary, will be conducted as directed by the Engineer or designated representative. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction.
11. 3.04 Rock Embankments
12. Rock embankments shall be defined as those composed principally of rock and shall be constructed of accepted material from approved sources. Rock embankments shall not be placed immediately adjacent to structures.
13. Except as otherwise indicated on the Drawings, rock embankments shall be constructed in successive layers of 18 inches (450 mm) or less in thickness for the full width of the cross section. When, in the opinion of the Engineer or designated representative, the rock sizes necessitate a greater thickness of layer than specified, the layer thickness may be increased as necessary, but in no case shall the thickness of layer exceed 2 1/2 feet (750 mm). Each layer shall be constructed by starting at one end and dumping the rock on top of the layer being constructed then pushing the material ahead with a bulldozer in such a manner that the larger rock will be placed on either the ground or the preceding embankment layer. Each layer shall be constructed in such a manner that the interstices between the larger stones are filled with small stones and spalls which have been created by this operation and from the placement of succeeding layers of material.
14. The maximum dimension of any rock used in embankment shall be less than the thickness of the embankment layer and in no case shall any rock over 2 feet (600 mm) in its greatest dimension be placed in the embankment, unless otherwise approved by the Engineer or designated representative. All oversized rocks, which are otherwise suitable for construction, shall be broken to the required dimension and utilized in embankment construction where indicated. When preferred by the Contractor and acceptable to the Engineer or designated representative, oversized rocks may be placed at other locations where the embankment layer is of greater depth, thus requiring less breakage.
15. Each layer shall be compacted to the required density as outlined for "Earth Embankments", above, except in those layers where rock will make density testing

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difficult, the Engineer or designated representative may accept the layer by visual inspection or proof rolling conforming to Specification Item No. 236S, "Proof Rolling)".

16. Unless otherwise indicated, the upper 3 feet (1 meter) of the embankment shall not contain stones larger than 4 inches (100 mm) in their greatest dimension and shall be composed of material so graded that the density and uniformity of the surface layer may be secured in accordance with TxDOT Test Method Tex-114-E.

17. Exposed oversize material shall be broken up or removed.

### 3.05 Measurement

All accepted embankment, when included in the contract as a separate pay item, will be measured in place and the volume computed in cubic by the method of average end areas. No allowance shall be made for shrinkage.

END OF SECTION

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SECTION 02140 DEWATERING

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Submittals  
Removal of Water from Excavations

1.02 Summary

The Contractor shall furnish, install, maintain, and operate all necessary pumping and other equipment for removal of water from the various parts of the work and for maintaining the excavations and other parts of the work free from water as required for constructing each part of the work. The Contractor shall be solely responsible for ground water site investigations.

1.03 Related Sections

Section 01300 - SUBMITTALS  
Section 02200 - GRADING, EXCAVATING, BACKFILLING and COMPACTING

1.04 Submittals

- A. The Contractor shall submit a dewatering plan seven (7) days prior to construction for each site requiring dewatering to the District showing the configuration of the Contractor's dewatering system.
- B. Complete information shall be provided regarding the methods and equipment the Contractor proposes to utilize in the installation, operation, monitoring, and maintenance of the water removal and control systems including the sequence of construction, disposal of groundwater and surface water, and system removal.
- C. Dewatering system Drawings and calculations shall be prepared by and stamped with the seal of a Registered Engineer in the State of Texas with at least seven (7) years experience in designing similar systems.
- D. If the initially installed dewatering facilities are found to be inadequate as determined by the Engineer, the Contractor shall install and operate additional facilities to allow excavation and other construction operations to be performed in the dry. The plan may be placed in operation upon approval, but nothing in this specification shall relieve the Contractor from full responsibility for the adequacy of the dewatering system.
- E. The Contractor shall submit twenty-eight (28) days prior to dewatering all Federal, State, County permits from the proper regulatory agencies (TNRCC, COE) for deposit of groundwater into the Rio Grande, or other suitable groundwater disposal plan.
- F. Contractor shall obtain all applicable permits for earthwork, work in roads, rights-of-way, etc., as required by local, state and federal agencies.
- G. Contractor shall comply with the requirements of the Storm Water Pollution Prevention Plan and Monitoring Plan.

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- H. Contractor shall perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction, including but not limited to OSHA Standard 29 CFR 1926.650.
- I. Contractor shall be responsible for all monitoring, sampling and testing required by regulating agencies having jurisdiction.
- J. Contractor shall include in the dewatering plan the procedure for well abandonment (if wells are required) for approval by the District.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 Removal of Water from Excavations

- A. The Contractor's method of removal of water from excavations shall be subject to approval of the District. Where excavation extends below the water table, the portions below the water table shall be dewatered in advance of excavation. The dewatering shall be accomplished in a manner that will prevent loss of fines from the foundation and will maintain stability of the excavated slopes and bottom of the excavation, for construction operations, for permanent work, and to prevent damage during all stages of construction.
- B. Before excavating to a final grade, the water table shall be lowered a minimum of 5 feet below final grade to provide a firm foundation for construction purposes. This water level shall be maintained until backfill has been placed around and over the culvert and about the structures to an elevation approved by the District.
- C. Surface and subsurface water shall be prevented from flowing into excavations and from flooding adjacent areas. Water shall be removed from excavation as fast as it collects.
- D. Contractor shall provide for backup dewatering equipment to insure continuity of dewatering operations.
- E. Contractor shall dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the work under construction or completed and per the requirements of all permits.
- F. Contractor shall dispose of water in such a manner as to cause no inconvenience to the District or others involved in work about the site.
- G. Water from the construction site shall be conveyed in a closed conduit. Trench excavations shall not be used as temporary drainage ditches.
- H. After completion of all permanent work, the dewatering wells shall be abandoned according to the District approved well abandonment procedure.

END OF SECTION

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SECTION 02200 GRADING, EXCAVATING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Quality Assurance  
Submittals  
Type of Suitable Backfill  
Type of Import Select Backfill/Embankment Material  
Type of Gravel for Drainage Pockets for Retaining Walls Water for Compaction  
Reserved  
Grading  
Excavation Requirements  
Backfill Requirements  
Compaction Requirements  
Seeding for Erosion Control  
Field Quality Control

1.02 Summary

This Section includes the earthwork requirements for the construction of the El Paso County Water Improvement District No. 1's Project. This Section also includes the seeding requirements for erosion control within the construction limits.

1.03 Related Sections

Section 01050 - FIELD ENGINEERING  
Section 01300 - SUBMITTALS  
Section 01400 - QUALITY CONTROL  
Section 03300 - CAST-IN-PLACE CONCRETE

1.04 Quality Assurance

- A. The Contractor shall provide an independent (outside of the Contractors influence) and qualified testing firm, certified by the U.S. Army Corps of Engineers, to perform all earthwork tests in accordance with ASTM E 329-90 required of the Contractor, as specified in these Contract Documents, and as requested of the District. The certified testing firm shall have at least seven (7) years experience in completing similar work.
- B. The Contractor shall have a representative from the certified testing firm to perform all testing of earthwork, as specified in these Contract Documents.
- C. The District will determine when and where the testing of relative compaction will be performed to meet the frequencies specified in these Contract Documents.
- D. If additional testing, which exceeds what is specified in these Contract Documents, is requested by the District, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The testing requested of the Contractor by the District will be those tests required in this

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Section. The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.

1.05 Submittals

- A. The Contractor shall submit to the District, within twenty-four (24) hours of performance of the test, the results of all tests performed as specified in these Contract Documents.
- B. The Contractor shall submit to the District, seven (7) calendar days prior to start of construction, a letter indicating compliance with these Contract Documents in providing an independent, qualified and certified testing firm to perform all testing required. This letter shall include at a minimum, a statement of qualifications from the certified testing firm selected by the Contractor and a copy of the U.S. Army Corps of Engineers certification.
- C. The Contractor shall submit to the District, within twenty-four (24) hours of completion of the physical test, the test results of all relative compaction tests conducted to determine the acceptability of all fill and embankment placement.
- D. The Contractor shall submit a detailed plan, seven (7) calendar days prior to start of construction, indicating how the Contractor plans to comply with the relative compaction test frequencies specified in these Contract Documents.
- E. The Contractor shall submit to the District, seven (7) calendar days prior to the material placement, sieve analysis data for all import select backfill embankment material expected to be used on this project from commercial sources. The submittal shall include the proposed material placement location.

PART 2 PRODUCTS

2.01 Type of Suitable Backfill

- A. Unless otherwise specified, the material obtained from the project excavations shall be suitable for use as fill or backfill, provided that the material consists of natural soil only, and that the natural soil does not have a plasticity index greater than 18 nor a liquid limit greater than 50. Soils classified as OL, MH, CH, OH, or PT shall not be used for embankment material. (Ref ASTM D - 2487)

2.02 Type of Import Select Backfill/Embankment Material

- A. Import select backfill/embankment material shall be a natural soil, having a plasticity index less than or equal to 18, and a liquid limit less than or equal to 50. Material removed in clearing or grubbing shall not be used as backfill. The following Unified Soil Classification System soil types shall not be used as embankment or backfill material:

OL	Organic Silts and Organic Silt-Clays of low plasticity.
MH	Inorganic Silts, Micaceous or diatomaceous Fine Sandy or Silty Soils, Elastic Silts
CH	Inorganic Clays of High Plasticity, Fat Clays
OH	Organic Clays of Medium to High Plasticity
PT	Peat and other Highly Organic Soils

- B. No material shall be placed in backfill when either the material or the surface on which it is to be placed are frozen.

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2.03 Type of Gravel for Drainage Pockets for Structures, Side Drains, and Underdrains

Gravel placed behind the retaining wall shall consist of clean, nonporous rock crushed gravel, or uncrushed gravel, and shall have the following gradation:

Sieve Size (U.S. Standard Sieve)	Percent Finer by Weight
3/4"	100
1/2"	90-100
3/8"	20-60
No. 4	0-15
No. 8	0-5

2.04 Water for Compaction

The Contractor shall be responsible for obtaining water from other sources for all its operational needs. The water used for compacting embankment shall be the same as that specified in Section 03300-CAST-IN-PLACE CONCRETE.

PART 3 EXECUTION

3.01 Grading

The Contractor shall shape, trim and finish slopes of embankments to the lines and grades as shown on Drawings. Neatly and smoothly trim surfaces to obtain a uniform graded appearance of the embankment material. A vertical tolerance of +/- one-tenth (+/- 0.1) of a foot shall be maintained in the restoration of surface grades, unless otherwise specified.

3.02 Excavation Requirements

- A. Excavation is unclassified. The Contractor shall perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. No additional allowances will be made on account of any of the material being wet or frozen. The Contractor shall assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations.
- B. The word "Overexcavation" as used herein is defined as the removal of material, below or beyond the required grade or dimension without the direction of the District. All overexcavation performed for any purpose or reason, and whether or not due to the fault of the Contractor shall be at the expense of the Contractor. The backfilling and compacting for overexcavation shall also be at the expense of the Contractor.
- C. Excavation for the Structures
  - 1. Grade: Excavation for the foundation of the new structures shall be to elevations shown on the Drawings. Insofar as practicable, the material removed in excavation for the structures shall be used for backfill and

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embankments unless otherwise specified. The bottom and side slopes of the excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and compacted as per these Contract Documents.

2. Removal of unsuitable material: Where unsuitable material is encountered, the District will direct additional excavation, to remove the unsuitable material. The additional excavation shall be filled with suitable backfill and compacted to provide a firm foundation for the canal concrete.
3. Removal of unstable or incompressible material: If the soil encountered at the established structure grade is unstable or incompressible material, the following procedure shall be used:
  - a. Unstable material shall be removed to a depth not to exceed two (2) feet below the footing of the structure unless additional depth is authorized by the District. All soil removed shall be replaced with stable material in uniform layers not to exceed six (6) inches in depth (loose measurement). Each layer shall have sufficient moisture to be compacted as per the requirements in this Section to provide a stable foundation for the structure.
  - b. When the material encountered at the footing grade of the structure is found to be rock, partially rock or other incompressible material, the incompressible material shall be removed to a depth of six (6) inches below the footing grade and backfilled with a compressible material. Each layer shall have sufficient moisture to be compacted as per the requirements in this Section to provide a stable foundation for the structure.
4. Backfill for Overexcavation: If at any point in excavation the foundation material for the structure is excavated beyond the lines and grades required, the overexcavation shall be filled with suitable backfill material and compacted to 95% relative compaction as per ASTM D 1557.

F. Excavation for Utility Pipe Trenches

1. Prior to excavating the pipe trench, the surface shall be cleared and grubbed as specified in Section 02100-CLEARING AND GRUBBING.
2. Excavation for the trench shall be as per ASTM D 2321.
3. Removal of rock or unyielding material: If rock or other unyielding material is encountered in bottom of the trench, it shall be removed to a depth of six (6) inches below grade, refilled with selected materials and thoroughly compacted to grade.
4. Removal of unsuitable material: Where unsuitable material is encountered in the pipe trench, the Contractor shall perform additional excavation to remove the unsuitable material. The additional excavation shall be filled with suitable material and compacted as per the requirements in this Section. Where the soil encountered at established footing grade is a quicksand, muck, or similar unstable material, the following procedure shall be used unless other methods are called for on the Drawings.
  - a. The depth to which unstable material is removed shall not exceed two feet below the footing of culverts that are two feet or more in

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height, and shall not exceed the height of culverts for those less than two feet high.

- b. Excavation shall be carried at least one foot horizontally beyond the limits of the structure on all sides.
  - c. All unstable soil removed shall be replaced with suitable stable material, in uniform layer of suitable depth for compaction.
5. Backfill of Overexcavation: If the trench is excavated beyond the lines required to receive the pipe embedment, the overexcavation shall be filled with suitable material and compacted as per the requirements of this Section.

3.03 Backfill Requirements

- A. Only suitable material as specified in this Section under Products shall be used for backfilling RSCIP Canal Rehabilitation Project. In so far as practicable, the suitable backfill material removed in excavation and from the borrow areas as shown on Drawings shall be used for backfill and embankments, but when sufficient material is not available from these sources, the Contractor, for the purpose of preparing the bid, should consider obtaining the required material from private sources.
- B. No material shall be placed in backfill when either the material or the surfaces on which it is to be placed are frozen. Material removed in clearing and grubbing shall not be used in backfill. Unsuitable backfill materials are as described in this Section.
- C. Backfill shall be placed to the lines and grades shown on the Drawings. All backfill shall be placed carefully and spread in uniform layers so that all spaces about rocks and clods will be filled. All fill above the original ground surface shall be placed as compacted embankment.
- D. Prior to placing backfill on original ground surface, the surface shall be cleared and grubbed as specified in Section 02100-CLEARING AND GRUBBING.

3.04 Utility Pipe Zone and Final Backfill Materials

- A. Definitions: For the purpose of this specification,
  1. A" Pipe Zone" shall be defined as the area from the bottom of the trench to twelve (12) inches above the top of the pipe and to the undisturbed trench wall on either side of the pipe.
  2. An "Embedment" shall be defined as those vertical stratas of backfill material in the pipe zone consisting of bedding, haunching, and initial backfill, as defined in ASTM D-2321.
- B. Pipe zone backfill and compaction shall be as specified in this specification under Section 3.03 Backfill Requirements and Section 3.04 Compaction Requirements.
- C. Final Backfill: Material for backfilling above the pipe zone shall be as specified in Section 3.03 Backfilling Requirements.

3.05 Compaction Requirements

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- A. The compaction requirements for all earth foundations shall be trimmed to the specified dimensions and compacted to 95% relative compaction as per ASTM D 1557.
- B. Prior to placing backfill on an original ground surface, the original ground surface shall be compacted to 95% relative compaction as per ASTM D 1557. Prior to and during compaction operations, the moisture content shall be uniform throughout each layer. Backfill shall be compacted to the lines and grades shown on the Drawings. All backfill material shall be deposited in horizontal layers after compaction of not more than six (6) inch lifts and compacted to 95% relative compaction as per ASTM D 1557. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted and shall be homogeneous, free from lenses, pockets, streaks, voids, laminations, or other imperfections. The excavating and placing operations shall be such that the materials when compacted shall be blended sufficiently to secure the highest practicable density and lowest permeability and highest shear strength.
- C. Utility and drainage pipe embedment shall be as per ASTM D 2321 except for the following modifications. Pipe embedment shall be deposited in horizontal layers after compaction of not more than six (6) inch lifts and compacted to 95% relative compaction as per ASTM D 1557. Pipe embedment shall be compacted to the lines and grades shown on Drawings. The final grade of the bedding shall be leveled by hand and the material in the haunching zone shall be worked around the pipe by hand to provide uniform support.

3.06 Field Quality Control

The Contractor shall obtain samples and conduct tests as specified in these Contract Documents and as specified below. Based upon the results of these tests, the Contractor shall take the required corrective action as described below:

- A. Imported Select Backfill
  - 1. Frequency of Test.
    - a. The Contractor shall test all import select backfill material for gradation once prior to use of any source or stockpile and once each time the source or stockpile is changed. The Contractor shall sample imported materials as specified in ASTM D 75, and shall test for gradation of imported material as specified in ASTM C 136.
    - b. The Contractor shall test the water for soluble sulfate content in accordance with the Bureau of Reclamation "Method of Test for Determining the Quantity of Soluble Sulfate in Solid (Soil or Rock) and Water Samples," prior to using for compaction, and every time the source is changed.
  - 2. Corrective Action - The Contractor shall resample and retest import select backfill material and water which does not meet the requirements specified in these Contract Documents. If the import select backfill material and water still do not meet the requirements specified in these Contract Documents, the Contractor shall provide another source. This shall be provided at the Contractor's expense until the specified requirements in these Contract Documents are met.

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B. Relative Compaction

1. Frequency of Test.

The Contractor shall test for relative compaction as specified below:

- a. Relative compaction is the ratio, expressed as a percentage of the in place dry density to the laboratory maximum dry density in accordance with ASTM D 1557.
  - b. Test shall be made to determine the optimum moisture and maximum dry unit weight in accordance with ASTM 1557; Method A. Test shall be made for each type of material or source of borrow material and at 2000 foot intervals along the RSCIP centerline.
  - c. The in place dry density of soil shall be conducted in accordance with ASTM D 1556 and ASTM D 2922. For every ten (10) tests conducted in accordance with ASTM D 2922, one (1) test shall be conducted in accordance with ASTM D 1556. The Contractor shall perform in place dry density tests at the following frequencies:
    - (1) Foundation compaction tests for all structures. Two (2) tests per day, or one (1) test every 500 linear feet of foundation length.
    - (2) Backfill for canal regrading, canal liner backfill, pipe extensions, transitions, pipes, and other structures. One (1) test per day, or one (1) test per two-hundred (200) linear feet for each three (3) lifts placed, or every fifty (50) cubic yards placed, whichever provides for the greatest number of tests.
2. Corrective Action - Foundation not meeting the specified compaction shall be reworked and retested. Backfill material failing to meet the required compaction shall be reworked, or removed and replaced at the Contractor's expense. Should the compaction methods used consistently fail to achieve the required degree of compaction, the Contractor shall revise its compaction methods to achieve the required compaction.

END OF SECTION

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SECTION 03210 REINFORCING STEEL

PART 1 GENERAL

Section Includes

Scope of Work

Related Work

1.02 Scope of Work

This item shall consist of the furnishing and placing of reinforcing steel, deformed and smooth, of the size and quantity indicated and in accordance with these specifications. Furnish all labor, materials, equipment, and incidentals to fully complete work.

1.03 Related Work

Certain work performed under the provisions of this Specification relates to other work performed under this contract. All specifications included in the Contract Documents govern work, however, special attention is directed to the following sections:

Section 02315 for Excavation.

Section 03300 for Cast-in-Place Concrete.

PART 2 PRODUCTS

2.01 Section Includes

Bars

Welded Wire Fabric

Chairs and Supports

Storing

2.02 Bars

1. Bar reinforcement shall be deformed and shall conform to ASTM A 615, A 616, Grades 40, 60 or 75 and shall be open-hearth, basic oxygen or electric furnace new billet steel, unless otherwise indicated. Large diameter new billet steel (Nos. 14 and 18), Grade 75, will be permitted for straight bars only.
2. Where bending of bar sizes No. 14 or No. 18 of Grades 40 or 60 is required, bend testing shall be performed on representative specimens as described for smaller bars in the applicable ASTM specification. The required bend shall be 90 degrees at a minimum temperature of 60 F around a pin having a diameter of 10 times the nominal diameter of the bar and shall be free of cracking.
3. Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum diameter indicated. Bars for spiral reinforcement shall comply with ASTM A 675, A 615 or A 617. Wire shall comply with ASTM A 82. The minimum yield strength for spiral reinforcement shall be 40,000 psi.
4. In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.
5. Report of chemical analysis showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel when it is to be welded, except for drill shafts. No tack welding will be allowed. All welding shall conform to the requirements of AWS D-1-72.
6. The nominal size and area and the theoretical weight (lbs.) of reinforcing steel bars covered by these specifications are as follows:

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Bar Size Number	Nom. Diameter, inches	Nom. Area, Sq. ins.	Weight/Linear Foot
2	0.250	0.05	0.167
3	0.375	0.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.60	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.65
18	2.257	4.00	13.60

7. Smooth bars, larger than No. 4, may be steel conforming to the above or may be furnished in any steel that meets the physical requirements of ASTM A 36. Smooth, round bars shall be designated by size number through No. 4. Smooth bars above No. 4 shall be designated by diameter in inches.

2.03 Welded Wire Fabric

Wire for fabric reinforcement shall be cold-drawn from rods hot-rolled from open-hearth, basic oxygen or electric furnace billet. Wire shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A 82 or A 496. Wire fabric, when used as reinforcement, shall conform to ASTM A 185 or A 497.

When wire is ordered by size numbers, the following relation between size number, diameter in inches and area shall apply unless otherwise indicated:

Size, W Number	Nom. Diameter (inch)	Nom. Area, sq. inches
31	0.628	0.310
30	0.618	0.300
28	0.597	0.280
26	0.575	0.260
24	0.553	0.240
22	0.529	0.220
20	0.505	0.200
18	0.479	0.180
16	0.451	0.160
14	0.422	0.140
12	0.391	0.120
10	0.357	0.100
8	0.319	0.080
7	0.299	0.070
6	0.276	0.060
5.5	0.265	0.055
5	0.252	0.050
4.5	0.239	0.045
4	0.226	0.040

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3.5	0.211	0.035
3	0.195	0.030
2.5	0.178	0.025
2	0.160	0.020
1.5	0.138	0.015
1.2	0.124	0.012
1	0.113	0.010
0.5	0.080	0.005

Where deformed wire is required, the size number shall be preceded by D and for smooth wire the prefix W shall be shown.

2.04 Chairs and Supports

Chairs and Supports shall be steel, precast mortar or concrete blocks cast in molds meeting the approval of the Engineer of sufficient strength to position the reinforcement as indicated when supporting the dead load of the reinforcement, the weight of the workers placing concrete and the weight of the concrete bearing on the steel. Chairs shall be plastic coated when indicated.

<b><i>Chair Types and Applicable Uses</i></b>	
Structural or Architectural Elements (columns, beams, walls, slabs) exposed to weather, not subjected to sand blasting, water blasting or grinding.	Galvanized steel or steel chairs with plastic coated feet.
Structural or Architectural Elements exposed to weather and subject to sand blasting, water blasting or grinding.	Stainless steel chairs.
Structural or Architectural Elements not exposed to weather or corrosive conditions.	Uncoated steel chairs
Slabs and grade beams cast on grade.	Steel chairs with a base with 9 inch <sup>2</sup> minimum area or sufficient area to prevent the chair from sinking into fill or subgrade. Precast mortar or concrete blocks meeting the requirements of this item may be used.

2.05 Storing

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel indicated.

PART 3 EXECUTION

3.01 Section Includes  
Bending

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Tolerances  
Splices  
Placing

3.02 Bending

The reinforcement shall be bent cold, true to the shapes indicated. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection.

Unless otherwise indicated, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend.

<b>Bar Number</b>	<b>Grade 40</b>	<b>Grade 60</b>
3, 4, 5	3d	4d
6, 7, 8	4d	5d

All bends in main bars and in secondary bars not covered above.

<b>Bar Number</b>	<b>Grade 40</b>	<b>Grade 60</b>	<b>Grade 75</b>
3 thru 8	6d	6d	--
9, 10	8d	8d	--
11	8d	8d	8d
14, 18	10d	10d	--

3.03 Tolerances

Fabricating tolerances for bars shall not be greater than that specified in the ACI code.

3.04 Splices

1. No splicing of bars, except when indicated or specified herein, will be permitted without written approval of the Engineer. No substitution of bars will be allowed without the approval of the Engineer. Any splicing of substituted bars shall conform to Table 1.
2. Splices not indicated will be permitted in slabs not more than 15 inches in thickness, columns, walls and parapets, but not included for measurement, subject to the following:
3. Splices will not be permitted in bars 20 feet or less in plan length. For bars exceeding 20 feet in plan length, the distance center to center of splices shall not be less than 20 feet minus 1 splice length, with no more than 1 individual bar length less than 10 feet. Splices not indicated, but permitted hereby, shall conform to Table 1. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

<b>Bar Number</b>	<b>Grade 40</b>	<b>Grade 60</b>
3	1 foot 0 inches	1 foot 0 inches
4	1 foot 2 inches	1 foot 9 inches
5	1 foot 5 inches	2 feet 2 inches
6	1 foot 9 inches	2 feet 7 inches
7	2 feet 4 inches	3 feet 5 inches

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No. 8	3 feet 0 inches	4 feet 6 inches
No. 9	3 feet 10 inches	5 feet 8 inches
No. 10	4 feet 10 inches	7 feet 3 inches
No. 11	5 feet 11 inches	8 feet 11 inches

Spiral steel shall be lapped a minimum of 1 turn. Bar No. 14 and No. 18 may not be lapped.

4. Welding of reinforcing bars may be used only where indicated or as permitted herein. All welding operations, processes, equipment, materials, workmanship and inspection shall conform to the requirements indicated. All splices shall be of such dimension and character as to develop the full strength of the bar being spliced.
5. End preparation for butt welding reinforcing bars shall be done in the field, except Bar No. 6 and larger shall be done in the shop. Delivered bars shall be of sufficient length to permit this practice.
6. For box culvert extensions with less than 1 foot of fill, the existing longitudinal bars shall have a lap with the new bars as shown in Table 1. For box culvert extensions with more than 1 foot of fill, a minimum lap of 6 inches will be required.
7. Unless otherwise indicated, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in Table 1. Shear transfer dowels shall have a minimum embedment of 12 inches.

### 3.05 Placing

1. Reinforcement shall be placed as near as possible in the position indicated. Unless otherwise indicated, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch. Cover of concrete to the nearest surface of steel shall be as follows:

	<b>Minimum Cover, Inches</b>
(a) Concrete cast against and permanently exposed to earth	3
(b) Concrete exposed to earth or weather:	
Bar No. 6 through 18 bars	2
Bar No. 5, W31 or D31 wire and smaller	1 1/2
(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 and 18	1 1/2
Bar No. 11 and smaller	1
Beams, columns:	
Primary reinforcement, ties, stirrups, spirals	1 1/2
Shells, folded plate members:	
Bar No. 6 and larger	1
Bar No. 5, W31 or D31 wire, and smaller	1

2. Vertical stirrups shall always pass around the main tension members and be attached securely thereto. The reinforcing steel shall be spaced its required distance from the form surface by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers or approved precast mortar or

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concrete blocks. For approval of plastic spacers on a project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

3. All reinforcing steel shall be tied at all intersections, except that where spacing is less than 1 foot in each direction, alternate intersections only need be tied. For reinforcing steel cages for other structural members, the steel shall be tied at enough intersections to provide a rigid cage of steel. Mats of wire fabric shall overlap each other 1 full space as a minimum to maintain a uniform strength and shall be tied at the ends and edges.
4. Where prefabricated deformed wire mats are specified or if the Contractor requests, welded wire fabric may be substituted for a comparable area of steel reinforcing bar plan, subject to the approval of the Engineer.
5. A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases and when specifically authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed 2 1/2 inches square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required and the surface to be placed adjacent to the forms shall be a true plane, free of surface imperfections.
6. Reinforcement shall be supported and tied in such a manner that a sufficiently rigid cage of steel is provided. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance with the above.
7. No concrete shall be deposited until the Engineer has reviewed the placement of the reinforcing steel and all mortar, mud, dirt, etc, shall be cleaned from the reinforcement, forms, workers' boots and tools.

END OF SECTION

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SECTION 03250 CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Submittals  
Waterstops  
Elastomeric Sealer  
Roofing Felt  
Waterproofing Membrane  
Non-Shrink Grout  
Waterstop Installation  
Elastomeric Sealer Installation  
Roofing Felt Installation  
Waterproofing Membrane Installation  
Non-Shrink Grout Installation  
Quality Control

1.02 Summary

The Section includes information on the types and installation of waterstops, elastomeric sealer, sponge rubber, roofing felt, waterproofing material, and non-shrink grout.

1.03 Related Sections

Section 01300 - SUBMITTALS  
Section 03300 - CAST-IN-PLACE CONCRETE

1.04 Submittals

- A. The Contractor shall submit to the District, at least seven (7) calendar days prior to installation, a letter indicating compliance with these Contract Documents along with a certified copy of all laboratory test reports representing each shipment of waterstop from the manufacturer.
- B. The Contractor shall submit to the District, at least seven (7) calendar days prior to installation, a letter indicating compliance with these Contract Documents, along with certified copies of the manufacturer's test reports for the joint sealant and manufacturer application requirements. These test reports shall indicate the name of the manufacture, type of joint sealant, manufacturer's lot number, and test results.
- C. The Contractor shall submit to the District, at least seven (7) calendar days prior to the installation, a letter indicating compliance with these Contract Documents, along with the manufacturer's test reports on the sponge rubber material to be

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used in the project. These test reports shall include the manufacturers lot number, test results, and manufacturers' installation requirements.

- D. The Contractor shall submit to the District, at least seven (7) calendar days prior to the installation, a letter indicating compliance with these Contract Documents, along with the manufacturer's data on the type of roofing felt to be used on the concrete dowels.
- E. The Contractor shall submit to the District, at least seven (7) calendar days prior to the installation, a letter indicating compliance with these Contract Documents, along with the manufacturer's test reports on the waterproofing materials to be installed in the drop structure and retaining walls. These test reports shall include the manufacturer's installation requirements.
- F. The Contractor shall submit to the District, at least seven (7) calendar days prior to the installation, a letter indicating compliance with these Contract Documents, along with the manufacturer's test reports on non-shrink grout. These test reports shall include the manufacturer's installation requirements.

## PART 2 PRODUCTS

### 2.01 Waterstops

- A. The Contractor shall furnish and install GREENSTREAK PVC or equivalent water stops at all cold joins in cast in place concrete. The Contractor shall select and install all waterstops in accordance with the manufacturers requirements.

### 2.02 Elastomeric Sealer

- A. The Contractor shall furnish and install an elastomeric sealer Class A to conform with The Bureau of Reclamation "Standard Specifications for Elastomeric Canal Joint Sealer" dated August 1, 1988 or ASTM C 920 Type M, Grade NS, Class 25, Use T. The material shall be plastic, rubber-like cold applied joint sealing compound.
- B. The materials shall be stored and protected in accordance with the manufacturer's printed instructions. Outdated materials shall not be used unless recertified by the manufacturer as suitable for use.

### 2.03 Sponge Rubber Joint Filler

Sponge rubber shall conform to the requirements of ASTM D 1752 or type I joint filler. Sponge rubber shall be stored in a cool place, preferably at 70° F or less, and in no case shall the rubber be stored in the open, exposed to the direct rays of the sun. Adhesive for fastening the sponge rubber in place shall be a non-bituminous adhesive as recommended by the manufacturer of the filler material.

### 2.04 Roofing Felt

Roofing Felt shall conform to the requirements of ASTM D-226, Type 1.

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2.05 Waterproofing Membrane

A. The Contractor shall furnish and install the waterproofing membrane material as shown on the Drawings. The listed physical characteristics of the waterproofing membrane shall be as listed below:

B.

<u>Property</u>	<u>Value</u>
Tensile Strength:	
Carrier Film	4,000 psi
Polymeric Membrane	250 psi
Elongation:	
Polymeric Membrane	300% min
Pliability:	
(180° bend @ -25° F)	Unaffected
Water Vapor Transmission:	
Hg. max	.01 grains/SF/HR/In
Water Absorption:	0.25%, 72 hrs max

B. Storage and Handling - Protect all materials as recommended by manufacturer.

2.06 Non-Shrink Grout

The Contractor shall furnish and install the non-shrink grout where shown on the Drawings. The listed physical characteristics of the non-shrink grout shall be as listed below:

<u>Property</u>	<u>Value</u>
Early Volume Change	0.00% Shrinkage 0.00% Expansion
Hardened Volume Change	0.00% Shrinkage 0.00% Expansion
Compressive Strength	5000 psi/7 Days

2.07 Butyl Rubber and Swellable Clay Waterproofing Waterstop

The Contractor shall furnish and install the waterstop as shown on the Drawings. The listed physical characteristics of the waterproofing material shall be as listed below:

<u>Property</u>	<u>Test Method</u>	<u>Product Results</u>
Specific Gravity @ 77°F	ASTM D-71	1.26
Penetration After Aging 21 days @ 130°F	ASTM D-217 300 GTL	75
Penetration	ASTM D-217 150 GTL	53
	300 GTL	83
Composition	Butyl Rubber and Swellable Clay Resulting in Maximum Exterior Swell of 300%	
Minimum Head Pressure	Hydrostatic Pressure Test	231 ft. (100 psi)
Application Temp. Range		5° to 125° F.
Service Temp. Range		-40° to 212° F.

## PART 3 EXECUTION

### 3.01 Waterstop Installation

- A. The Contractor shall furnish and install waterstops where shown on the Drawings. The Contractor shall furnish the waterstops and all material and equipment for splicing waterstops, for fastening waterstops to the forms and to the supporting reinforcing bars, and for completing the installation of the waterstops. The Contractor shall furnish all materials for splices and all field splicing molds, and electrical energy for heating and molds. The Contractor shall provide suitable support and protection for the waterstops during the progress of the work and shall repair or replace, at the Contractor's expense, any damaged waterstops which have been damaged to such an extent as to affect the serviceability of the waterstops. All waterstops shall be protected for oil, grease, and curing compound.
- B. The waterstops shall be installed with approximately one-half of the width of the material embedded in the concrete on each side of the joint. Care shall be exercised in placing and vibrating the concrete about the waterstop to ensure complete filling of the concrete forms under and about the waterstops and to obtain a continuous bond between the concrete and the waterstops at all points around the periphery of the waterstops. In the event the waterstop is installed in concrete on one side of a joint more than one (1) month prior to the scheduled date of placing the concrete on the other side on the joint, the exposed

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waterstop shall be covered or shaded to protect it from the direct rays of the sun during the exposure.

- C. Field splices in type "A" waterstops shall be molded splices. All molded splices shall be made by vulcanizing the splices in a steel mold as follows.
1. The adjoining ends at splices shall be beveled at an angle of 45° or flatter by the use of a saw and miter box so that the ends to be spliced together will be pressed together when the mold is closed. The beveled ends and the sides for at least one-fourth inch back from the ends shall be buffed thoroughly to provide clean, rough surfaces. All buffed surfaces shall be given two thin coats of rubber cement, and each coat shall be permitted to dry thoroughly.
  2. A piece of gum rubber cut to the same dimensions as the beveled face shall then be applied to the end of one strip after removing the cloth backing from the gum rubber. The adjoining strip shall then be placed thoroughly together with a suitable hand stitcher. The mold shall be heated to a temperature of 290° F before the splice is placed in the mold. The prepared splice shall be placed in the mold with the splice in the center of the mold, and the mold shall be closed tightly to prevent slipping during the vulcanizing process. The splice shall remain in the mold twenty-five (25) minutes after the mold is closed completely, during which time the mold shall be maintained at the temperature of 290° F.
  3. Each finished splice shall withstand a bend test by bending the waterstop 180° around a two (2)-inch diameter pin without showing any separation at the splice. All field-molded splices shall be tested by the Contractor in the presence of the District prior to installation.

### 3.02 Elastomeric Sealer Installation

- A. Package Marking and Shipping: Elastomeric Sealer shall be delivered to the project site in original sealed containers, marked with the following information: supplier, name of material, specification number, color, expiration period for use, pot life, and curing time (when applicable) at the standard conditions for laboratory tests. Marking on multi component material shall also state mixing instructions.
- B. Surface Cleaning - The Contractor shall thoroughly clean all joints, removing all foreign matter such as dust, paint (unless a permanent protective coating), oil, grease, water proofing or water-repellant treatments, curing compound, water, surface dirt, and frost. Immediately prior to placing the sealer, the joints shall be cleaned by brushing, grinding, blast cleaning, mechanical abrading, acid washing, or combinations of these methods to provide a clean, sound substrate for optimum sealant adhesion. The Contractor shall remove laitance from concrete by acid washing, grinding, or mechanical abrading, and remove form oils from concrete by blast-cleaning, and remove loose particles present or resulting from grinding, abrading or blast cleaning by blowing out joints with oil-free compressed air (or vacuuming) prior to application of sealer. The

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surface shall be free of frost and completely dry before sealer can be placed. Application of the sealer shall be as recommended by the manufacturer and shall be to the lines and grades shown on Drawings. The sealer shall be applied when ambient temperature is above 40° F.

- C. The Contractor shall prime surfaces when recommended by the sealant manufacturer for optimum adhesion. Use only the primer or surface conditioner that is recommended by the sealant manufacturer.
- D. The Contractor shall use the proper tools to produce the desired joint profile. Tools may be used wet or dry. Dipping tools in certain liquids could decrease adhesion of the sealant to the tool. All liquids should first be tested and accepted for use by the manufacturer. In using tooling liquids, care should be taken to ensure that the liquid does not contact joint surfaces prior to the sealant contacting the joint surface.

### 3.03 Sponge Rubber Joint Filler Installation

The Contractor shall furnish and install sponge rubber joint filler in concrete joints where shown on the Drawings. Sponge rubber filler shall be cut to the size and shape of the joint surfaces. The filler shall be secured to the concrete by adhesive applied between the filler and the first-placed concrete. Joint between adjoining portions of the filler material shall be sufficiently tight to prevent concrete from seeping through such joints. Where elastomeric sealer material is required, the joint filler shall be set back from the edge of the joint to provide the proper recess for installing elastomeric sealer. Elsewhere, unless otherwise shown on the Drawings or directed, the edges of the sponge rubber filler shall be placed flush with the finished surface of the concrete or to the bottom edge of chamfers.

### 3.04 Roofing Felt Installation

Roofing felt shall be furnished by the Contractor to ensure delamination between the dowels and concrete. Roofing felt shall be cut to the size and shape of the dowel to be inserted into the concrete. The roofing felt shall be secured to the dowel by adhesive applied between the dowel and the roofing felt. The roofing felt will cover the dowel so as to not produce gaps between the felt and the dowel. The roofing felt will completely cover the dowel so as to not enable the concrete to form a permanent adhesion to the dowel.

### 3.05 Waterproofing Membrane Installation

- A. The Contractor shall furnish and install waterproofing membrane as shown on the Drawings. The Contractor shall not place the waterproofing membrane until the concrete has been cured for a minimum of seven (7) days. The surface shall be clean, dry, smooth, and free of voids.
- B. The Contractor shall apply the waterproofing material in dry, fair weather when the air and surface temperatures are above 50°F. Do not apply waterproofing material on frozen concrete.

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- C. The Contractor shall prime all surfaces that can be covered in one (1) working day. Uncovered, primed surfaces must be re-primed the next day. The primer shall be compatible with the manufacture waterproofing strip and shall be applied to the concrete evenly as recommended by the manufacturer.
- D. Overlap of Membrane - The Contractor shall overlap all seams at least 2-1/2 inches unless otherwise specified by manufacturer.
- E. Protect the Membrane - The Contractor shall protect the waterproofing membrane on all vertical applications from damage. Backfilling should be done immediately using care and caution to avoid damaging the waterproofing membrane.

3.06 Non-Shrink Grout Installation

- A. The Contractor shall furnish and install non-shrink grout as shown on the Drawings. All surfaces to be in contact with the non-shrink grout shall be entirely free of oil, grease, laitance, or other foreign substances. The Contractor shall rough the surface to ensure a good bond to existing concrete. Clean thoroughly with liberal quantities of water, leaving the concrete saturated but free of standing water.
- B. Non-Shrink Grout shall be mixed to the desired consistency by varying the amount of water used. The Contractor shall not exceed the recommended amount of water as recommended by the manufacturer.
- C. The Contractor shall trowel, pump, or vibrate the non-shrink grout into place assuring that the void in which the grout is to be placed is completely filled.
- D. The non-shrink grout shall be cured for a minimum of three (3) days with wet burlap or an approved curing compound.

3.07 Butyl Rubber and Swellable Clay Waterproofing Waterstop Installation

The Contractor shall furnish and install waterstops where shown on the Drawings. The Contractor shall mold the waterstop to the required cross-sectional area as indicated on the Drawings. The waterstop shall be placed against clean surfaces free from dirt, oil, grease, and curing compound.

3.08 Non-Shrink Grout Installation

The Contractor shall furnish and install non-shrink grout as shown on the Drawings. All surfaces to be in contact with the non-shrink grout shall be entirely free of oil, grease, laitance, or other foreign substances. The Contractor shall rough the surface to ensure a good bond to existing concrete. Clean thoroughly with liberal quantities of water, leaving the concrete saturated but free of standing water.

Non-Shrink Grout shall be mixed to the desired consistency by varying the amount of water used. The Contractor shall not exceed the recommended amount of water as recommended by the manufacturer.

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The Contractor shall trowel, pump, or vibrate the non-shrink grout into place assuring that the void in which the grout is to be placed is completely filled.

The non-shrink grout shall be cured for a minimum of three (3) days with wet burlap or an approved curing compound.

END OF SECTION

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SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 Section Includes

Summary  
Related Sections  
Submittals  
Quality Assurance  
Formwork Design and Material  
Reinforcing Steel  
Concrete Materials  
Curing  
Concrete Mix  
Batching and Measuring  
Mixing and Transporting  
Placing Forms  
Placing Reinforcing Steel  
Placing Concrete  
Finishes and Finishing  
Protection  
Curing of Concrete  
Repair of Concrete  
Field Quality Control

1.02 Summary

This Section includes the requirements for cast-in-place concrete for Canal Rehabilitation Project turnout connection boxes, pipeline and inlet connection structures, pipeline adapter box, and other miscellaneous structures. The Contractor shall comply with the provisions of the "U.S. Department of Interior, Bureau of Reclamation, Standard Specification for Repair of Concrete M-47" for the respective sections and can be procured from the following source:

Superintendent of Documents  
U.S. District Printing Office  
P.O. Box 371954  
Pittsburgh, PA 15250-7954

1.03 Related Sections

Section 01300 - SUBMITTALS  
Section 02200 - GRADING, EXCAVATING, BACKFILLING, AND COMPACTING

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Section 03200 – PIPE

1.04 Submittals

- A. The Contractor shall submit to the District, within twenty-four (24) hours of performance of the test, the results of all tests performed as specified in these Contract Documents.
- B. The Contractor shall submit to the District, at least seven (7) calendar days prior to start of construction, a statement of qualifications of the certified testing firm selected by the Contractor to provide testing as specified herein and a copy of the U.S. Army Corps of Engineers certification.
- C. The Contractor shall submit to the District, at least seven (7) calendar days prior to placement of reinforcement steel, manufacturer specifications specifying the type of reinforcement steel to be used, and Drawings of reinforcement details for the settling basin lining and all structures. These shop Drawings shall include as a minimum, bar spacing details, bar bending details, and a bar list for the above-mentioned structures.
- D. The Contractor shall submit to the District, at least seven (7) calendar days prior to placement of form materials, documentation of compliance with requirements for types of form materials, form ties, and tie wires to be used for this project. This documentation shall include, as a minimum, a written letter from the Contractor assuring compliance, along with copies of purchase orders, receipts, and certifications.
- E. The Contractor shall submit to the District, at least seven (7) calendar days prior to placement of concrete, a letter along with test results assuring compliance with requirements of these Contract Documents for the types of concrete materials, types of chemical admixtures, and air-entraining admixtures to be used for this project. This letter may include copies of purchase orders, receipts, and certifications.
- F. The Contractor shall submit to the District, at least seven (7) calendar days before concrete placement, batching proportions for the concrete design mix to be used in all structures, and a letter assuring the proposed concrete mix will meet all requirements of these Contract Documents. The concrete mixture quantities of all ingredients per cubic yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the weight of cement and water; the weights of aggregates in a saturated surface-dry condition; and the quantities of admixtures.
- G. The Contractor shall submit to the District, within twenty-four (24) hours after placement of concrete, the original approved concrete placement checkout cards.
- H. The Contractor shall submit to the District, at least seven (7) calendar days before placement of concrete, manufacturer specifications and placement instructions for curing compound to be used on all concrete surfaces.
- I. The Contractor shall submit to the District, at least seven (7) days prior to placement of the first batch of concrete, a letter certifying along with an inspection checklist indicating that the batching, measuring, mixing, and transportation of concrete is in compliance with the requirements of these Contract Documents.

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1.05 Quality Assurance

- A. The Contractor shall provide an independent and qualified testing firm, certified by the U.S. Army Corps of Engineers to perform all tests required of the Contractor, as specified in the Contract Documents, and as requested by the District. The certified testing firm shall have at least seven (7) years experience in completing similar work.
- B. The Contractor shall have a representative from the certified testing firm to perform all testing of concrete, as specified in these Contract Documents. The Contractor shall require the certified testing firm to provide a representative at the construction site at all times during placement of concrete. Concrete shall not be placed until the representative is present at the construction site.
- C. The District will determine when and where the testing of the concrete mixture will be performed to meet the frequencies specified in these Contract Documents.
- D. If additional testing, which exceeds what is specified in these Contract Documents, is requested by the District, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The testing requested of the Contractor by the District will be those tests of concrete required in this Section. The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.
- E. NO CONCRETE SHALL BE PLACED WITHOUT THE DISTRICT'S PRIOR WRITTEN APPROVAL.
- F. NO FORMS SHALL BE REMOVED WITHOUT THE DISTRICT PRIOR WRITTEN APPROVAL.

PART 2 MATERIALS

2.01 Formwork Design and Materials

Formwork shall be designed in accordance with ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in this Section. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete. Forms shall be wood or steel or other approved concrete form material.

- A. Form Sheathing and Lining.
  - 1. Sheathing shall consist of wood, plywood, or steel, or other approved materials capable of transferring the load of the concrete to the supporting members. Wood sheathing or lining shall be softwood or plywood of such kind and quality, or shall be so treated or coated, that there will be no deterioration or discoloration of the formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete. Plywood used for form sheathing or lining shall be concrete form, class 1, grade B-B, exterior, mill oiled and edge sealed, in accordance with the latest edition Product Standard PS1 of the U.S. Department of Commerce. Softwood lumber used for form sheathing shall meet

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applicable requirements of the latest edition of the Grading Rules for Western Lumber as published by the Western Wood Products Association for dressed lumber or worked lumber of the specified grade. All common boards shall be surfaced on both edges (S2E) in accordance with the standard grading rules.

2. The ability of form sheathing and lining to withstand distortion caused by placement and vibration of concrete shall be such that formed surfaces will conform with specified structural deviations, surface tolerances, and finish requirements.
3. The basic modular size of sheathing material shall be 4 feet by 8 feet. The dimensions of filler panels for corners, soffits, and similar offsets, may be smaller, but the panels shall be fabricated from similar materials, and the resultant concrete surfaces shall have a uniform texture. Voids at joints in the plywood form lining or sheathing shall be filled and finished smooth prior to concrete placement. The sheathing or lining shall be in alignment both horizontally and vertically, and shall be placed to minimize joint marks on the concrete surfaces.

- B. Form Ties and Form Anchors. Embedded ties for holding forms shall remain embedded and, shall terminate not less than two (2) diameters or twice the minimum dimension of the tie, whichever is greater, from the formed surfaces of the concrete.

## 2.02 Reinforcing Steel

- A. Reinforcing steel shall be deformed bars and smooth bars as shown on the Drawings and shall conform to ASTM A 615, grade 60, including supplementary requirements, or ASTM A 617, grade 60.
- B. Tie Wire: Minimum 16 gage annealed type.
- C. Reinforcing Steel Bar Size Designations:

#3 reinforcing bar has a nominal dia. of 3/8 inch  
#4 reinforcing bar has a nominal dia. of 2 inch  
#5 reinforcing bar has a nominal dia. of 5/8 inch  
#6 reinforcing bar has a nominal dia. of 3/4 inch  
#7 reinforcing bar has a nominal dia. of 7/8 inch  
#8 reinforcing bar has a nominal dia. of 1 inch

- D. Fabricated deformed steel bar mats may be substituted for deformed bars for settling basin lining only. The fabricated deformed steel bar mats shall conform to ASTM A 184/A 184M, grade 60. If fabricated deformed steel bar mats are used, the spacing between the reinforcement steel shall not be greater, and the area of steel per square foot shall not be less than specified in these Contract Documents. Deformed steel wire products may be used for settling basin lining only provided that the tensile and yield strengths are equal to or greater than Grade 60 Deformed and Plain Billet-Steel Bars for concrete reinforcement as per ASTM 615, the steel concrete cover requirements are met, and the area of steel per square foot shall not be less than specified in these Contract Documents.

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2.03 Concrete Materials

- A. Cement: ASTM C 150, Type II.
- B. Pozzolan will not be allowed.
- C. Air-Entraining and Chemical Admixtures.
  - 1. Air-Entraining Admixture. An air-entraining admixture shall be used in all concrete. The admixture shall conform to ASTM C 260: Provided, that air-entraining admixture used with type F or G chemical admixture shall be a neutralized vinsol resin formulation. The amount of air-entraining admixture used shall be that amount necessary to affect a total air content in the concrete at the placement of 5% +/- 1.5% by volume of concrete.
  - 2. Chemical admixtures. Chemical admixtures shall be of uniform consistency, quality, and strength of solution. Admixtures shall be batched separately in liquid form in dispensers capable of measuring at one time the full quantity of each admixture required for each batch. Chemical admixtures which will introduce more than 1/10 of one (1) percent chloride, by weight of cement, shall not be used.
    - a. Accelerator. The Contractor may use an accelerating admixture in concrete when the mean daily temperature in the vicinity of the placement has been less than 41° F for two (2) of the four (4) days prior to placement. Accelerating admixture shall not be used in less severe weather except upon written approval by the District. Request for such approval shall state the reason for using the accelerator, the amount and brand of accelerator to be used, and the location of the concrete in which the Contractor proposes use of the accelerator. The accelerator shall conform to ASTM C 494 for type C or E chemical admixtures. The amount of an accelerator used, except for calcium chloride, shall be that amount necessary to affect the requirements of ASTM C 494. Calcium chloride shall not be used in the concrete.
    - b. Water Reducing and/or Set Controlling. Contractor may use a water-reducing and/or set-controlling admixture, referred to herein as WRA, in all concrete. The admixture shall conform to ASTM C 494 for Type A, F, or G chemical admixtures, except that type E chemical admixture meeting ASTM requirements will also be an acceptable WRA only during cold weather.
- D. Water

The water used in making concrete, mortar, and grout shall be free from objectionable quantities of silt, organic matter, salts, and other impurities. In no case shall the water contain more than 500 parts per million soluble sulfate.

- E. Sand
  - 1. The term "sand" is used to designate aggregate in which the maximum size particle will pass a 3/16-inch (No. 4) test sieve. Sand shall be natural sand

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which may be supplemented with crushed sand to make up deficiencies in the natural sand gradings. Crushed sand, if used, shall be produced by suitable ball or rod mill, or disk or cone crusher, so that the particles are predominantly cubical in shape and free from flat or elongated particles. Crusher fines produced by a jaw crusher used other than as a primary crusher shall not be used in production of sand. Crushed sand shall be blended uniformly with the natural sand by routing through the sand classifier.

2. Sand must meet the following quality requirements:
  - a. Organic Impurities in Sand as specified by ASTM C 40. Color no darker than the specified standard.
  - b. Sodium Sulfate Test for Soundness as specified by ASTM C 88. Eight percent maximum weighted average loss, by weight, after 5 cycles.
  - c. Specific Gravity as specified by ASTM C 128, Saturated, Surface-Dry Basis. 2.60 minimum.
  - d. Deleterious Substances. As shown below.

Allowable Percentages of Deleterious Substances in Sand

<u>Deleterious Substances</u>	<u>Maximum Percent, by Weight in Sand as Batched</u>
Material passing No. 200 sieve (ASTM C 117)	3
Lightweight material (ASTM C 123 using a solution of zinc chloride)	2
Friable particles (ASTM C 142)	1
Other deleterious substances (such as mica, coated grains, soft flaky particles, and loam)	2
Maximum allowable sum of all the above deleterious substances	5

- e. Grading. The sand as batched shall be well graded, and when tested by means of standard sieves (ASTM C 136), shall conform to the limits below.

Sand Grading Requirements

<u>Sieve No.</u>	<u>Individual Percent by Weight Retained on Sieve</u>
4	0 to 5
8	5 to 15*
16	10 to 25*
30	10 to 30
50	15 to 35

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100	12 to 20
Pan	3 to 7

\*If the individual percent retained on the No. 16 sieve is 20 percent or less, the maximum limit for the individual percent retained on the No. 8 sieve may be increased to 20 percent. The grading of the sand shall be controlled so that the fineness modulus (ASTM C 136) of at least 9 out of any 10 consecutive tests samples of finished sand will not vary more than 0.20 from the average fineness modulus of the 10 test samples.

F. Coarse Aggregate

1. The term "coarse aggregate" designates clean, well-graded aggregate of particle sizes within the range of 3/16 of an inch to 3/4 of an inch or any size or range of sizes within such limits. Coarse aggregate for concrete shall consist of natural gravel or crushed rock or a mixture of natural gravel and crushed rock. Jaw crushers shall not be used except as a primary crusher. If crushed, coarse aggregate is used with natural coarse aggregate, the crushed aggregate shall be blended uniformly with the natural aggregate by routing both together through the classifying screens. Coarse aggregate shall have no more than 30 percent particles with a maximum to a minimum dimension of 3 to 1.
2. Coarse aggregate must meet the following quality requirements:
  - a. Los Angeles Abrasion Loss as specified by ASTM C 131, Using Grading A. Ten (10) percent maximum loss of weight at 100 revolutions, or 40 percent maximum loss of weight at 500 revolutions.
  - b. Sodium Sulfate Test for Soundness of Aggregates as specified by ASTM C 88. Ten percent maximum weighted average loss by weight, after 5 cycles.
  - c. Specific Gravity as specified by ASTM C 127, Saturated, Surface-Dry Basis, 2.60 minimum.
 Deleterious Substances. As shown below.

Allowable Percentages of Deleterious Substances Coarse Aggregate

<u>Deleterious Substances</u>	<u>Maximum Percent, by Weight in Coarse Aggregate as Batched</u>
Lightweight material (ASTM C 123 using a solution of zinc chloride)	2
Friable particles (ASTM C 142)	2
Other deleterious substances	2
Maximum allowable sum of all the above deleterious substances	2

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- e. Grading. Coarse aggregate as batched shall, when tested in accordance with ASTM C 117 and C 136, conform to the grading requirements below.

Nominal Maximum Size	3/4 inch
Nominal size range	3/16 to 3/4 inch
Maximum percent retained on (indicated) oversize test sieve	0% (7/8 inch)
Percent retained on (indicated) test sieve	50 to 75% (3/8 inch)
Maximum percent passing (indicated) undersize	2% (No. 5)
Maximum percent passing the No. 200 sieve	0.5%

2.04 Curing

The Contractor shall cure all concrete with liquid membrane curing compounds, unless approved otherwise by the District. The liquid membrane forming compounds shall conform to ASTM C 309, Type 2 (white pigmented) and shall be of uniform consistency and quality within each container.

PART 3 EXECUTION

3.01 Concrete Mix

- A. The Contractor shall provide concrete for turnout connection boxes, pipeline and inlet connection structures, pipeline adapter box., culverts, siphons, and other structures noted on Drawings which meet the following criteria:
1. Compressive strength at 28 days: 3600 psi
  2. Slump: 3 inches +/- 1 inch
  3. Maximum water/cement ratio: 0.55
- B. The Contractor shall provide concrete for all other structures which meet the following criteria:
1. Compressive strength at 28 days: 4500 psi
  2. Slump: 3 inches +/- 0.5 inch
  3. Maximum water/cement ratio: 0.55
- C. Flowable fill for bedding and backfill shown on Drawings has the following criteria:
1. Compressive Strength at 28 days: 2000 psi
  2. Slump: 5 inches +/- 1 inch

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3.02 Batching and Measuring

Batching and measuring shall conform to the requirements of ACI-304 as modified below.

- A. The Contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the prescribed amounts of the various materials entering the concrete mixers. The amounts of bulk cement, sand and each size of coarse aggregate entering each batch of concrete shall be determined by individual weighing. Sand and coarse aggregate may be weighed with separate scales and hoppers or cumulatively with one scale and hopper. Cement shall be weighed separately with an individual scale and hopper. Water and admixtures shall be measured by weight or by volume. Where bagged cement is used, it need not be weighed if the concrete is proportioned on the basis of integral bags of cement.
- B. Aggregate will be rejected by the District if it contains particles frozen together. During freezing weather, the Contractor shall protect aggregate stockpiles containing free water by covering and heating them, or shall screen out frozen material prior to use, or shall do both to prevent or remove frozen particles.
- C. When bulk cement and aggregates are dry batched and hauled to where mixing is accomplished, each batch shall be protected during transit to prevent loss and to limit pre-hydration of the cement. Separate compartments with suitable covers shall be provided to protect the cement or shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cement is enfolded in moist aggregates or otherwise exposed to moisture and delays occur between batching and mixing, the Contractor shall, at its own expense, add extra cement to each batch in accordance with the schedule below.

Additional (Cement) (Cementitious materials) Requirements

<u>Hours of contact between cement and wet aggregate*</u>	<u>Additional Cement Required</u>
0 to 2	0 percent
2 to 3	5 percent
3 to 4	10 percent
4 to 5	15 percent
5 to 6	20 percent
Over 6	Batch will be rejected

\*The District reserves the right to require the addition of cement for shorter periods of contact during periods of hot weather and the Contractor shall be entitled to no additional compensation by reason of the shortened period of contact.

D. Equipment

- 1. All weighing and measuring equipment shall be accurate to 0.40 percent over the working range. In addition, the construction and accuracy of

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equipment shall conform to the applicable requirements of the National Bureau of Standards Handbook 44, Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices. The Contractor shall schedule and perform monthly static tests to assure that the operating performance of each scale and measuring device is within the 0.40 percent accuracy and shall provide standard test weights and any other equipment necessary to conduct these tests. The Contractor shall make such adjustments, repairs, or replacements as may be necessary to meet the specified requirements for accuracy of measurement.

2. Each weighing unit shall be spring-less and shall visibly register the actual weights during the weighing operation and not just indicate when a prescribed weight has been obtained. The clear interval for dial scale graduations shall be not less than 0.03 inches. Each scale graduation shall indicate increments no greater than 2.5 pounds for water and cement, and no more than 10 pounds for aggregate for each cubic yard normally batched. Each batch weight indicator and volumetric dispenser shall be in full view of the operator. Batching controls shall be interlocked so that a new batch cannot be started until the weighing hoppers have been completely emptied of the last batch and the scales register zero weight.
3. The equipment shall be capable of controlling the delivery of material so that the combined inaccuracies in feeding and measuring during normal operation will not exceed by individual weight +/- 1 percent for water; +/- 1-1/2 percent for cement, +/- 2 percent each for sand and 3/4 inch nominal maximum-size aggregate, and +/- 3 percent for admixtures. The weighing hoppers shall be constructed so as to permit removal of materials batched in excess of the prescribed mix design and the above tolerances.
4. Measuring devices for air-entraining and chemical admixtures shall have sufficient capacity to measure at one time the full quantity of the properly diluted solution required for each batch, and shall be maintained in a clean and freely operating condition. If admixtures are measured by a method other than direct weighing, equipment shall be designed for confirmation of the accuracy of each batch quantity by use of visual-mechanical gages readily visible from the batch plant operator's station. Admixture batching equipment shall be so constructed that the required batch quantity can only be added once to each batch, and so that each admixture is discharged separately into the batched mixing water as it is being discharged into the mixer.
5. Equipment for conveying batched materials from weighing hoppers into the mixer shall be provided, maintained, and operated so as to prevent spillage of the batched materials and overlap of batches.
6. Equipment for handling cement in the batching plant shall be constructed and operated so as to prevent noticeable dust during the measuring and discharging of each batch of material.
7. Aggregate batch bins shall be so constructed as to be self-cleaning during drawdown.
8. Coarse aggregate shall be deposited in the batch bins directly over the discharge gates.

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9. Convenient facilities shall be provided for readily and safely obtaining representative samples of cement, admixtures, sand, and each size of coarse aggregate from the discharge stream between batch bins and the weighing hoppers or between the batch hopper and the mixer.
10. The water batching device shall be constructed so that the water will be discharged quickly and freely into the mixer without an objectionable dribble from the end of the discharge pipe, and shall be such that leakage will not occur when the valves are closed. In addition, equipment shall be capable of adjusting batch water by as little as three (3) pounds per cubic yard and there shall be a means for accurately introducing small increments of water into each mixer after batching for occasional final tempering of the concrete.
11. The equipment shall be capable of adjustment to compensate for the varying moisture content of the sand and coarse aggregates and to adjust the mix proportions as needed.

3.03 Mixing and Transporting

Mixing and transporting in accordance with ACI-304 as modified below.

- A. The concrete ingredients shall be thoroughly mixed in mixers designed to assure uniform distribution of all the component materials throughout the concrete at the end of the mixing period. The concrete, as discharged from the mixer, shall be uniform in composition and consistency from batch to batch. Mixers will be examined regularly by the Contractor for changes in condition due to accumulation of hardened concrete or mortar or to wear of blades. The adequacy of the mixing will be determined by the Contractor in accordance with the concrete uniformity requirements of ASTM C 94, annex A1. Samples of concrete for such tests will be taken from any size batch which is commonly mixed during concrete production. For testing purposes, the Contractor shall mix, in the mixers to be tested, and shall collect the required samples from that batch. Any mixer that at any time produces unsatisfactory results shall not be used until repaired. If repair attempts are unsuccessful, a defective mixer shall be replaced. Batch size shall be at least 10 percent of, but not in excess of, the rated capacity of the mixer.
- B. Central Mixers. Water shall be admitted prior to and during charging of the mixer with all other concrete ingredients. After all materials are in the mixer, each batch shall be mixed for not less than 90 seconds. Excessive over mixing which requires additions of water to maintain the required concrete consistency will not be permitted. The mixing equipment shall conform to the following additional requirements:
  1. Plant configurations shall be such that the mixing action of each mixer shall be observed from a safe location which can be easily reached from the control station. Provisions shall also be made so that the operator can observe the concrete in the receiving hopper or buckets as it is being dumped from the mixers.
  2. Each mixer shall be controlled with a timing device which will indicate the mixing period and assure completion of the required mixing period.

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3. The batch plant shall be equipped with an interlocking mechanism which will prevent concrete batches from entering mixers which are not empty.
- C. Truck Mixers. Truck mixers shall be equipped with a water meter, accurate to within one (1) percent of the total mix water, located between the water supply and mixer. Truck mixers shall also be equipped with a reliable revolution counter for indicating the total number of revolutions of the drum for each batch. The revolution counter shall be visible from the operator control area and shall be reset to zero for each batch. Truck mixers shall have a metal plate attached in a prominent place indicating the manufacturer's recommended drum capacities, in terms of volume, and the maximum and minimum speeds of rotation for both mixing and agitating. Initial mixing shall be continued for not less than 70 revolutions nor more than 100 revolutions of the drum after all the ingredients, except approximately 5 percent of the water which may be withheld for tempering, are in the drum. The mixing speed shall be not less than 12 revolutions per minute nor more than 22 revolutions per minute. Except as specified, additional water shall not be added to the concrete after the initial introduction of mixing water to the batch. Additional tempering water may be added to the batch on arrival at the placement when the concrete slump is less than specified; however, the design water content and specified slump shall not be exceeded. After this tempering, additional water shall not be added to the concrete. After addition of tempering water, mixing shall be continued at the specified mixing speed for a minimum of 30 revolutions. After a prolonged period of agitation, 10 to 15 revolutions of the drum at mixing speed will be required just prior to discharging. Discharge of the concrete shall be completed before the drum has revolved a total of 300 revolutions. Each batch of concrete, when delivered at the job site from commercial ready-mix plants, shall be accompanied by a batch ticket in accordance with ASTM C 94.

3.04 Placing Forms

Forming shall be placed in accordance with ACI 304R, ACI 309R, and ACI 347R as modified below.

- A. Forms shall be used, wherever necessary to confine the concrete and shape it to the required lines. The Contractor shall set and maintain concrete forms to ensure that completed work is within all applicable structural deviations, surface tolerances, and finish requirements. If a type of form does not consistently perform in an acceptable manner, the type of form shall be changed and the method of erection shall be modified.
- B. A sufficient number of properly installed plumb and string lines shall be installed before, and maintained during, concrete placement for use by Contractor's personnel and District inspectors. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- C. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in proper position. The design of formwork and placing rate of concrete containing type F or G chemical admixtures shall be adjusted to compensate for the greater

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hydraulic pressures exerted on the forms by concrete of high fluidity. Where form vibrators are to be used, forms shall be sufficiently rigid to effectively transmit energy from the form vibrators to the concrete, while not damaging or altering positions of forms. Surfaces and joints of forms shall be sealed sufficiently to prevent absorption of water into forms or loss of mortar from the concrete. Nominal 3/4-inch chamfer strips shall be placed in the corners of forms and at the tops of wall placements to produce beveled edges on permanently exposed concrete surfaces. Interior angles of intersection concrete surfaces and edges of construction and expansion joints shall not be beveled except where indicated on the Drawings.

- D. Cleaning and Oiling of Forms. At the time the concrete is placed in the forms, the surfaces of the forms shall be free from encrustations of mortar, grout or other foreign material. Before concrete is placed, the surfaces of the forms shall be coated with a form oil that will effectively prevent sticking and will not soften or stain the concrete surfaces, or cause the surfaces to become chalky or dust producing.
- E. Removal of Forms. To facilitate satisfactory progress with the specified curing and to allow the earliest practical repair of surface imperfections, forms shall be removed within 24 hours after the concrete has hardened sufficiently to prevent damage by careful form removal, and specified repair and curing shall commence immediately thereafter. It is the Contractor's responsibility to design and build adequate forms and to leave them in place until the forms can be safely removed. The Contractor shall be liable for damage and injury caused by removing forms before the concrete has gained sufficient strength. Forms shall be removed with care so as to avoid injury to the concrete and any concrete so damaged shall be repaired in accordance with the U.S. Department of The Interior, Bureau of Reclamation, Standard Specifications for Repair of Concrete M-47.
- F. Removal of Ties. The ties shall be constructed so that removal of the ends can be accomplished without causing appreciable spalling at the faces of the concrete. Voids left by the removal of the ties shall be filled as specified in the U.S. Department of The Interior, Bureau of Reclamation, Standard Specifications for Repair of Concrete M-47.

### 3.05 Placing Reinforcing Steel

Reinforcing steel shall be placed in accordance with ACI-304 as modified below.

- A. Reinforcing steel shall be cut, bent, spliced and placed as shown on the Drawings. Any additional splices other than those shown on the Drawings shall be indicated as a deviation in the reinforcing steel detail submittal. All reinforcing steel splices shall be maintained at the distances provided in each drawing. For clarity, reinforcing steel of certain bar designations are not shown in all Plan, Elevation, and Cross Section views, however reinforcing steel shall be placed to be consistent with the indicated bar spacing shown in the referenced Drawings.
- B. In the Drawings, the District has provided as a minimum requirements, and as a guide, the lengths of straight reinforcing steel, reinforcing schedules, and steel ending details. The Contractor shall be responsible for determining the actual dimensions and geometry of all reinforcing steel in accordance with the

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dimensions of the structure. The Contractor shall furnish all reinforcing steel required for completion of the work. The Contractor shall, prior to ordering any reinforcing steel, prepare reinforcing steel details based on the Contractor's independent calculations and submit to the District for review.

- C. The amount of concrete cover protecting reinforcing steel shall not deviate from that shown on the Drawings by more than 1/4 inch for the transitions, check structures, wasteway, outlet/inlet structures, etc. The required cover for the settling basin lining shall be a minimum of 1-5/8 inch relative to surface exposed to air and soil.
- D. Unless otherwise described, placement dimensions shall be to the center lines of the reinforcing steel. Reinforcing steel will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.
- E. Before reinforcing steel is embedded in concrete, the surfaces of the reinforcing steel and the surfaces of any supports shall be cleaned of a heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances which, in the opinion of the District, are objectionable.
- F. The spacing of reinforcing steel shall not deviate from the required spacing by more than one (1) inch.
- G. Reinforcing steel shall be secured in position so that it will not be displaced during the placing of the concrete, and special care shall be exercised to prevent any disturbance of the reinforcing steel in concrete that has already been placed. Reinforcing steel shall not be field bent to the extent of permanent set, nor straightened. Welding or tack welding of reinforcing steel will not be permitted. Chairs, hangers, spacers, and other supports for reinforcement shall be of concrete, metal, or of other approved material. Unless otherwise shown on the Drawings, reinforcement in structures shall be so placed that there will be a clear distance of at least one (1) inch between the reinforcing steel and any anchor bolts, form ties, or other embedded metal work.
- H. Bent Bars: Unless larger radius bends are indicated on the construction Drawings, all reinforcing steel requiring bending shall be bent around pins having the following diameters:

<u>BAR SIZE #</u>	<u>#3</u>	<u>#4</u>	<u>#5</u>	<u>#6</u>	<u>#7</u>	<u>#8</u>
STANDARD BENDS						
DIAMETER OF PIN (inches)	2.25	3.0	3.75	4.5	5.25	6.0
STIRRUP AND TIE BENDS						
DIAMETER OF PIN (inches)	1.5	2.0	2.5	4.5	5.25	6.0

3.07 Placing Concrete

Place concrete in accordance with ACI-304 as modified below.

- A. Preparations for Concrete Placement.

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1. No concrete shall be placed until all formwork, installation of items to be embedded, and preparations of surfaces involved in the placement have been approved by the District. The Contractor shall supply concrete placement checkout cards satisfactory to the District, and shall provide a watertight container for such cards at a convenient location near each individual concrete placement site. The cards shall list all the various work items, for example, "Cleanup" and "Embedded items," required prior to placement of concrete. After each work item for an individual placement has been completed, that item on the card shall be signed by the Contractor or his/her representative signifying completion of the required work. The District will inspect the work during and after completion of each phase of the preparations; and if the work is satisfactory, will sign the checkout card. Approval of preparations for placement will not be complete until the Contractor or his/her representative and the District have approved, by signature, all applicable items for that placement. The use of the placement checkout cards may be waived by the District where their use is impracticable.
2. Prior to beginning concrete placement, the Contractor shall make ready a sufficient number of properly operating vibrators and operators, and shall have readily available additional vibrators to replace defective ones during the progress of the placement.
3. All foundation surfaces upon or against which concrete is to be placed shall be free from frost, ice, water, mud, and debris.
4. Earth foundations shall be damp when concrete is placed against them. Surfaces shall be thoroughly moist, but not muddy, to a depth of six (6) inches, or to impermeable material, whichever is less.
5. All construction joints shall be roughened to a full amplitude of one-fourth inch and all laitance removed in preparation for placing adjoining concrete. A construction joint is defined as a planned joint where two placements of concrete meet, across which development and maintenance of bonds are required, and through which any reinforcing steel that may be present is not interrupted. Methods of roughening surfaces and removing laitance may include mechanical abrasion or cutting, sandblasting, acid etching, or high-pressure water jetting of hardened (not green) concrete. Water jetting will normally be at pressures of at least 6000 pounds per square inch. Construction joints shall be thoroughly cleaned of loose or defective concrete, coatings, sand, curing compound, and other foreign material on the surface. After this initial cleanup and at the last opportunity prior to placing concrete, concrete surfaces shall be thoroughly washed with water or air-water jets, and shall be uniformly surface dried. Construction joints other than those specifically shown on the Drawings shall not be allowed, unless written approval is provided by the District.
6. Contraction joints serve to provide for volumetric shrinkage of monolithic concrete and for movement between monolithic units at established joints, thus preventing formation of objectionable shrinkage cracks elsewhere in the concrete. Prior to application of curing compound to contraction joints, the surfaces of all joints shall be cleaned thoroughly of accretions of concrete or other foreign material by scraping or chipping. Curing compound shall not be removed, but shall remain on these joints and be

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kept intact until adjoining concrete is placed. Waterstops, reinforcing steel, and other embedded items shall be free of curing compound when adjoining concrete is placed.

7. Sawed joints may be constructed during concrete placement or shall be made early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete-sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed. Joints shall be filled with sealants, unless otherwise shown.

B. Concrete Placement

1. The Contractor shall notify the District twenty-four (24) hours before placement of concrete. Placement shall not begin until all preparations are complete and the concrete placement check out card has been signed by the Contractor and the District, substantiating completion of all preparations for that placement. The Contractor shall assure reinforcing steel and formed joint fillers are not disturbed during concrete placement. Concrete which has become so stiff that proper placing cannot be assured shall be wasted. Concrete shall not be placed in standing water. Concrete shall not be placed in running water, and shall not be subjected to running water until after the concrete has hardened. Concrete shall be deposited as nearly as practical in its final position and shall not be allowed to flow in such a manner that the lateral movement will cause segregation of the coarse aggregate from the concrete mass. Methods and equipment employed in depositing concrete in forms shall minimize clusters of coarse aggregate. Clusters that occur shall be scattered before the concrete is vibrated.
2. Cold Joints. A cold joint is an unplanned joint resulting when a concrete surface hardens before the next batch is placed against it. Cold joints are undesirable and should be avoided. However, in the event of equipment breakdown or other unavoidable prolonged interruption of continuous placing when it appears that unconsolidated concrete may harden to the extent that later vibration will not fully consolidate it, the Contractor shall immediately consolidate such concrete to a stable and uniform slope. If delay of placement is then short enough to permit penetration of the underlying concrete, placement shall resume with particular care being taken to thoroughly penetrate and revibrate the concrete surface placed before the delay. If concrete cannot be penetrated with a vibrator, the cold joint shall then be treated as a construction joint if the design requirements are such that a construction joint is practical. If a construction joint impairs the structural integrity, as determined by the District, the concrete shall be repaired. Repairs in some instances may include removal of all or a portion of the previously placed concrete and the Contractor will not be entitled to any payment for such additional work.
3. Care shall be taken to prevent cold joints when placing concrete in any part of the work. The concrete-placing rate shall ensure concrete is placed

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while the previously placed, adjacent concrete is plastic so that the concrete can be made monolithic by normal use of the vibrators.

4. Concrete shall not be placed in rain sufficiently heavy or prolonged to wash mortar from concrete. A cold joint may necessarily result from prolonged heavy rainfall.
5. Normally, concrete shall be deposited in its final position in the placement within 90 minutes after the introduction of the mix water and cement into the mixer. This limitation may be waived by the District if the concrete is of such slump and workability, and contains the specified entrained air content after the 90-minute time limit that it can be satisfactorily placed without the addition of water. Furthermore, a time limit less than 90 minutes may be invoked during hot weather or under conditions contributing to quick stiffening of the concrete. The methods and equipment used for transporting concrete from the batch plant and the elapse time during transportation shall not cause measurable segregation of coarse aggregate or slump loss. Concrete shall be deposited as near as practical to its final position by use of buckets, chutes, conveyors, or concrete pumps. The use of aluminum pipe or aluminum chutes for delivery of concrete will not be permitted. Concrete buckets shall be capable of promptly discharging concrete of specified mix design, and the dumping mechanism shall be capable of discharging at one location repeated small portions of concrete from a full bucket. Buckets and conveyors shall be designed for attached drop chutes or tremies which shall be used to deposit concrete whenever the concrete must be dropped more than 10 feet from the bucket to the placing surface. Concrete pumps shall be equipped with slick lines having a minimum diameter of seven (7) inches. Pumps and slick lines shall be capable of transporting concrete containing a maximum amount of coarse aggregate and a minimum amount of sand, cement, and water. The minimum proportion of 3/4-inch aggregate shall be 5.5 cubic feet (solid volume) per cubic yard of concrete and, dependent upon the shape and texture of the aggregate utilized, this proportion will be increased as practical. Buckets, chutes, hoppers, pumps, transit mix trucks, and other equipment shall readily handle and place concrete of the specified slump. The Contractor shall, when directed, replace inadequate transporting equipment with acceptable equipment.
6. Consolidation
  - a. Concrete shall be consolidated by vibration unless otherwise. The vibration shall be sufficient to remove all undesirable air voids from the concrete, including the air voids trapped against forms and construction joints. Close attention and additional effort may be required to adequately consolidate concrete adjacent to construction joints and sloping surfaces. Such close attention and additional effort required to consolidate concrete adjacent to construction joints and sloping surfaces shall be at no additional cost to the District. After consolidation, the concrete shall be free of rock pockets and honeycomb areas, and shall be closed snugly against all surfaces of forms, construction joints, and embedment.

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- b. After concrete has been deposited, the mounds or high spots shall be leveled by vibration. Except as hereinafter provided, consolidation of all concrete shall be by immersion-type vibrators operated in near vertical position. The vibrating head shall penetrate and revibrate the concrete in the upper portion of the underlying layer. Care shall be exercised to avoid contact of the vibrating head with embedded items and with formed surfaces which will later be exposed to view. Concrete shall not be placed upon other plastic concrete until the previously placed concrete has been thoroughly consolidated. Vibrator operators shall establish a pattern of vibrator insertions. The pattern shall be such that the distance between insertions will be about 1-1/2 times the radius of action, or such that the area visibly affected by the vibrator overlaps the adjacent just-vibrated area by a few inches. The radius of action for properly maintained and operated internal vibrators is shown below.

Radius of Action for Internal Vibrators

<u>Diameter of Head, Inches</u>	<u>Radius of Action, Inches</u>
3/4 - 1-1/2	3 - 6
1-1/4 - 2-1/2	5 - 10
2 - 3-1/2	7 - 14
3 - 6	12 - 20
5 - 7	16 - 24

- c. Form vibrators shall be used in conjunction with slip-form lining machines to consolidate concrete in settling basin lining. Immersion-type vibrators shall be used to supplement form vibrators when needed to adequately consolidate lining. Such vibrators shall be arranged for effective uniform consolidation of the concrete.
  - d. Immersion-type vibrators shall be operated at speeds of at least 7,000 vibrations per minute when immersed in concrete. Form vibrators shall operate at speeds of at least 8,000 vibrations per minute when consolidating concrete. The Contractor shall immediately replace improperly operating vibrators with acceptable vibrators.
7. Structural Deviations. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions. Allowable variations from specified lines, grades, and dimensions are listed below.
- a. Departure from established centerline or alignment is +/- 2 inches on tangents and +/- 4 inches on curves.
  - b. Departure from an established profile grade is +/- 1 inch. Any departures from alignment or grade shall be uniform. No other

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- departure and no correction in alignment or grade shall be made in less than 20 feet.
- c. Reduction in thickness of reinforced lining is zero (0) percent of specified thickness.
  - d. Variation from specified width of section at any height is +/- 0.25 percent of specified width plus one (1) inch.
  - e. Variation from established height of lining is +/- 0.50 percent of specified height plus one (1) inch.
8. Concrete Surface Irregularities. Bulges, depressions, and offsets are defined as concrete surface irregularities. Concrete surface irregularities are classified as "abrupt" or "gradual" and allowable tolerances are specified below.
- a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms. Abrupt surface irregularities are further defined as isolated irregularities in which the maximum dimension of the irregularity perpendicular to the surface is greater than the maximum dimension of the irregularity in the plane of the surface. Also, abrupt surface irregularities include all incidences of isolated surface irregularities which exceed the gradual irregularity described below.
  - b. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on the concrete surface. Gradual surface irregularities are further defined as isolated undulation on the concrete surface. The maximum dimension of the undulation perpendicular to the surface is small relative to the maximum dimension of the undulation in the plane of the surface.
  - c. Maximum allowable concrete surface irregularity tolerance for finish formed surfaces shall be 1/4 inch for abrupt irregularities measured from a seven (7) foot template and 2 inch for gradual irregularities measured from a ten (10) foot template.
  - d. Maximum allowable concrete surface irregularity tolerance for finish unformed surfaces shall be 1/4 inch for settling basin bottom slabs measured from a ten (10) foot template and 2 inch for settling basin side slopes measured from a ten (10) foot template.
9. Hardened concrete which is not within specified tolerances shall be repaired to bring it within those tolerances in accordance with the U.S. Department of The Interior, Bureau of Reclamation, Standard Specifications for Repair of Concrete M-47. Concrete repair to bring concrete within tolerances shall be done only after consultation with the District regarding the method of repair. The Contractor shall notify the District as to the time when repair will be performed.
10. Temperature of Concrete and Concrete Placement.
- a. Temperatures of concrete at placement shall be between 50°F and 80°F. The temperature will be determined by placing a thermometer in the concrete immediately after sampling at the

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placement site. Then the temperature of the concrete at the batch plant shall be adjusted to assure that the specified concrete temperature is attained at the placement.

- b. Concrete ingredients shall be heated as necessary, but shall not be heated to a temperature higher than that necessary to keep the temperature of the concrete from falling below the specified minimum temperature.
- c. Hot and cold weather concreting shall conform to the requirements of ACI-305 and ACI-306, respectively.

3.08 Finishes and Finishing

General. Finishing of concrete shall be performed in accordance with ACI-304 as modified below.

A. Formed Surfaces Upon or Against Which Fill Material Is to Be Placed.

Form tie rod ends on surfaces which will be in contact with fill material shall be protected from moisture. Protection shall consist of recessing the tie rod ends and filling the recesses with dry pack in accordance with U. S. Department of the Interior, Bureau of Reclamation Standard Specification for Repair of Concrete M-47.

B. Formed Surfaces Exposed to Public View.

Form tie rod ends on surfaces which will be exposed to the view shall be protected from moisture. Protection shall consist of recessing the tie rod ends and filling the recesses with dry pack in accordance with the United States Department of the Interior, Bureau of Reclamation Standard Specification for Repair of Concrete M-47. After all required patching and correction of imperfections have been completed, surfaces shall be rubbed while surfaces are still damp with a Carborundum stone surfacing tool. Rubbing shall remove all imperfections left in the formed concrete, i.e., seams and woodgrain impressions, etc.

C. Unformed Settling Basin Lining Surfaces

Floating may be performed by use of hand or powered driven equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently, but before bleed water forms, and shall be the minimum necessary to produce a surface that is free of screed marks and is uniform in texture. Floating shall be continued until a small amount of mortar without excess water is brought to the surface. The finished surface shall be equivalent in evenness, smoothness, and freedom from rock pockets and surface voids to that obtainable by effective use of a long-handled steel trowel. Light surface pitting and light trowel marks will not be considered objectionable for settling basin lining. Where the surface produced by a lining machine, meets the specified requirements, no further finishing will be required.

D. Exposed Aggregate Finish

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Select aggregates, usually of uniform sizes 1/4 inch to 1/3 inch or larger shall be evenly distributed on the surface immediately after the slab has been bullfloated. Flat or elongated aggregate particles should not be used since they could be dislodged while being exposed. Aggregates to be exposed should be washed thoroughly before use to assure a satisfactory bond. The aggregate particles must be completely embedded in concrete. When the concrete has hardened sufficiently, the aggregate should be exposed by simultaneously brushing and flushing with water.

E. Unformed Surface Exposed to the Public

These surfaces shall receive a trowel and broom finish. After bleed water has disappeared and when the floated surface has hardened sufficiently to prevent an excess of fine material from being drawn to the surface, steel troweling shall be started. Steel troweling shall be performed with firm pressure so as to flatten the sandy texture of the floated surface and produce a dense uniform surface, free from blemishes and trowel marks. A slip-resistant surface shall be produced by brooming before the concrete has thoroughly hardened, but is sufficiently hard to retain a scoring.

3.09 Protection

- A. The Contractor shall protect all concrete against damage until final acceptance by the District. Concrete shall not be loaded, forms and shoring shall not be removed, and backfill shall not be placed against concrete until the concrete has gained sufficient strength to safely support its weight and all imposed loads.
- B. Fresh concrete shall be protected against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.
- C. Whenever freezing temperatures are imminent, the Contractor shall enclose exposed concrete with warmth-retaining sheets or other insulating means and maintain the concrete at a temperature of not less than 50°F for 72 hours after placement.
- D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented combustion heaters will not be permitted during the first 24 hours of curing unless unformed concrete surfaces are sealed from the resulting carbon dioxide rich environment.
- E. Discontinuance of protection against cold temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 5°F per hour and 40°F in 24 hours.
- F. When precipitation or freezing weather appears imminent, the Contractor shall immediately make ready at the placement site all materials which may be required for protection of concrete. The District may delay placement of concrete until adequate provisions for protection against weather are made. These costs shall be borne by the Contractor.
- G. Concrete curing membranes shall be kept intact, and other curing materials and processes shall be maintained as necessary to assure continuous curing for the minimum specified curing time.

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3.10 Curing of Concrete

All concrete is to be cured. Curing of concrete shall be in accordance with ACI-308 as modified below.

- A. All concrete surfaces shall be treated as specified to prevent loss of moisture from the concrete until the required curing period has elapsed or until immediately prior to placement of other concrete or backfill against those surfaces. Only sufficient time to prepare construction joint surfaces and to bring them to a surface-dry condition shall be allowed between discontinuance of curing and placement of adjacent concrete.
- B. As soon as unformed concrete surfaces have been finished, as specified, and have attained a dull appearance free from bleed water and moist sheen, they shall be treated as specified herein.
- C. Forms shall be removed within 24 hours after the concrete has hardened sufficiently to prevent structural collapse or other damage by careful form removal. Where required, repair of all minor surface imperfections shall be made immediately after form removal. Minor surface repair shall be completed within two (2) hours after form removal and shall be immediately followed by the initiation of curing by the applicable method specified. Concrete surfaces shall be kept continuously moist before and after form removal until initiation of curing.
- D. Curing with Compound
  - 1. Curing shall be by application to designated concrete surfaces to provide water-retaining film. The curing compound shall be reapplied as necessary to maintain a continuous, water-retaining film on the surface for seven (7) days. The curing compound shall be mixed thoroughly and spray-applied to the concrete surfaces in one coat to provide a continuous, uniform film over the concrete. The coverage rate shall be not less than 200 square feet per gallon. Special care shall be taken to ensure ample coverage with the compound at edges, corners, and rough surfaces, and to keep curing compound off waterstops and reinforcing steel. In applying curing compound, care shall be taken to produce a uniform, continuous film, and to avoid sagging, puddling, and excessive thickness. To prevent sagging on surfaces which are not horizontal, application shall consist of two or more passes over each point on the surface, using a cross-spraying technique, and with a time interval between passes not exceeding thirty (30) minutes. The application shall be performed by personnel qualified in using the specified spray techniques.
  - 2. In order to ensure bond of curing compound, the Contractor shall remove excessive form oil from concrete surfaces by washing with a solution of trisodium phosphate, followed by a thorough rinsing of the surfaces with clear water. The trisodium phosphate wash will be required when it is determined by the District that the amount of form oil on the concrete will impair the bond of the curing compound or when surfaces are exposed to public view.
  - 3. Formed concrete surfaces shall be kept continuously moist by repeated light spraying with water until immediately prior to application of curing compound. Curing compound shall be applied as soon as the surface film

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of moisture has disappeared, but while the concrete still has a damp appearance.

4. After application of the curing compound has been completed and the coating is dry to touch, all remaining required concrete repairs shall be performed without delay in accordance with Article 3.11, Repair of Concrete, of this Section. Completed repairs shall be moistened and coated with curing compound in accordance with the foregoing requirements.

### 3.11 Repair of Concrete

Repair of Concrete shall be in accordance with latest edition of United States Department of The Interior Bureau of Reclamation Standard Specifications for Repair of Concrete M-47.

### 3.12 Plaster Application

Application of plaster shall conform to the provisions of ASTM C 842 for plaster applied and finished by hand.

### 3.13 Field Quality Control

The Contractor shall obtain samples and conduct tests as specified in these Contract Documents and as specified below, and based upon the results of these tests, shall take the action required:

#### A. Batch-Plant Control

1. Frequency of Test. The Contractor shall require the Certified Testing Firm to perform an inspection of the Batch Plant to assure compliance with these Contract Documents. This inspection shall be conducted prior to placement of the first batch of concrete.
2. Corrective Action. The Contractor shall require the Batch Plant to correct all deficiencies prior to batching the first batch of concrete, or shall provide another batch plant which meets the requirements of these Contract Documents.

#### B. Concrete Materials

##### 1. Sand and Coarse Aggregate

##### a. Frequency of Tests.

- (1) The Contractor shall perform gradation and fineness modulus tests as specified in these Contract Documents prior to batching the first batch of concrete, and every time an additional, new material is used in the concrete mix or when the source is changed.

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- (2) The Contractor shall perform all tests as specified in these Contract Documents prior to batching the first batch of concrete and every time the source is changed.

b. Corrective Action.

The Contractor shall resample and retest material which does not meet the requirements specified in these Contract Documents. If the material still does not meet the requirements specified in these Contract Documents, the Contractor shall provide another source. This shall be provided at the Contractor's expense until the specified requirements in these Contract Documents are met.

2. Water

- a. Frequency of Test. The Contractor shall test the water for soluble sulfate content in accordance with the Bureau of Reclamation "Method of Test for Determining the Quantity of Soluble Sulfate in Solid (Soil or Rock) and Water Samples," prior to batching the first batch of concrete, and every time the source is changed.
- b. Corrective Action. The Contractor shall resample and retest water which does not meet the requirements specified in these Contract Documents. If the water still does not meet the requirements specified in these Contract Documents, the Contractor shall provide another source. This shall be provided at the Contractor's expense until the specified requirements in these Contract Documents are met.

3. Air-Entraining and Chemical Admixtures

a. Frequency of Test.

- (1) If chemical admixtures are used in the concrete design, the Contractor shall confirm compliance as specified in these Contract Documents by testing the materials prior to batching the first batch of concrete, and every time a new material is used in the concrete mix or when the source is changed.
- (2) The Contractor shall confirm compliance as specified in these Contract Documents by testing the air-entraining admixture prior to batching the first batch of concrete, and every time a new material is used in the concrete mix or when the source is changed.

- b. Corrective Action. The Contractor shall resample and retest material which does not meet the requirements specified in these Contract Documents. If the material still does not meet the requirements specified in these Contract Documents, the Contractor shall provide another source. This shall be provided at

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the Contractor's expense until the specified requirements in these Contract Documents are met.

4. Concrete Mixture

a. Compressive Strength Tests.

(1) Frequency of Test

- (a) Contractor shall make one set of four (4) standard cylinders as per ASTM C 31 for each compressive strength test as per ASTM C 39. Two cylinders to be tested at seven (7) days and two cylinders to be tested at seven (7) days.
- (b) The Contractor shall make a minimum of two sets of specimens (8 cylinders) every day, or one set of test specimens (4 cylinders) for each 50 cubic yards, of each strength of concrete placed, whichever is greater. For concrete placement of ten yards (one delivery truck) or less in one day, the Contractor shall make one set of specimens (4 cylinders). The District will determine when testing shall be performed by the Contractor.
- (c) A compressive strength test as per ASTM C 39 will be considered satisfactory so long as the average of the test results of two (2) companion cylinders equals or exceeds the specified compressive strength and no individual cylinder test result falls below the specified compressive strength by more than 500 pounds per square inch.
- (d) If additional testing is requested by the District, which exceeds the minimum frequency specified in these Contract Documents, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.

(2) Corrective Action.

- (a) When any concrete compressive strength test of standard-cured test cylinders for all concrete does not meet the requirements for satisfactory concrete as specified above, or if tests of field-cured cylinders indicate deficiencies in protection and curing, nondestructive testing in accordance with ASTM C 597, or ASTM C 803, or ASTM C 805 will be performed to estimate the relative strengths at various locations in the structure as an aid in

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evaluating concrete strength in place and for selecting areas to be cored. Such tests shall not be used as a basis for acceptance or rejection.

- (b) The Contractor shall obtain and test cores in accordance with ASTM C 42. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered unsatisfactory. The location of cores will be determined by the District to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified compressive strength requirement. If this test indicates that the concrete is unsatisfactory, the Contractor shall be required to remove that portion of the unsatisfactory concrete from construction joint to construction joint. This removal shall include doweling or connecting of the new concrete to the existing concrete. If the test indicates that the concrete is satisfactory, the Contractor shall be required to repair the holes from the cores as specified in the U.S. Department of The Interior, Bureau of Reclamation, Standard Specifications for Repair of Concrete M-47.

b. Slump Test.

(1) Frequency of Test.

- (a) The Contractor shall test at the same frequency as specified for the compressive strength tests. The District will determine when testing shall be performed by the Contractor. The Contractor shall test for slump as specified in ASTM C 143.

- (b) If additional testing is requested by the District, which exceeds the minimum frequency specified in these Contract Documents, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The testing requested of the Contractor by the District will be those test of concrete required in this Section. The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.

(2) Corrective Action.

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- (a) If the slump test does not meet the requirements of the Contract Documents, a second test shall immediately be made on the same batch of concrete. If the second slump test does not meet the requirements of the Contract Documents, an adjustment shall be immediately made at the batch plant on the concrete mix design, and the concrete shall be discarded.
  - (b) The Contractor shall be required to perform additional compressive, slump, air content, and temperature tests from the following batch of concrete to verify the correctness of the adjustment. These additional tests shall be at the Contractor's expense.
- c. Air Content Test.
  - (1) Frequency of Test.
    - (a) The Contractor shall test at the same frequency as specified for the compressive strength tests. The District will determine when testing shall be performed by the Contractor. The District shall test the concrete mix for air content as specified in ASTM C 231.
    - (b) If additional testing is requested by the District, which exceeds the minimum frequency specified in these Contract Documents, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The testing requested of the Contractor by the District will be those tests of concrete required in this Section. The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.
  - (2) Corrective Action.
    - (a) If the air content test does not meet the requirements of the Contract Documents, a second test shall immediately be made on the same batch of concrete. If the second air content test does not meet the requirements of these Contract Documents, an adjustment shall be immediately made at the batch plant on the concrete mix design, and the concrete shall be discarded.
    - (b) The Contractor shall be required to perform additional compressive, slump, air content, and temperature tests from the following batch of concrete to verify the correctness of the adjustment.

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These additional tests shall be at the Contractor's expense.

d. Temperature of Concrete

(1) Frequency of Test.

- (a) The Contractor shall test at the same frequency as specified for the compressive strength tests. The District will determine when testing shall be performed by the Contractor. The District shall test the temperature of the concrete as specified in ASTM C 1064.
- (b) If additional testing is requested by the District, which exceeds the minimum frequency specified in these Contract Documents, the District will pay for additional passing test(s) while the Contractor shall pay for additional failing test(s). The testing requested of the Contractor by the District will be those tests of concrete required in this Section. The Contractor shall immediately notify the District if any unsatisfactory test conditions are observed to exist.

(2) Corrective Action.

- (a) If the temperature test does not meet the requirements of these Contract Documents, a second test shall immediately be made on the same batch of concrete. If the second temperature test does not meet the requirements of these Contract Documents, an adjustment shall be immediately made at the batch plant on the concrete mix design, and the concrete shall be discarded.
- (b) The Contractor shall be required to perform additional compressive, slump, air content, and temperature tests from the following batch of concrete to verify the correctness of the adjustment. These additional tests shall be at the Contractor's expense.

END OF SECTION