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CONSTRUCTION SPECIFICATIONS

SUNRISE MOUNTAIN LANDFILL

CLARK COUNTY, NEVADA

TASK 4.4

REVISION 3, JULY 1, 2011

Prepared for:

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Prepared by:

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SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Project site location and access
2. General scope of work of the contract
3. Existing site conditions
4. Construction sequence
5. Construction Drawings
6. Manufacturer's specifications and instructions
7. Work quality
8. Access to work

1.02 PROJECT LOCATION AND ACCESS

A. Project Location: The Sunrise Mountain Landfill (Site) is located approximately 3 miles east of Las Vegas, in Clark County, Nevada on the eastern edge of Las Vegas Valley, immediately southeast of Frenchman Mountain. The Site includes the closed Sunrise Mountain Landfill, which lies on a 720-acre parcel of land that is leased to Clark County by the Bureau of Land Management (BLM); and three adjacent areas known as the Northeast Canyon Area, the Eastern Perimeter Area, and the Western Burn Pit Area.

B. Access: Access to the work area is via the Site's main entrance located at the west end of Vegas Valley Drive off of South Nellis Boulevard. The entrance to the Site shall be controlled by the Contractor to allow for efficient and safe operations and to limit access to the general public.

1.03 SCOPE OF WORK

A. General: The work is primarily site work related to the construction of a final cover system including storm water control features. The work is more fully detailed in the Specifications and Construction Drawings included herein.

B. Principal Features:

1. Mobilization of construction equipment and labor, and constructing temporary facilities for the Contractor, including proper storage of materials.
2. Installation of temporary facilities to support the Contractor's work.
3. Excavations required for:
    a. Refuse relocation
    b. Obtaining soil barrier and erosion layer material from on site borrow areas (blasting likely to be required).

c. Excavation of sedimentation basins

d. Construction of detention dam

4. Obtaining, sizing, and installing the following materials from On-Site sources and Contractor selected sources:

a. Soil barrier layer

b. Erosion protection layer

c. Dam fill

d. Gravel fill

e. Sand bedding

f. Roller compacted concrete (RCC)

g. General fill

h. Structural fill

i. Riprap

C. The above description of the work is for general information only, and in no way limits the responsibility of the Contractor for accomplishing the work in strict accordance with the Construction Drawings and Specifications listed in the table of contents and contained herein, as well as other Specifications referenced herein.

1.04 EXISTING SITE CONDITIONS

A. The Contractor is advised that there are survey monuments, underground utilities, landfill gas (LFG) collection system components, paved roads, fencing, LFG perimeter probes, and groundwater monitoring wells on the Project Site. The Contractor shall be responsible for the repair or replacement of any existing facilities and equipment damaged by the Contractor's personnel, equipment, subcontractors, or material suppliers.

B. The Contractor is advised that the construction of this project will entail working directly with buried refuse. As buried organic materials decompose anaerobically, they generate LFG. This LFG normally consists of approximately 45 percent carbon dioxide (CO2), 55 percent methane (CH4), and minor quantities of other gases dependent on the composition of the buried materials. Hydrogen sulfide (H2S) and other toxic gases have been encountered at similar sites, and may be present at this Site even though during operation it was not classified to accept hazardous waste.

C. The Site is permitted by the State of Nevada and was operated to prohibit the disposal of "hazardous solid waste". Notwithstanding the above, the Owner cannot guarantee that toxic or hazardous materials or vapors will not be encountered by the Contractor during the performance of this project.

D. Contractor shall be responsible for pre-survey to verify existing conditions and shall notify the Owner of discrepancies from the Drawings prior to construction.

1.05 CONSTRUCTION SEQUENCE

A. The sequence of operations is set forth below in Article 1.05.C. The Contractor may propose changes in sequence of construction for approval by the Owner’s Representative. Full

compensation for conforming to such requirements will be considered as included in the related Bid Schedule items of work and no additional compensation will be allowed therefore.

B. Meetings will be conducted between the Owner's Representative and Contractor prior to starting each sequence of construction listed below. The intent of these meetings is to review and discuss Specification requirements for that particular sequence of construction. During these meetings, the Contractor shall present a construction plan for each construction sequence as applicable, outlining and detailing the equipment, personnel, schedule, and materials required, including source, transportation, storage, excavation, placement, and compaction of materials proposed.

C. Sequence of Operations:

1. Mobilize.
2. Complete the pre-construction survey.
3. Prepare staking plan for soil barrier layer and regarding of areas of concentrated flow.
4. Complete plan preparations (including Safety Plan).
5. Layout survey of borrow areas and begin material processing of on-site borrow soils and stockpiles as necessary.
6. Bury LFG collection headers segment by segment with limited impact to landfill gas system operations.
7. Provide submittals for soil and rock components.
8. Grade the entire limits of Site to remove berms and other deformities to provide a smooth unyielding surface for Erosion Layer placement.
9. Layout survey for dam, relocate existing refuse from footprint of dam as shown on the Drawings, and construct dam and associated outlets, abutments, and drainage features. Construct dam embankment and principal spillway first then excavate for the RCC emergency spillway.
10. Prepare storm water control features outside the limits of waste and protect as necessary.
11. Place barrier layer soils starting in the North area and proceed toward the southern boundary of the Site.
12. Excavate storm water ditches and install aggregate base.
13. Complete topographic survey and generate map of top of soil barrier layer to document slopes of final surface.
14. Prepare erosion layer staking plan to identify slopes less than 10% for placement of 13 inch erosion layer and slopes of greater than or equal to 10% for placement of 14 inch erosion layer.
15. Place the erosion layer starting in the North area and proceed toward the southern boundary of the Site. All final surface features such as roadways and storm water control features will be installed and completed.
16. Install rip rap and concrete lined storm water conveyance structures.
17. Install pipe and box culverts.

18. Complete final site pickup and complete any items identified in the punch list walkthrough.

19. Demobilize.

1.06 CONSTRUCTION DRAWINGS

A. Where "as shown," "as detailed," "as noted," or words of like meaning are used in the Contract Documents, it shall be understood that reference is being made to the Construction Drawings unless otherwise specified.

1.07 MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS

A. Unless otherwise indicated or specified, all manufactured materials, products, processes, equipment, or the like shall be installed or applied consistent with the Manufacturer's instructions, directions, or Specifications. Said installation or application shall be in accordance with printed instructions furnished by the Manufacturer of the material or equipment concerned for use under conditions similar to those at the Site. Two copies of such instructions shall be furnished to the Owner's Representative and his acceptance thereof obtained before work is begun.

B. Any deviation from the Manufacturer's printed recommendations shall be explained and acknowledged as correct for the circumstances, in writing, by the particular Manufacturer. The Contractor will be held responsible for all installations not conforming to the Manufacturer's recommendations. If any item of material or equipment is found to be installed not consistent with the Manufacturer's recommendations, the Contractor shall make all changes necessary to achieve such compliance.

C. Contractor shall secure all field measurements required for proper and accurate fabrication and installation of the work included in this Contract. Exact measurements are the Contractor's responsibility. The Contractor shall also furnish or obtain all templates, patterns, and setting instructions required for the installation of all work. All dimensions shall be verified by the Contractor in the field.

1.08 WORK QUALITY

A. Shop and field work shall be performed by mechanics and workers skilled and experienced in the fabrication and installation of the work feature involved. All work under this Contract shall be performed consistent with the best practices of the various trades involved and consistent with the Construction Drawings, reviewed shop drawings, and these Specifications.

B. All work shall be erected and installed plumb, level, square and true, or true to indicated angle, and in proper alignment and relationship to the work of other trades. All finished work shall be free from defects and damage.

C. The Owner's Representative reserves the right to reject any and all materials and work quality which is not considered to be up to the general standards of the various trades involved. Such inferior material or work quality shall be repaired or replaced, as directed, at no additional cost to the Owner's Representative.

1.09 ACCESS TO WORK

A. The authorized representatives of the following government agencies will have the right of access to inspect the work covered by these Contract Documents during the performance of this Contract:

1. U.S. Environmental Protection Agency
2. U.S. Bureau of Land Management
3. Nevada Department of Environmental Protection
4. Clark County Department of Environmental Health.
5. Nevada Division of Water Resources
6. Other local, state, and federal agencies.

B. These inspections will be performed in the presence of the Owner's Representative. Reasonable facilities for the proper handling and inspection of the materials and the work shall be furnished by the Contractor.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Contractor and subcontractors shall adhere to mitigation methods defined in the Clean Diesel Plan for closure of the Site.

PART 4 MEASUREMENTS AND PAYMENT

A. METHOD OF MEASUREMENT

Not used.

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The items listed below, refer to and are the same pay items listed on the Sunrise Landfill Corrective Action Plan Project Bid Form. They constitute all of the lump sum and unit cost pay items for the completion of the Work.

B. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, services, including but not limited to the Owner's representative and Contractor's field offices and sheds, job signs, sanitary requirements, testing, safety devices, submittals, record drawings, water supplies, dust controls, power, telephone, maintaining traffic, removal of Contractor generated waste, watchmen, security, bonds, insurance, surveying and all other conditions of the General Provisions. Compensation for all such labor, materials, and services shall be included in the bid prices stipulated for the lump sum, unit cost, and contingency pay items.

C. Each lump sum and unit bid price will be deemed to include an amount considered by the Contractor to be adequate compensation to cover the Contractor's overhead and profit for each of the separately identified pay items.

D. Contractor mobilization and demobilization shall be paid for separately with a lump sum pay item.

E. Siltation and erosion controls including, but not limited to silt fencing, straw bales, erosion control matting, and other measures, and compliance with all storm water management/sediment control regulations shall not be paid for separately and shall be included in the bid prices stipulated for the lump sum and unit price pay items.

F. All Contractor Health and Safety provisions to perform the work will not be paid for separately and shall be included in the bid prices stipulated for the lump sum, unit price, and contingency pay items.

G. Contractor Quality Control (CQC) Plan and associated testing provisions during the progression of the work will not be paid for separately and shall be included in the bid prices stipulated for the lump sum, unit price, and contingency pay items.

H. Monthly Payment Applications for Lump Sum and Unit Price Items in progress shall be based on the percent complete at the end of each month as determined by the owner. During the last week of each month, the Contractor is responsible for providing the owner with records of construction that has occurred during the month. The Owner will consider the information provided by the Contractor and other information as necessary before making a determination on the percent complete on each pay item for the month. The Contractor's monthly payment application should reflect the percent complete for each pay item as determined by the owner.

1.02 RELATED DOCUMENTS

A. The Construction Drawings and General Conditions of the Contract, including General Provisions and Special Provisions and other Specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies administrative and procedural requirements for lump sum, unit price, and contingency pay items.

B. A Lump Sum price is an amount proposed by bidders and stated on the Bid Form as a price where measurement will not be made for payment for materials, services and/or work identified in the Construction Drawings and Specifications for a particular pay item. The Contractor will not be entitled to any adjustment in a lump sum bid price as a result of any change caused by a variation in quantities as a result of more accurate measurements. The Contractor agrees to accept the aforesaid lump sum bid price as complete and total compensation for all work to be performed under a lump sum pay item.

C. A Unit Price is an amount proposed by bidders and stated on the Bid Form as a price per unit of measurement based on the Engineer's estimated quantities for materials and/or services. In the event the actual quantities of work are less than or exceed the Engineer's estimated quantities, adjustment in the unit price bid for the work may be adjusted upon request by either the owner or Contractor, as stipulated in the General Provisions of the Contract.

D. Lump sum and unit prices shall include all necessary material, overhead, profit and applicable taxes.

E. Refer to individual Technical Specifications sections for construction activities requiring the establishment of bid prices.

F. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit cost bid prices, and to have this work measured by an independent surveyor the owner's expense.

G. The Owner reserves the right to reject the Contractor's work in place until the work meets the requirements of the Construction Drawings and Specifications.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement Standards: All work to be paid for at a Contract price per unit of measurement will be verified by the Owner consistent with United States Standard Measures.

B. Measurement by Volume:

1. Measurement by volume will be by the cubic dimension listed or indicated in the Bid Schedule. Method of volume measurement will be as determined or directed by the Owner.
2. Confirmation of volume may be required by utilizing weighing methods. In this event, such volumes will be converted to weight measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Owner and shall be agreed to by the Contractor before such method of measurement of pay quantities will be accepted.

C. Measurement by Area: Measurement by area will be by the square dimension listed or indicated in the Bid Schedule. Method of square measurement will be as determined or directed by the Owner.

D. Linear Measurement: Linear measurement will be by the linear dimension listed or indicated in the Bid Schedule. Method of linear measurement will be as determined or directed by the Owner. Generally, items, components, or work to be measured will be measured at the centerline of the item in place.

E. Lump-Sum Measurement: Lump-sum measurement will be for the entire item, unit of work, structure, or combination thereof, as listed or indicated in the Bid Schedule.

1.05 FIELD MEASUREMENT FOR PAYMENT

A. The Contractor shall compute all quantities of work performed or of materials and equipment delivered to the site for payment purposes.

B. The Owner may at any time verify quantities calculated by the Contractor consistent with the provisions of Section 01050 of these Specifications.

1.06 PAYMENT

A. Payment will be full compensation for furnishing all labor, materials, tools, equipment, transportation, services, and incidentals, as specified, and for performing all work necessary for completing the erection or installation of the item or work classification, including all adjusting and balancing, testing, cleaning, and all other incidental work.

B. Full compensation for all expenses involved in conforming to the requirements for measuring materials or work shall be considered as included in the unit or lump-sum prices paid for the materials or work being measured, and no additional compensation will be permitted.

C. Full compensation for an item of work for which no measurement or payment is specified will be considered to be included in the applicable related item of work in the Bid Schedule or incidental of the Contract.

1.07 VALUES OF UNIT PRICES

A. The number of units and quantities contained in the Bid Schedule are approximate only, and final payment will be made for the actual number of units and quantities which are incorporated in or made necessary by the work included in this Contract.

B. In the event that work and materials or equipment are required to be furnished to a greater or lesser extent than is indicated by the Construction Drawings and Specifications, such work and materials or equipment shall be furnished in greater or lesser quantities.

1.08 CHANGES AND EXTRA WORK

A. Changes and extra work ordered by the Owner/Owner's Representative will be measured and paid for consistent with the requirements of Article 10 of the General Conditions.

1.09 REJECTED MATERIALS

A. Quantities of material wasted or disposed of in a manner not called for under the Contract; rejected loads of material, including material rejected after it has been placed by reasons of the failure of the Contractor to conform to the provisions of the Contract; material not unloaded from the transporting vehicle; material placed outside the limits indicated on the Drawings or established by the Owner; or material remaining on hand after completion of the work, will not be paid for, and such quantities shall not be included in the final total quantities. No compensation will be permitted for loading, hauling, and disposing of rejected material. Contractor is responsible for removing rejected and unused materials from site.

1.010 CONTRACT BID ITEMS

Bid Item 1 Mobilization/Demobilization

A. Basis of Measurement: Lump Sum (LS)

B. Basis for Payment: Includes mobilization and demobilization of equipment, materials, and labor as required to complete the Work, prepare Contractor's staging area including all temporary control facilities and temporary controls (including but not limited to pollution control, dust control, traffic control and safety) and any other administrative costs necessary to complete work described in Division 1. Fifty percent (50%) of the mobilization/demobilization will be paid after mobilization and completion of 25% of the Work. The balance of the payment will be made after submittal to and acceptance by the Owner. The total amount quoted for mobilization/demobilization in the base bid schedule shall not exceed ten (10) percent of the total net base bid price.

Bid Item 2 Layout of Work and Surveys

A. Measurement, Lump Sum (LS).

B. Includes all work necessary to perform layout of work and surveys as described in Section 01050.

Bid Item 3 Site Grading

A. Basis of Measurement: Acre (AC) Based on survey of actual area graded.

B. Basis for Payment: Includes all labor and equipment necessary to complete the grading of the site to remove small soil stockpiles, remove pipe anchoring soil piles and fill in small undulations in preparation for the placement of the erosion layer.

Bid Item 4A Dam Foundation Excavation

A. Basis of Measurement: Cubic Yard (CY). Based on survey of completed excavation grade compared to the existing grades found in the contract construction drawings excluding excavation of soils in the detention basin used as earthfill in the detention dam.

B. Basis for Payment: Includes all labor and equipment necessary to complete the work described in Section 02220 and as defined in the Contract Drawings and Specifications. Excavation of earthfill materials in the detention basin for use as earthfill in the detention dam shall not be compensated as excavation.

Bid Item 4B Basin Excavation

A. Basis of Measurement: Cubic Yard (CY). Based on survey of completed excavation grade compared to the existing grades found in the contract construction drawings.

B. Basis for Payment: Includes all labor and equipment necessary to complete the work described in Section 02220 and as defined in the Contract Drawings and Specifications.

Bid Item 5 Abutment Cutoff Wall Excavation and Fill

A. Basis of Measurement: Square Yard (SY). Based on survey of completed excavation grade compared to the surveyed top of excavation grades times the surveyed length of the cutoff wall.

B. Basis for Payment: Includes all labor and equipment necessary to complete the work described in Sections 02220 and 02224 and as defined in the Contract Drawings and Specifications.

Bid Item 6A Waste Relocation for Dam

A. Basis of Measurement: Cubic Yard (CY). Based on survey of compacted waste and daily cover in final location.

B. Basis for Payment: Furnish all labor, materials, equipment, tools, safety supplies and appurtenances required to complete the work of relocating all waste materials during and as the result of the construction operations under this Contract, as specified or required.

Bid Item 6B Waste Relocation for T Wash Area

A. Basis of Measurement: Cubic Yard (CY). Based on survey of compacted waste and daily cover in final location.

B. Basis for Payment: Furnish all labor, materials, equipment, tools, safety supplies and appurtenances required to complete the work of relocating all waste materials during and as the result of the construction operations under this Contract, as specified or required.

Bid Item 7 Soil Barrier Layer

A. Basis of Measurement: Cubic Yard (CY). Based on a volume of barrier layer material placed as determined by the survey of the completed top of barrier layer material compared to the existing grades found in the contract Construction Drawings.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to sections 02220 and 02224 and the contract Construction Drawings.

Bid Item 8 Quarry Development and Closure

A. Basis of Measurement: Lump sum (LS).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for performing the closure of the quarry area in conformance with section 02222.

Bid Item 9 Erosion Layer ≥ 10% slope

A. Basis of Measurement: Cubic Yard (CY). Based on survey of area covered with erosion layer slope ≥10% material multiplied by the neat line thickness required.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02224 and the contract Construction Drawings.

Bid Item 10 Erosion Layer < 10% slope

A. Basis of Measurement: Cubic Yard (CY). Based on survey of area covered with erosion layer slope ≤10% material multiplied by the neat line thickness required.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02224 and the contract Construction Drawings.

Bid Item 11 Type 2, Class B Aggregate Base

A. Basis of Measurement: Cubic Yard (CY). Based on survey of area covered with aggregate base material multiplied by the neat line thickness required.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to sections 02224 and 03100 and the contract Construction Drawings.

Bid Item 12A Rip Rap Storm Water Channel

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work including channel excavation (soil and waste), base aggregate placement, and rip rap placement including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to sections 02220, 02224, and 02228 and the contract Construction Drawings.

Bid Item 12B Rip Rap

C. Basis of Measurement: Cubic Yard (CY). Measured over the area covered multiplied by the neat line thickness required.

D. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, dam road channel material, NDOT 300 dam toe channel material, and incidentals as necessary to complete the work in reference to section 02224 and the contract Construction Drawings.

Bid Item 13 Concrete Storm Water Channel

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work including soil excavation, waste excavation and relocation, base aggregate material placement, rock anchors, epoxy, cutoff walls and incidentals as necessary to complete the construction including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to sections 03100, 03101, or 03411 (if pre-cast) and the contract Construction Drawings.

Bid Item 14 3' x 5' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 15 3' x 6' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 16 4' x 6' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 17 4' x 7' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation,

backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 18 6' x 12' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 19 7' x 7' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 20 24-inch Diameter RCP Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the RCP culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and section 03113 of the Specifications.

Bid Item 21 30-inch Diameter RCP Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the RCP culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and section 03113 of the Specifications.

Bid Item 22 36-inch CMP Principal Spillway Outlet Riser

A. Basis of Measurement: Each (EA).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the CMP culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and section 02722 of the Specifications.

Bid Item 23 Dam Embankment

A. Basis of Measurement: Cubic Yard (CY). Based on survey.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the construction of the dam embankment in reference to sections 02224 and the contract Construction Drawings.

Bid Item 24 Roller Compacted Concrete

A. Basis of Measurement: Cubic Yard (CY).

B. Basis for Payment: Payment will constitute full compensation for furnishing all labor, materials (including cementitious materials), equipment, tools, transportation, water and materials for curing and all other items necessary and incidental to the construction of the roller-compacted complete in-place. The volume of RCC used in constructing the test section(s) will be measured and included in the computation of total volume of RCC placed. The unit price shall include conducting and testing mix designs, tests, test section, temperature control, foundation preparation (rock), bedding mixes, grout enriched RCC (GE-RCC), bedding mortar, joint treatment, curing, compaction, surface finishing and all labor, equipment and materials for the RCC.

Bid Item 25 Class 4000 Concrete Dam Structures

A. Basis of Measurement: Cubic Yard (CY).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, NDOT #4 stone and incidentals as necessary to complete the construction of the roller compacted dam structures in reference to sections 03101 and the contract Construction Drawings.

Bid Item 27 NDOT No. 57 Stone

A. Basis of Measurement: Cubic Yard (CY).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the construction of the dam blanket drain and spillway perimeter drain in accordance with the Construction Plans and Specifications.

Bid Item 28 12 oz/sy Nonwoven Geotextile

A. Basis of Measurement: Square Foot (SF). Square footage of geotextile installed not including overlaps.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals as necessary to complete the construction of the geotextile for the blanket drain, toe drain, perimeter drain as shown on the Construction Drawings and described in section 02243.

Bid Item 29 48-inch Reinforced Concrete Pipe ASTM 361 E30

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, bedding, and incidentals as necessary to complete the work in reference to section 03113 and the contract Construction Drawings.

Bid Item 30 12-inch Diameter Corrugated Metal Pipe

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, NDOT granular backfill, and incidentals as necessary to complete the work in reference to section 02722 and the contract Construction Drawings.

Bid Item 31 24-inch Diameter Corrugated Metal Pipe

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02722 and the contract Construction Drawings.

Bid Item 32 30-inch Diameter Corrugated Metal Pipe

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02722 and the contract Construction Drawings.

Bid Item 33 36-inch Diameter Corrugated Metal Pipe

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and

incidentals as necessary to complete the work in reference to section 02722 and the contract Construction Drawings.

Bid Item 34 48-inch Diameter Corrugated Metal Pipe

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02722 and the contract Construction Drawings.

Bid Item 35 12-inch Diameter SDR 17 HDPE Pipe (perforated and nonperforated)

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials,fittings, tools, equipment, NDOT granular backfill, and incidentals as necessary to complete the work in reference to the Specifactions and the contract Construction Drawings.

Bid Item 36 8-inch Diameter SDR 11 HDPE Pipe (perforated and nonperforated)

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials,fittings, tools, equipment, and incidentals as necessary to complete the work in reference to the Specifications and the contract Construction Drawings.

Bid Item 37 Salvaged 14-inch Diameter SDR 17.0 HDPE Pipe

A. Basis of Measurement: Lineal Foot (LF). Based on survey, performed every 50 feet along the crown of the installed pipe.

B. Basis for Payment: Includes work necessary salvage reinstall HDPE LFG pipe (perforated and nonperforated) including trench excavation, pipe bedding, backfill, pipe fittings, pipe anchors, pipe guides, blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, pipe placement, tracer wire, and other associated appurtenances as shown on the Construction Drawings and described in section 02232 of the Specifications.

Bid Item 38 New 6-inch Diameter SDR 17.0 HDPE Pipe

A. Basis of Measurement: Lineal Foot (LF). Based on survey, performed every 50-feet along the crown of the installed pipe.

B. Basis for Payment: Includes work necessary to supply and install HDPE LFG pipe (perforated and nonperforated) including trench excavation, pipe bedding, backfill, pipe fittings, pipe anchors, pipe guides, blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, pipe placement, tracer wires and other associated appurtenances as shown on the Construction Drawings and described in section 02232of the Specifications.

Bid Item 39 Salvaged 6-inch Diameter SDR 17.0 HDPE Pipe

A. Basis of Measurement: Lineal Foot (LF). Based on survey, performed every 50 feet along the crown of the installed pipe.

B. Basis for Payment: Includes work necessary to salvage and reinstall HDPE LFG pipe (perforated and nonperforated) including trench excavation, pipe bedding, backfill, pipe fittings, pipe anchors, pipe guides, blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, pipe placement, tracer wires and other associated appurtenances as shown on the Construction Drawings and described in section 02232 of the Specifications.

Bid Item 40 LFG Condensate Traps

A. Basis of Measurement: Each (EA).

B. Basis for Payment: Includes work necessary to reinstall condensate traps including trench excavation, vault boxes, pipe bedding, backfill, pipe fittings, pipe anchors, pipe guides, blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, pipe placement and other associated appurtenances as shown on the Construction Drawings and described in section 02232 of the Specifications.

Bid Item 41 New 14-inch Diameter LFG Butterfly Valves

A. Basis of Measurement: Each (EA).

B. Basis for Payment: Includes work necessary to supply and install valves including blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, vault boxes, 1" diameter HDPE pipe, stainless steel fittings, PVC fittings, pipe placement and other associated appurtenances as shown on the Construction Drawings and described in section 02231 of the Specifications.

Bid Item 42 New 6-inch Diameter LFG Butterfly Valves

A. Basis of Measurement: Each (EA).

B. Basis for Payment: Includes work necessary to supply and install valves including blind flanges, wyes, tees, reducers, branch saddles, bolts, fusion welding, vault boxes, 1" diameter HDPE pipe, stainless steel fittings, PVC fittings, pipe placement and other associated appurtenances as shown on the Construction Drawings and described in section 02231 of the Specifications.

Bid Item 43 Structural Backfill

A. Basis of Measurement: Cubic Yard (CY).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02224 and the contract Construction Drawings.

Bid Item 44 Foundation Treatment

A. Basis of Measurement: Square Foot (SF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02250 of the Specifications and the contract Construction Drawings. (includes treatment of gypsum seams)

Bid Item 45 Dental Concrete

A. Basis of Measurement: Square Yard (CY).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02250 and the contract Construction Drawings.

Bid Item 46 6-ft x 6-ft. Box Culvert Principal Spillway Riser

A. Basis of Measurement: Lump Sum (LS).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in the contract Construction Drawings. Lump Sum Price shall include box culvert, trash rack, foundation, and stone filter.

Bid Item 47 Fencing

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section 02222 and the contract Construction Drawings.

Bid Item 48 Drop Inlet Structures

A. Basis of Measurement: Each (EA).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to Nevada DOT Standard Specification Section 609 and the contract Construction Drawings.

Bid Item 49 Rock Fall Barrier Fence

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and

incidentals as necessary to complete the work in reference to section 02238 and the contract Construction Drawings.

Bid Item 50 Channel Debris Fencing

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to the contract Construction Drawings.

Bid Item 51 Rockfall and Adjacent Inlet Channels

A. Basis of Measurement: Lineal Foot (LF) of the concrete rockfall channel and sidewalls constructed by the Contractor and accepted by the Owner.

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner which includes labor, materials, and equipment to carry out the excavation, subgrade preparation, backfill, concrete lining with rock anchors and joints of the invert channel, sidewalls (vertical retaining and sloped transition sections) and incidentals as necessary to complete the work in reference to the contract Construction Drawings. This bid item also includes design of plans and specifications and construction for retaining walls for the rockfall and adjacent inlet channels. The concrete lining of the rockfall and adjacent inlet channels will be paid for using this bid item alone, no additional payment will be made for doing this work through other bid items.

Bid Item 52 Selective Demo

A. Basis of Measurement: Lump Sum (LS).

B. Basis for Payment: The quantity of work done will be paid at the contract lump sum bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the removal and salvaging of existing corrugated metal pipe (CMP), CMP Flumes, CMP inlets, and CMP anchors in reference to section 02070 of the Specifications and the contract drawings.

Bid Item 53 Wellhead Connections

A. Basis of Measurement: Each (EA).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the disconnection of the existing wellheads and subsequent reconnection after final piping installation and installation of 30 mil PVC well bore seals, 6" electro-fusion couplers, stainless steel clamps, and other associated appurtenances as necessary to complete the work in reference to the contract Construction Drawings.

Bid Item 54 5' x 12' Concrete Box Culverts

A. Basis of Measurement: Lineal Foot (LF).

B. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the box culverts including excavation, backfill, bedding, concrete headwall and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 55 Plunge Pools

C. Basis of Measurement: Each (EA).

D. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the installation of the plunge pools including excavation, backfill, bedding, concrete placement and reinforcement, rip rap, and all other associated appurtenances to provide a fully functional system according to the contract Construction Drawings and Specifications.

Bid Item 56 Asphalt Paving

E. Basis of Measurement: Lineal Foot (SY).

F. Basis for Payment: The quantity of work done will be paid at the contract unit price bid for this item, which price and payment shall be full compensation for doing all the work herein described in an acceptable manner, including the furnishing of all labor, materials, tools, equipment, and incidentals as necessary to complete the work in reference to section ~~02722~~02725 and the contract Construction Drawings.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used

END OF SECTION

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SECTION 01035

MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field Orders.

B. Work Directive Changes.

C. Change Orders.

1.02 RELATED SECTIONS

Not used.

1.03 REFERENCES

Not used.

1.04 CHANGE PROCEDURES

A. Owner's Representative will issue Field Orders for minor changes in the Work not involving an adjustment to Contract Price or Contract Time.

B. Owner's Representative may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Construction Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a Proposal with estimate within 5 days.

C. Contractor may request a change by submitting a Proposal to Owner's Representative, describing the proposed change and its full effect on the Work. A Proposal will include a statement describing the reason for the change, the effect on the Contract Price and Contract Time, and a statement describing the effect on Work by separate or other contractors.

D. Owner's Representative may issue a Work Change Directive for any change which, if not processed expeditiously, might delay the Project. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order.

E. Changes affecting Contract Price or Contract Time, resulting under paragraphs 1.04 B, C, and D of this Section, will be processed as a Change Order.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01050

CONTRACTOR SURVEYING & FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. The following are included in this Section:

1. Bench Mark
2. Contractor Surveying
3. Contractor Field Engineer
4. Coordination

1.02 RELATED SECTIONS

A. Section 01025 – Measurement and Payment

1.03 DESCRIPTION

A. Reference Points: The reference points to be provided by the Owner will include referenced monuments, survey control line(s), and elevation bench marks in the vicinity of the project. If displaced by the Contractor, replacement of these reference points will be at the expense of the Contractor. All other necessary reference points shall be established by the Contractor.

B. The Contractor shall furnish all necessary detail surveys including all lines, grades, and appropriate surveys as specified. Surveys shall be performed under direct supervision of a Nevada Registered Professional Land Surveyor.

C. The Owner reserves the right to perform any desired checking and correction of the Contractor's surveys but this shall not relieve the Contractor of the responsibility for adequate performance of the work. The Owner's Representative will complete any checking within 2 working days of the Contractor's completed survey.

D. Equipment and Personnel: The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required, consistent with recognized professional standards, and in proper condition and adjustment at all times.

E. Field Notes and Records: The Contractor shall record surveys in duplicate page field notebooks. The original pages of such records shall be furnished to the Owner's Representative at intervals required by the Owner. The Owner will have up to 2 working days to review the data and notify the Contractor of any errors. A duplicate of each field notebook shall be furnished to the Owner when filled or completed.

F. Use by the Owner: The Owner may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the work and may be checked by the Owner or Owner's Representative at any time. The Contractor shall be responsible for (1) any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective and (2) any resultant defects in the work. The Contractor will be required

to conduct resurveys or check surveys to correct errors indicated by review of the field notebooks or otherwise detected.

1.04 TOLERANCES

A. Vertical tolerance: + 0.2 ft for erosion and barrier layer.

B. Vertical Tolerance: +/- 0.1 ft. for channel flow lines.

1.05 CONTRACTOR'S SURVEYING

A. Contractor shall employ and retain, as needed, at the work site a surveyor with the experience and capability of performing all survey and layout tasks required of Contractor. Tasks included are:

1. Provide all surveying equipment required including but not limited to transit, level, stakes and required surveying accessories.
2. Furnish all required lines and grades for construction of dam and site grading.
3. Provide pre-construction survey of entire site to provide basis for all subsequent grading.
4. Provide preconstruction 50-foot grid of site to provide for subsequent thickness verification measurements.
5. Keep professional, accurate, well organized, and legible notes of all measurements and calculations made while surveying and laying out the work.
6. Survey, locate, and record and redline drawings to accurately represent the alignment of the dam as well as contours/elevations of final cuts and fills. Provide two hard copy as-built prints and electronically editable file (e.g., AutoCAD or similar) to Owner's Representative upon completion.
7. Re-establish control reference points damaged or destroyed by Contractor at Contractor's expense.
8. Perform such surveys and computations as are necessary to determine quantities of work performed or placed during each progress payment period.
9. 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.

B. Contractor shall notify the Owner's Representative at least 24 hours before performing a quantity survey and, unless waived in writing by the Owner's Representative, quantity surveys shall be performed in the presence of the Owner's Representative.

C. Primary Control Monuments

1. If monuments are damaged by Contractor, replace by Registered Land Surveyor at Contractor's expense.
2. Contractor shall:
    a. Arrange operations to avoid interference with establishment and maintenance of primary lines and grades. Restaking will be done by Contractor at Contractor's expense.

b. Check and document accuracy of line and grade by visual inspection, checks between stakes, and periodic checks (with surveying equipment) between primary control monuments and stakes as necessary to control the work. Submit all geometric control information to Owner's Representative prior to initiation of a work item requiring stakeout and on a continuing minimum weekly basis.

c. Protect and preserve stakes for project duration.

1.06 SURVEY SUBMITTALS

A. Survey submittal shall be made as described herein.

1. The original field books shall be submitted within 1 week upon acceptance of the work.
2. The surveyors' in-place volume calculations shall be submitted with progress payment requests.

1.07 SURVEYS FOR AS-BUILT DRAWINGS

A. The Contractor shall perform a preconstruction topographic survey (topos) immediately prior to the start of work and as-built topos at the completion of the following: top of subgrade, top of barrier layer, top of earth fills, and top of erosion layer. The as-built surveys shall be performed at a minimum 50-foot grid with elevations also taken at grade break points. The location of the survey points for each liner segment (subgrade, top of barrier layer, top of erosion layer) shall be directly above the survey point location previously obtained, (i.e., same northing and easting). Within the dam construction area, as-built drawings for the top of bedrock (dam foundation), dam embankment, RCC spillway, Ogee spillway, underdrain system, and storm water control structures shall be provided. Additional as-built drawings to be completed include the alignment and elevations of the dam outlet pipeline, all concrete and riprap ditches, box culverts, underground LFG piping and condensate trap locations and pipe culverts.

B. These as-builts shall be submitted on drawings to the Owner indicating location of survey point (i.e., northing, easting, and elevation) and shall be stamped by a Nevada Registered Professional Land Surveyor. The Owner shall have up to 5 working days to review and approve the as-built surveys. After final approval by the Owner, the Contractor shall submit three sets of final drawings for each survey. Final drawings shall present elevations of finished layers, the thickness difference between succeeding layers, and surveyed locations of all pipe bends and junctions.

1.08 RECORDS

A. Contractor shall maintain on Site a complete and accurate log of all control and survey Work as it progresses.

1. All survey data shall be in accordance with recognized professional surveying standards. All original field notes, computations, and other surveying data shall be recorded by Contractor's surveyor in Contractor furnished hard-bound field books, and shall be signed and sealed by Contractor's surveyor. The completeness and accuracy of all survey Work, and the completeness and accuracy of the survey records, including the field books, shall be the responsibility of Contractor. Failure to organize and maintain survey records in a professional manner to allow reasonable and independent verification of all calculations by the Owner's Representative and to allow reasonable identification by the Owner's Representative of all elevations, dimensions, and grades of the Work, shall be cause for rejection of the survey records, including the field books.

a. Illegible notes or data, or erasures on any page of the field books are not acceptable. Copied notes or data shall not be permitted. Corrections by ruling or lining out errors will be satisfactory only if initialed by the surveyor. Violation of the above may require resurveying the data in question.

1.09 CONTRACTOR'S FIELD ENGINEER

A. Contractor shall employ and retain at the Site a field engineer or experienced construction superintendent acceptable to Owner with the experience and capability of performing all engineering tasks required of Contractor. Tasks included are:

1. Provide daily reports of Project activity as specified in Section 01320.
2. Maintain field office files and drawings, Record Drawings, and coordinate engineering services with subcontractors. Prepare layout and coordination drawings for construction operations.
3. Check and coordinate Work for conflicts and interferences and immediately advise the Owner's Representative of all discrepancies noted.
4. Cooperate with Owner's Representative in field inspections, as required.
5. Review and coordinate submittals.

1.010 COORDINATION

A. The Contractor shall be responsible for ensuring that all underground utilities are marked by the utility Owner or the utility Owner's representative.

B. The Contractor shall coordinate and field survey all construction activities to allow the Owner's Representative or others to verify the surveying, or other activities related to the Work. The Contractor shall not proceed with any portion of the Work until the previous portion of the Work is survey checked, tested and/or otherwise approved by the Owner's Representative. The Owner's Representative will require the Contractor to uncover, remove, and/or reconstruct any portion of the work at no additional cost to the Owner if the Contractor performed that portion of the work prior to survey acceptance, and/or approval by the Owner's Representative.

C. The Contractor shall be responsible for coordinating the activities of all of his/her subcontractors. The Contractor shall notify the Owner's Representative a minimum of 24 hours prior to commencing any portion of the work that will require survey checks, testing and/or approval by the Owner's Representative or subcontractors.

D. The Contractor shall be responsible for coordination of schedules, workers, or any other requirements for any portion of the work. Coordination requirements include coordination with ongoing operations associated at the site.

E. The Contractor shall be responsible for any damage done by his/her subcontractors. The Contractor shall be responsible for the quality and adequacy of any work performed by his/her subcontractors.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

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SECTION 01052

HEALTH AND SAFETY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General requirements for the following:

1. Protection of health and safety of personnel
2. Additional considerations for Contractor's safety program

B. The provisions of this section are supplementary to other provisions specified elsewhere in the Contract Documents.

C. Nothing in this section shall preclude the Contractor from complying with the more stringent requirements of the applicable federal, state, county, and industry standards, rules, and regulations.

1.02 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01400 – Quality Control

C. Section 01500 – Temporary Facilities and Controls

1.03 REFERENCES

Not used.

1.04 SPECIAL SAFETY PRECAUTIONS

A. Since this project is located in a landfill and possibly in an area subject to gas migration, the Contractor shall become familiar with the potential hazards associated with landfill gas.

B. The following landfill and gas related information is included to assist the Contractor and is not intended to encompass all aspects to protect the workers or to comply with applicable regulations.

1.05 POTENTIAL FOR HAZARDS

A. Landfill gases usually vent to the atmosphere through the cover soils, but may migrate laterally to adjacent areas depending on site and weather conditions.

B. Landfill gases have the potential to create the following hazardous conditions if not controlled or recognized:

1. Landfill gases may collect in underground trenches, vaults, conduits, and structures, as well as in topographically low surface areas.
2. Fires may start spontaneously from exposed and/or decomposing refuse.
3. Fires and explosions may occur from the presence of methane gas.

4. Landfill gases may cause an oxygen deficiency in underground trenches, vaults, conduits, and structures, as well as in topographically low surface areas.
5. Hydrogen sulfide, a highly toxic and flammable gas, or other toxic gases may be present.
6. Possible caving of trenches and excavations may occur when working over or in refuse fills.

1.06 SAFETY PRECAUTIONS

A. In addition to conforming to the safety rules and regulations of governmental authorities having jurisdiction, the Contractor shall take the following precautionary measures:

1. Smoking shall be prohibited within the construction area.
2. If refuse is unintentionally exposed during construction activities, the Owner's Representative shall be notified immediately.

B. The contractor may encounter explosive and/or toxic gases during construction. Continuous monitoring for explosive and/or toxic gases is required for any depressed area. If gases are encountered over OSHA/NIOSH Permissible Levels within the project area, the Owner's Representative shall be notified immediately.

C. If gases are encountered over Permissible Levels, all of the Contractors and employees working within the area will need to have hazardous waste operations and emergency response (HAZWOPER) training.

D. Contractor's site specific safety program shall include the following measures:

1. Compliance with the requirements of OSHA and all other regulatory agency requirements.
2. Inhalation of landfill gases over Permissible Levels shall be avoided. Such gases or oxygen deficient air may cause nausea and dizziness, which could lead to accidents. Work should proceed in a direction upwind of the excavation where possible, unless the excavation is constantly monitored and declared safe.
3. Workers shall avoid contact with exposed refuse, condensate, or leachate. Irritants or hazardous materials may be present.
4. Fire extinguishers with a rating of at least A, B, and C shall be available at all times on the Site.
5. Start-up and shutdown of equipment shall be avoided in areas of exposed refuse.

1.07 SUBMITTALS

A. Contractor shall submit copies of Health and Safety Plan (HASP) to Owner's Representative within 14 days after notice to proceed. Work on-site shall not proceed until Contractor's HASP has been submitted and reviewed by Owner's Representative.

1. Submittal of Contractor's HASP to Owner's Representative is to inform Owner's Representative so they can comply with HASP during performance of their responsibilities as described in Contract Documents. Submittal of Contractor HASP shall neither impose on O wner's Representative responsibility for adequacy of HASP nor relieve Contractor from full responsibility therefore.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed Products list.

D. Shop Drawings.

E. Product Data.

F. Samples.

G. Manufacturer's installation instructions.

H. Manufacturers' certificates.

I. Warranties

J. Survey Submittals

1.02 RELATED SECTIONS

A. Section 01050 Survey and Field Engineering

B. Section 01310 Construction Schedule

C. Section 01400 Quality Control

D. Section 01600 Material and Equipment

E. Section 01700 Contract Closeout

F. Section 02224 Material Placement

G. Section 02243 Geotextile

H. Section 02722 Corrugated Metal Pipe

I. Section 03101 Cast-in-Place Concrete

J. Section 03411 Pre-Cast Concrete

K. Section 03440 Prestressed Concrete Cylinder Pipe

1.03 REFERENCES

Not used.

1.04 SUBMITTAL PROCEDURES

A. Transmit each submittal with a transmittal form. Provide a minimum of three copies of each submittal. Owner will retain one copy each.

B. Sequentially number the transmittal forms. For revised submittals, add an alphabetic suffix to the original number.

C. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number as appropriate.

D. Apply Contractor's stamp, signature, or initials certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Schedule submittals to expedite review by the Owner and delivery in the time frame specified. Coordinate submission of related items.

F. Allow seven days review time for each submittal excluding delivery time to and from the Contractor.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.

H. Provide space for Contractor and Owner's Representative review stamps.

I. If revisions and re-submittals are required, identify all changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

K. Submittals not requested will not be recognized or processed.

1.05 SURVEY

A. Submit survey data as specified in Section 01050.

B. Submit all quantity surveys with progress payment request as verification for payment

1.06 CONSTRUCTION PROGRESS SCHEDULES

A. Submit in accordance with Section 01310 Construction Schedule.

1.07 PROPOSED PRODUCTS LIST

A. Within 5 days after date of Owner\Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product and Material Safety Data Sheets (MSDS).

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.08 SHOP DRAWINGS

A. Submit the number of opaque reproductions which Contractor requires, plus 2 copies which will be retained by Owner.

B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 – Contract Closeout.

1.09 PRODUCT DATA

A. Submit the number of copies which the Contractor requires, plus 2 copies, which will be retained by the Owner.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 Contract Closeout.

1.010 SAMPLES

A. Geotechnical Conformance Sampling:

1. If requested by the Owner's Representative, submit material samples to the Owner's Representative in a clean 5 gallon bucket labeled with the following information:

   Material Name

   Date Sampled

   Sampler Name

   Submittal Date

B. Product Samples:

1. If requested by the Owner's Representative, submit product samples to the Owner's Representative with a chain of custody with the following information:

   Material Name

   Applicable Specification

   Submittal Date

1.011 MANUFACTURER INSTALLATION INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start up, adjusting, and finishing, to Owner's Representative in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.012 MANUFACTURER CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer to Owner's Representative, in quantities specified for each Product.

B. Indicate that material or Product conforms to or exceeds specified requirements. S ubmit supporting reference data, affidavits, certifications, and quality control testing.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Owner.

1.013 WARRANTIES

A. When specified in individual specifications, submit product warrantee information.

B. Comply with Section 01700 - Contract Closeout.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prepare in Microsoft Project and submit with Bid, a p reliminary construction schedule in compliance with Section 01300 - Submittals.

B. Owner will review the preliminary construction schedule and incorporate it into their overall project schedule.

C. The schedule should reflect a minimum placement rate for each soil material per day to complete the project.

D. The actual start date will be determined by the Owner.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

1.03 REFERENCES

Not used.

1.04 DELAYS AND RECOVERY

A. If, at any time during Project, Contractor fails to complete an activity by its latest scheduled completion date, Contractor must submit within two working days a written statement as to how and when Contractor will reorganize work force to return to current construction schedule.

B. Whenever it becomes apparent from progress evaluation and updated schedule data that milestone completion dates and/or contract completion dates will not be met, some or all of the following actions must be taken upon receipt of approval from the Owner's Representative:

1. Increase construction staffing in such quantities and crafts to substantially eliminate backlog of work.
2. Increase number of working hours per shift, shifts per work day, work days per week, or amount of construction equipment, or combination of foregoing to substantially eliminate backlog of work.
3. Reschedule work items to achieve concurrence of accomplishment.

C. Under no circumstances will addition of equipment or construction forces, increasing working hours or any other method, manner or procedure to return to current Construction Progress Schedule be considered justification for contract modification or treated as an acceleration.

1.05 PROJECT UPDATES

A. Update schedules weekly.

1.06 SUBMITTALS

A. Contractor shall submit the baseline schedule with the bid documents. After approval of the schedule by the Owner, Contractor shall submit updated schedules to reflect the work completed, milestone progress, and work in progress, on a bi-weekly basis.

B. Updated schedules shall be submitted to the Owner's Representative.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01320

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 THE FOLLOWING ARE INCLUDED IN THIS SECTION:

A. Progress Schedules.

B. Meetings and Coordination.

C. Progress Reports.

1.02 PROGRESS SCHEDULES

A. Prepare a graphic progress schedule in Microsoft Project and update regularly. The schedule shall be delivered to the Owner's Representative before starting any work but not later than fourteen (14) days after award of the contract.

1.03 MEETINGS AND COORDINATION

A. Meetings and coordination by the Contractor required to execute the Work include but is not limited to a preconstruction conference, weekly progress meetings upon mobilization as well as any and all necessary coordination of construction activities to complete the work on schedule and without disruption or defect.

1.04 PROGRESS REPORTS

A. Daily Reports containing pertinent information pertaining to the project

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.01 PROGRESS SCHEDULES

A. The progress schedule must be updated at least weekly and delivered to the Owner's Representative at the construction progress meeting.

3.02 MEETINGS AND COORDINATION

A. Preconstruction conference.

1. Owner will schedule a conference after Notice of Award and prior to Contractor occupancy. This conference is intended to further define Contractor's schedules, sequence work, and project Construction Drawings.
2. Attendance required: Owner's Representative, Contractor, and major Subcontractors.
3. Agenda for the conference is as follows:
    a. Health and safety requirements and Contingency Construction Drawings.
    b. Submission of list of Subcontractors.

c. Designation of personnel representing the parties in Contract.

d. Procedures and processing of field decisions, site access, submittals, substitutions, applications for payments, proposal request, change orders and contract closeout procedures.

e. Use of premises by Owner and Contractor.

f. Construction facilities, controls, and utilities provided by Owner.

g. Temporary utilities to be provided by Contractor.

h. On-site and off-site access, routes, storage areas, and Coordination with Daily Operations.

i. Survey requirements.

j. Security and housekeeping procedures.

k. Project Schedules.

l. Procedures for laboratory and field testing requirements.

m. Procedures for maintaining record documents.

B. Weekly Progress Meetings

1. The Contractor shall attend weekly meetings to discuss the progress of the Work. Meeting schedules will be mutually agreed to by Owner's Representative and Contractor.

2. The Owner's Representative shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record meeting notes, and distribute copies within three working days to Owner, participants, and those affected by decisions made.

3. Attendance required: Owner's Representative, Contractor's superintendent, Contractor's Site Safety Officer, Contractor's Project Manager, and any other parties as appropriate to review agenda topics for each meeting.

4. Agenda for the meetings is as follows:

a. Health and safety.

b. Review minutes of previous meeting.

c. Review of submittals, schedule, and status of submittals.

d. Review progress of work.

e. Planned progress for succeeding work period and required coordination.

f. Identification of field observations, problems, and decisions.

g. Maintenance of quality and work standards.

h. Other business relating to the Work.

3.03 PROGRESS REPORTS

A. Daily Report

1. Provide daily reports of Project activity. Reports to be submitted to the Owner's Representative with all pertinent information pertaining to the project as follows:

a. Major equipment and materials installed.

b. Major construction equipment utilized.

c. Location of all areas in which construction was done.

d. Materials and equipment received.

e. Work and tests performed.

f. Weather conditions.

g. Safety.

h. Delays.

i. Instructions received.

2. Submit two copies of Contractor's daily reports. The daily report is due at the Owner's Representative's field office by 9:00 a.m. the next working day after the work was performed and shall be signed by a responsible member of Contractor's staff.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

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SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acceptance or quality assurance testing by Owner.

B. Quality control testing by Contractor.

C. Certificates of compliance.

1.02 RELATED SECTIONS

A. Section 01300 — Submittals

B. Section 01190 – Health and Safety

C. Section 01560 – Temporary Facilities and Controls

D. Section 01600 – Material and Equipment

E. Section 02220 – Excavation and Grading

F. Section 02243 - Geotextile

1.03 REFERENCES

Not used.

1.04 SOURCE OF MATERIALS

A. Contractor must notify Owner in writing of the sources from which it proposes to obtain material requiring approval, certification, or testing. Such notification must be made as soon as possible after award of Contract but no later than 5 days after receipt of the Notice to Proceed.

1.05 ACCEPTANCE TESTING OR QUALITY ASSURANCE TESTING

A. Acceptance testing is the testing of materials prior to their use in the Work and also any testing deemed necessary by Owner for acceptance of the completed Work. Owner will perform acceptance testing of materials and workmanship in accordance with the Contract Documents and reserves the right to perform additional testing at any time to determine conformance with the requirements of the Contract Documents.

B. Acceptance testing by Owner is not to be considered as a replacement for control testing conducted by Contractor or a manufacturer producing materials for Contractor. Acceptance testing will be at the expense of Owner.

1.06 QUALITY CONTROL TESTING

C. Quality control testing is the testing of materials prior to their delivery to the site and such other tests as are specified in the various sections of the Specifications to ensure compliance with the Contract Documents. Contractor shall assume full responsibility for control testing and give

sufficient notice to Owner's Representative to permit them to witness the tests. Control testing is at the expense of Contractor and where specifically required, performed by an independent testing firm.

D. Within 15 days of Owner-Contractor Agreement, submit the name, address, and qualifications, together with the scope of proposed services, of the proposed testing firm(s) to the Owner for Owner and EPA approval.

E. Notify Owner's Representative for approval at least 5 days prior to the scheduled commencement of any work involving such testing.

F. Within five days after completion of testing performed by or for Contractor, submit test results to Owner's Representative. Identify test reports with the information specified for samples in Section 01300 including, the name and address of the organization performing the test, and the date of the tests.

G. Quality Control Testing parameters and frequency for all soils are to be completed in accordance with Section 02224 Material Placement

1.07 CERTIFICATES OF COMPLIANCE

A. Contractor may use certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures. Submit certificates required to demonstrate proof of materials compliance with specification requirements, submit in duplicate with each lot of material delivered to the Work or prior to delivery as required by the Contract. The lots so certified must be clearly identified by the certificate. Certificates must be signed by an authorized representative of the producer or manufacturer, and state that the material complies in all respects with the requirements of the Contract Documents. In the case of multiple shipments, each shipment must be accompanied or preceded by a Certificate of Compliance.

B. The Certificate of Compliance must be accompanied by a certified copy of tests results or state that such test results are on file with the producer or manufacturer and must be furnished to the Owner's Representative on request. The certificate must give the information specified for samples in Section 01300 - Submittals including, the name and address of the organization performing the tests, the date of the tests, and the quantity of material shipped.

C. Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance does not relieve Contractor of responsibility for incorporating material in the Work, which conforms to the requirements of the Contract. Any such material not conforming to such requirements will be subject to rejection, whether in place or not.

D. Owner reserves the right to refuse to permit the use of certain materials on the basis of a Certificate of Compliance.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

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SECTION 01540

SECURITY OF EQUIPMENT, MATERIALS, AND WORKMANSHIP

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment

B. Materials

C. Workmanship

1.2 RELATED SECTIONS

A. Section 01600 Materials and Equipment

1.3 SECURITY PROGRAM

A. The Contractor shall protect Work and existing premises from theft, vandalism and unauthorized entry during operations. The Owner will have no active security operations subsequent to mobilization by the Contractor, nor will the Owner be responsible for any damage or theft to Contractor equipment, assets, materials or work completed prior to substantial completion.

B. Any manned security program is the responsibility of the Contractor at the Contractor's discretion. Security at all locations on the property shall be the Contractor's responsibility.

1.4 SIGNAGE

A. The Contractor shall supply and install "No Trespassing" signage on temporary fencing and other locations as required. Signs shall be painted metal and conform to local laws and ordinances.

B. The Contractor shall place signs on the fence exterior in accordance with local ordinances or permit requirements. If no such requirements are present, signs shall be installed at approximately 100 foot intervals on fencing, with additional locations as necessary, unless otherwise authorized by OWNER.

C. The presence and placement of signs, whether they be stand-alone or fixed to mobile equipment, identifying or advertising the presence of the Contractor or any Subcontractors on site, shall be prohibited unless approval is obtained from the Owner.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

A. Not Used

END OF SECTION

SECTION 01560

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED:

A. Electricity, lighting

B. Water

C. Sanitary facilities

D. Field Office

E. Protection of installed work

F. Cleaning during construction

G. Removal

1.02 RELATED REQUIREMENTS

A. Section 0111 - Summary of Work.

1.03 ELECTRICITY, LIGHTING

A. A power pole exists on site adjacent to the existing Owner's facilities. The contractor may tie into this line for power. A separate meter must be installed.

1.04 WATER

A. Provide personnel with adequate drinking water (bottled or otherwise).

B. Obtain non-potable water from an existing supply line located south of the property located at (36'07"03.2 Latitude 115'01"29.6 longitude). Water is provided by the Las Vegas Water Pollution Control Facility. The line is capable of providing 200 gallons per minute. It is the Contractor's responsibility to purchase water from the Facility (Contact name and number) at the price negotiated by the Owner ($1.05/1000 gallons). Cost to be negotiated with the owner prior to construction

C. Provide the Owner's Representative with a record of the Contractor's volume of daily water usage.

D. Provide equipment to transport water from the line to Contractor's location of use (water pulls or pumps)

E. Provide storage facilities (tanks/ponds) or transport water from the line as needed. The storage methods must be approved by the Owner's Representative prior to installation.

1.05 SANITARY FACILITIES

A. Provide separate (male/female) sanitary facilities during entire construction period. Adequate numbers as per OSHA requirements.

1.06 FIELD OFFICE

A. Provide a minimum of one 10x40 field office with sufficient space to hold the weekly progress meeting. The office shall be equipped with electricity, heating, and air conditioning. The trailer shall have an office for the Site Engineer/Superintendent and a separate office for the Owner's Representative. The Owner's Representative's office shall be equipped with a desk, chair and 5 ft filing cabinet. Additionally, the field office shall have sufficient filing space to store all pertinent contract documents. The field office should be established in the area of the existing Owner's trailer at a location approved by the Owner's Representative.

1.07 PROTECTION OF INSTALLED WORK

A. Provide temporary protection for installed products. C ontrol traffic in immediate area to minimize damage.

1.08 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off-site, as needed.

1.09 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to substantial completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. R emove underground installations to a depth of 2 feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original condition.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 01400 - Quality Control

C. Section 01500 – Temporary Facilities and Controls

1.03 MATERIALS

A. New material and components, forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and completion of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Contractor shall remove any surplus materials at the completion of work.

1.04 TRANSPORTATION AND HANDLING

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

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.05 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible

B. Store loose granular materials on solid flat surfaces in well drained areas.

C. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

D. Contractor shall provide adequate and suitable storage for equipment and materials that are liable to injury and shall be responsible for any loss or damage to any equipment or materials by theft, breakage, or otherwise.

E. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes Contractor procedures for securing approval of proposed product options and substitutions.

B. Related work:

1. Make submittals in accordance with pertinent provisions of Section 01300 Submittals.

1.02 RELATED SECTIONS

Not used.

1.03 PRODUCT OPTIONS

A. The Contract is based on standards of quality established in the Contract Documents.

1. In agreeing to the terms and conditions of the Contract, the Contractor has accepted responsibility to verify that the specified products will be available and to place orders for all required materials in such a timely manner as i s needed to meet his agreed construction schedule.

2. The Owner does not agree to the substitution of materials or methods called for in the Contract Documents, except as they may specifically otherwise state in writing.

B. Materials and/or methods specified by name:

1. Where materials and/or methods are specified by naming one single manufacturer and/or model number, without stating that equal products will be considered, only the material and/or method named is approved for incorporation into the Work.

2. Should the Contractor demonstrate to the approval of the Owner that a specified material or method was ordered in a timely manner and will not be available in time for incorporation into this Work, the Contractor shall submit to the Owner such data on proposed substitute materials and/or methods as are needed to help the Owner determine suitability of the proposed substitution.

C. Where materials and/or methods are specified by name and/or model number, followed by the words "or an equal approved in advance by the Owner" or similar wording:

1. The material and/or method specified by name established the required standard of quality.

2. Materials and/or methods proposed by the Contractor to be used in lieu of materials and/or methods so specified by name must in all ways be equal or exceed the qualities of the named materials and/or methods.

D. The following products do not require further approval except for interface within the Work:

1. Products specified by reference to standard specifications such as ASTM and similar standards.
2. Products specified by manufacturer's name and catalog model number.

E. Where the phase "or equal," or "or equal as approved by the Owner," occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved in writing for this Work by the Owner.

F. The decision of the Owner shall be final.

1.04 DELAYS

A. Delays in construction arising by virtue of the non-availability of a specified material and/or method will not be considered by the Owner as justification of a change to the agreed Time of Completion.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation, maintenance, completion, and submission of project record drawings, specifications, and related documents.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals.

1.03 MAINTENANCE OF RECORD DOCUMENTS

A. Maintain at the job site one copy of the following Project or Contract Documents for record purposes:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and Work Change Directives.
5. Field Orders.
6. Reviewed Shop Drawings.
7. Clarifications or Explanatory Drawings and Specifications.
8. Inspection Reports.
9. Laboratory Test Records.
10. Field Test Records.

B. Store documents used for record purposes in the field office or other approved location, apart from documents used for construction.

C. File documents in accordance with the Construction Specification sections.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by the Owner and his authorized representatives. Electronic copies of documents will be made available upon Owner's request.

1.04 RECORD DRAWINGS

A. Project Drawings:

1. Maintain record drawings of all work and subcontracts continuously as the job progresses. Keep a separate set of prints, for this purpose only and at the job site at all times.

2. Keep these drawings up-to-date.
3. During the course of construction, identify on the drawings the actual locations for all site utilities and services installed underground or otherwise concealed. Show deviations from the drawings in detail. Locate all main runs, whether piping or drain lines, by dimension and elevation.
4. During the course of the construction record as-built information.
5. Deliver the final and record set of "as built" drawings to the Owner in both electronic and paper format prior to the Owner's acceptance of the Project.

B. Addenda and Change Orders:

1. Incorporate changes to the Drawings affected by Addenda, Change Orders, or Field Orders. Identify change by Addendum, Change Order, or Field Order number and effective date.
2. When revised drawings are issued as the basis of or along with addenda or change order, incorporate these revised drawings into the record set with appropriate annotation.

C. Shop Drawings:

1. Collect and maintain one complete set of reviewed shop drawings, including manufacturer's printed catalog cuts and data, for record purposes.
2. Shop drawings must be filed and maintained separate from project drawings.
3. Shop drawings must be delivered in new paperboard boxes manufactured specifically for the storage of file folders. Boxes must have covers and cutout handles and be accurately identified as to the contents.

1.05 RECORD SPECIFICATIONS

A. Project Specifications:

1. Information, changes, and notes must be recorded in the specifications in blank areas, such as page margins or the backs of opposite pages, or on separate sheets inserted in the binder and updated on electronic formats.
2. In each section, in an appropriate location, record the manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

B. Addenda, Change Orders, Work Change Directives, and Field Orders

1. All Addenda, Change Orders, Work Change Directives, and Field Orders must be incorporated into the front of the specifications book in reverse chronological order. Use appropriate page dividers to identify addenda and change orders and to separate addenda from the specifications.
2. In addition, the changes to the specifications effected by Addenda, Change Order, Work Change Directives, or Field Order must be annotated on the affected page or pages of the specifications or adjacent thereto.

1.06 SUBMISSION OF DOCUMENTS

A. At completion of the project, and before submitting invoice for final payment, deliver record documents to Owner.

B. Record documents must be delivered neatly and efficiently packaged in paper and electronic format.

C. Submission of record documents must be accompanied with a transmittal letter, in triplicate, containing the following information:

1. Date of submission.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each record document. (Shop drawings may be grouped in basic categories or divisions of work.)
5. Certification that each document as submitted is complete and accurate.
6. Signature of Contractor or his authorized representative.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 MEASUREMENT AND PAYMENT

Not used.

END OF SECTION

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SECTION 02070

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. The General and Supplementary Conditions, and Sections in Division 1 of these Specifications, complement the work described in this Section. If the requirements of this section and conditions and sections noted above conflict, the Contractor shall adhere to the more stringent requirement as determined by the Owner.

B. Furnish all labor, materials, services and equipment as required to complete the removal and salvage of identified existing corrugated metal pipes (CMP), corrugated flumes, inlets, outlets and anchors.

C. Related Sections:

1. Section 01010 – Summary of Work
2. Section 01190 – Health and Safety
3. Section 01025 – Measurement and Payment

1.02 QUALITY ASSURANCE

A. Requirements of regulatory agencies: C omply with all laws, rules and regulations of governmental authorities having jurisdiction over the demolition work.

B. Perform the demolition work in accordance with the applicable requirements of the safety requirements for demolition, American National Standard A10.6.

1.03 SCOPE OF WORK

A. Removal and salvaging of existing identified CMP's, inlets, and anchors.

PART 2 – PRODUCTS

A. (Not Used)

PART 3 – EXECUTION

3.01 WORK PROCEDURE

A. Do not begin demolition operations until directed by Owner, after work is started it shall be continued to completion promptly and expeditiously at a rate that will allow the balance of the contract to be completed within the time specified. If extra shifts are necessary beyond regular working hours the work shall proceed with a minimum of nuisance of surrounding properties.

B. All work shall be conducted with due consideration for the safety of workmen.

3.02 GENERAL PROTECTION

A. Provide all protection, barricades, etc., which may be required by Federal, State and Municipal laws. Maintain all lights, signals and protection of all kinds for the full period of operation. Maintain this protection and remove same when directed.

B. Operations shall be done in such manner as to avoid hazards to persons and property and interference with the use of adjacent areas or interruption of free passage to and from such areas. Care shall also be taken to prevent the spread of dust and flying particles.

3.03 DISPOSAL OF MATERIALS AND DEBRIS RESULTING FROM DEMOLITION

A. CMP Culverts to be removed and salvaged are to be stored adjacent to and south of the existing site trailer or reinstalled in areas where like size are required on the plans.

B. Pipes, fittings, anchors, and flumes to be separated by size and stacked in a safe, orderly manner. Nonbiodegradable straps are to be used where necessary to ensure piping does not shift or mover over time when stacked.

END OF SECTION

SECTION 02220

EXCAVATION AND GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grading the surface of the barrier soil layer.

B. Grading of the surface of the erosion layer.

C. Excavating and grading of areas outside the original limits of waste, including:

1. Borrow Source Locations
2. Sediment Basin
3. Diversion Berms
4. Detention Dam
5. Additional areas not listed above.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B. Section 02224 – Material Placement

C. Section 02228 – Waste Relocation

D. Section 02230 – Trenching

E. Section 02243 – Geotextile

F. Section 03101 – Concrete – CIP

G. Section 03411 – Concrete - Precast

1.03 REFERENCES

A. Not used.

1.04 DEFINITIONS

A. Excavation: Removal of materials of whatever nature encountered, whether wet, frozen, or otherwise, including refuse, dense tills, hardpan, frozen materials, boulders, or rock fragments which can be removed by ripping or excavating with heavy duty mechanical construction equipment or by drilling and blasting. There is not a separate pay item for rock excavation.

B. Excavation Limits: Areal excavation limits shown on Construction Drawings to the specified depth or as directed by the Owner's Representative.

1.05 SUBMITTALS

A. Not used.

1.06 QUALITY ASSURANCE

A. Not used.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Protect open excavations against damage due to surface runoff and run-on. Take all necessary precautions to prevent erosion of excavated or disturbed surfaces.

B. Suspend operations whenever climatic conditions, as determined by the Owner's Representative, are unsatisfactory for excavating to the requirements of this Section.

C. After occurrence of heavy rains, do not operate equipment on previously placed material or on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.

D. Where excavations or previously placed material have been softened or eroded, remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified by the Owner's Representative.

E. Do not obstruct flow of surface drainage or natural watercourses unless specified on the Construction Drawings of herein.

F. Decontaminate equipment involved in excavation activities which may have come in contact with potentially contaminated material before being removed from site or being relocated to clean areas of site.

1.08 SEQUENCING AND SCHEDULING

A. Sequence and schedule excavation activities with work of other Sections.

B. Sequence and schedule excavation activities such that access to working areas is maintained at all times.

C. Excavate areas shown on Construction Drawings in an approved sequence. Submit proposed sequencing changes to the Owner's Representative in writing. Such changes, if approved, will be authorized by the Owner's Representative in writing.

D. Do not allow or cause any of the work performed to be covered up or enclosed prior to required inspections, tests, or approvals.

PART 2 PRODUCTS

A. Not used.

PART 3 EXECUTION

3.01 GENERAL

A. Contractor and subcontractors shall adhere to mitigation methods defined in the Clean Diesel Plan for the closure of the site.

B. Contractor and subcontractors shall keep all vehicles and equipment outside the Sunrise Mountain Instant Study Area.

3.02 EXAMINATION

A. Verify that survey benchmarks and intended elevations for work are as indicated.

B. Monitoring Wells: Contractor will locate and mark the location of existing monitoring wells prior to commencement of excavation. Mo nitoring wells shall be repaired/replaced if damaged at Contractor's expense.

C. Excavation Area Boundaries: As shown on Construction Drawings.

3.03 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect benchmarks and survey control points from excavating equipment and vehicular traffic.

C. Protect surface features which may be affected while work is in progress.

D. Protect construction personnel and structures, where temporary unbalanced earth pressures are likely to develop, utilizing bracing, shoring, or other approved methods to counteract the unbalance earth pressures.

E. Contractor is solely responsible for performing work in a safe manner and complying with all applicable local, state and federal codes, ordinances, laws, and regulations.

F. Protect wells and any other structures and pipelines from any displacement or disturbance during excavation operations.

3.04 GRADING SOIL BARRIER LAYER

A. Prior to placement of the soil barrier layer, cracks greater than ½-inch in width in the existing landfill surface, shall be over excavated until the crack is removed. The resulting excavation shall be backfilled in 6 inch lifts of soil barrier layer material. Backfill shall be compacted to meet requirements of section 02224.

B. Prior to placement of the soil barrier layer, existing berms, roads, and drainage ditches shall be graded to provide a smooth surface for placement of barrier layer materials.

C. After the soil barrier layer has been placed to meet the thickness requirements shown on the Construction Drawings determined byby grid point on point survey, fine grade the entire limits of waste to remove any relic ditches, berms, rills, and gullies.

D. Grade concentrated flow areas shown on the Construction Drawings to provide sheet flow across each area.

3.05 EXCAVATING AND GRADING - CHANNELS AND CULVERTS

A. Location and grading of proposed diversion berms, drainage features, sediment basins/traps shall be as shown on the Construction Drawings.

B. Excavate trenches for channels and culverts to lines and grades shown on the Construction Drawings.

C. Reuse excavated materials as structural backfill if it meets the requirements of Section 02224 – Material Placement.

D. Excavate culvert trenches to 12 inches below pipe inverts. H and trim excavation, if necessary, for accurate placement of pipe.

E. Excavate channels to accept channel linings.

F. Excavate channels to maintain minimum channel cross section.

3.06 EXCAVATION AND GRADING BORROW AREAS

A. Location of proposed borrow areas shall be as shown on the Construction Drawings. The borrow locations shall be within the Bureau Land Management (BLM) Limits and outside of the Instant Study Area.

B. It is the Contractor's responsibility to remove and process soils and aggregates from the borrow areas, to drill and blast (except the borrow to be used for the construction of the embankment or impoundment) if necessary to produce the quantities of materials listed in Section 02224 Material Placement.

C. Contractor must manage the borrow areas to prevent runoff of sediment laden storm water from the site at all times. The borrow areas shall not also change the ultimate off site flow paths or negatively affect the onsite controlled flow paths.

D. The contractor shall grade borrow areas in a manner where areas of flow concentration are not created.

E. Borrows shall yield suitable material that meets appropriate specifications for its intended use.

F. At the completion of the project, the borrow areas must be graded to minimize erosion, minimize ponding and promote storm water runoff away from the final landfill cover.

3.07 EXCAVATING AND GRADING –BASINS

A. Location and grading of proposed diversion berms, drainage features, sediment basins/traps shall be as shown on the Construction Drawings.

B. Reuse excavated materials as compacted backfill if it meets the requirements of Section 02224 – Material Placement.

3.08 OVER-EXCAVATION OF EXPOSED QUEANTOWEAP AND PAKOON FORMATIONS

A. Locally exposed beds of the Queantoweap and Pakoon formations within the impoundment area and along the western abutment will be delineated in the field during grading by a qualified geologist hired by the Owner, and over-excavated to a minimum depth of 3 feet.

B. The over-excavated materials be replaced with 2-foot-thick relatively low-permeability backfill (with a hydraulic conductivity of $\leq 1 \times 10^{-5}$ cm/sec) and 1-foot-thick of protective cover soil, as specified in Part 2.010 of Section 02224.

3.09 EXCAVATING AND GRADING – DETENTION DAM

A. Contractor to submit plan for the construction of the east and west abutments for approval prior to construction commencing.

B. Abutment cutoff wall excavations shall be in compliance with Federal and State OSHA requirements. Trenches shall be excavated by backhoe, clamshell, or other suitable trenching equipment. The excavating tool shall have a minimum width of 2-ft. The Contractor shall maintain the stability of the excavated trench at all times for the full depth. The bottom of the trench will be keyed a minimum of 2-feet into bedrock, except that if the excavating equipment is unable to achieve the minimum specified penetration into bedrock the trench will extend to the depth where refusal of the excavating equipment is encountered. The final depth and penetration of the trench shall be measured and checked by the Contractor and approved by the Site Engineer immediately following excavation.

C. Location and grading of proposed detention dam shall be as shown on the Construction Drawings.

D. Reuse excavated materials as backfill if it meets the requirements of Section 02224 – Material Placement.

3.010 EXCAVATING AND GRADING - AREAS OUTSIDE THE ORIGINAL LIMITS OF WASTE

A. Excavate and/or grade the Borrow Area, Sediment Trap, Sediment Basin and Access Road, and other additional areas to lines, grades, elevations, and dimensions shown on the Construction Drawings or as directed by Owner's Representative.

B. Stockpile all excavated materials, if necessary, at an area directed by the Owner's Representative. All materials to be used for cap construction shall be processed to meet specified gradations.

C. Keep limits of excavation undisturbed and free of loose, soft, or organic matter.

D. Maintain excavation depth tolerances. Unless directed otherwise by Owner's Representative, excavation in excess of the specified limits shall be considered unauthorized over-excavation.

E. Slope banks to angle of repose or less until shored.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation

G. Notify Owner's Representative of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

H. Safety of open excavations shall be the Contractor's sole responsibility.

I. Traffic control shall be the Contractor's sole responsibility.

3.011 TEMPORARY STOCKPILING

A. Obtain Owner's Representative approval for locations of temporary stockpiles. O btain Owner's Representative approval prior to placing material in such stockpiles.

B. Stockpile materials in accordance with Section 02224 – Material Placement.

3.012 TOLERANCES

A. Within 2 inches greater or less than specified depth, but not uniformly greater or less.

3.013 FIELD QUALITY CONTROL

A. Provide access for visual inspection and field testing of bearing surfaces.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION

SECTION 02222

QUARRY - DEVELOPMENT - OPERATION - CLOSURE - ABANDONMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Development of the on-site quarry for production of erosion layer materials.

B. Drilling, blasting, processing, stockpiling and handling erosion layer materials.

C. Construction and maintenance of truck haul road from quarry to landfill areas.

D. Closure and abandonment of on-site quarry on completion of the work.

1.02 RELATED SECTIONS

A. Section 01025 – Measurement and Payment

B. Section 01052 – Health and Safety

C. Section 01320 - Construction Progress Documentation

D. Section 01400 – Quality Control

E. Section 02220 – Excavation and Grading

F. Section 02224 – Material Placement

1.03 REFERENCES

A. ASTM D422 Particle-Size Analysis of Soils

B. ASTM D5519 Particle Size Analysis of Natural and Man-Made Riprap Materials

C. ASTM D6913 Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

D. 27 CFR Part 555 Federal Explosives Regulations

E. NRS Chapter 455 Excavations and High Voltage Lines

F. NRS Chapter 476 Explosives and Flammable Materials

G. NRS Chapter 618 Occupational Safety and Health

1.04 DEFINITIONS

A. Excavation: Removal of materials of whatever nature encountered, whether wet, frozen, or otherwise, including refuse, hardpan, caliche, boulders, or rock fragments which can be removed by excavating or ripping with heavy duty mechanical construction equipment or by drilling and blasting.

B. Drilling: Progressive development of small diameter cylindrical holes in rock using rotary cutting or percussive breaking equipment.

C. Blasting: Use of explosive materials and detonating devices to break rock material that cannot be removed solely by excavating or ripping with heavy duty mechanical construction equipment.

D. Flyrock: Uncontrolled projection of rock particles during blasting.

E. Overpressure: Compressive air blast created during blasting.

F. Vibration: Ground shaking caused during blasting (measured as peak particle velocity – PPV – at some distance from a blast).

G. Quarry Limits: Areal extent of disturbance caused by excavation, processing, stockpiling and waste disposal during production of erosion layer material (maximum allowable limits are as shown on Construction Drawings or as specified or as directed by the Owner's Representative).

1.05 SUBMITTALS

A. Resume of Blasting Consultant

B. Resume of Quarry Superintendent.

C. Resume of Lead Blaster.

D. Quarry Development Plan

E. List of Proposed Equipment

F. Manufacturer's Product Sheets (including MSDS information) for Blasting Materials.

G. Blasting Notifications and Blasting Construction Drawings.

H. Quarry Closure and Abandonment Plan

I. Geotechnical Data (at least 14 days prior to placement of materials, submit geotechnical test results of each material to show conformance to specification requirements as specified for each type of material from each source)

J. Truckload Delivery Records for Erosion Layer

K. Post Closure Quarry Stability Evaluation Report

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the applicable provisions of the standards listed in Section 1.03.

B. Inspect and test work in compliance with the CQA Plan.

C. Contractor at his discretion may perform additional testing in addition to the requirements of the CQA Plan as necessary or advisable for his own purposes to control the quality of the Work.

1.07 SAFETY AND RESPONSIBILITY (see Section 01052)

A. Contractor is solely responsible for performing work in a safe manner and complying with all applicable local, state and federal codes, ordinances, laws, and regulations including:

1. 27 CFR Part 555 Federal Explosives Regulations
2. NRS Chapter 455 Excavations and High Voltage Lines
3. NRS Chapter 476 Explosives and Flammable Materials
4. NRS Chapter 618 Occupational Safety and Health

1.08 PERMITS (TBD)

A. All necessary permits for blasting and quarry operations to be obtained by Contractor.

PART 2 PRODUCTS

2.01 UNSUITABLE MATERIALS (see Section 02224.2.01)

A. Unsuitable materials means the following materials:

1. Trees, stumps, branches, or any other wood or lumber.
2. Wire, steel, cast iron, cans, drums, or any other foreign material.
3. Materials containing hazardous or toxic constituents.
4. Material not meeting specification requirements.

2.02 EROSION LAYER (see Section 02224.2.03)

A. Materials shall contain no deleterious materials, debris, organic matter, etc. and shall be obtained from an on-site source(s). Material with small amounts of gypsum is permitted so long as other criteria are met.

B. Erosion layer materials may require blending of native borrow soils with quarried and/or processed rock to meet the gradation requirements of this paragraph.

C. Material loss on exposure to Sodium Sulfate or Magnesium Sulfate shall not be greater than 20 percent after 18 cycles according to ASTM C88.

D. L.A. abrasion (ASTM C535 or ASTM C131) Material loss shall not be greater than 40% after 500 revolutions.

E. Specific Gravity (ASTM C127). Specific gravity shall not be less than 2.60.

F. Material Requirements - Slopes greater than or equal to 10%

1. Contractor shall place a gravel erosion layer with the layer thickness(es) as specified below or as shown on the Construction Drawings.

2. Gradation requirements for the erosion layer on slopes greater than or equal to 10% shall be as follows:

Layer Thickness (in.)	Sieve Designation	% Passing Range min. (%)	max (%)
14	6" (152 mm)	43	100
	4" (102 mm)	31	70
	1" / 25 mm	12	36
	0.5”/12.7mm	5	27

3. The maximum particle size in the 14 inch erosion layer shall not exceed the erosion layer thickness. Oversized material shall be removed b screening, hand removal, blading or other approved method.

G. Material Requirements - Slopes less than or equal to 10%

1. Contractor shall place a gravel-soil erosion layer with the layer thickness(es) as specified below or as shown on the Construction Drawings.
2. Erosion layer may contain clay particles provided that:
   a. The particles are non-dispersive,
   b. Have a liquid limit between 0 to 30, and
   c. Have a plasticity index between 0 and 10.
3. Gradation requirements for the erosion layer on slopes less than or equal to 10% shall be as follows:

Layer Thickness (in.)	Sieve Designation	% Passing Range min. (%)	max (%)
13	6" / 152 mm	96	100
	3" / 76 mm	69	81
	1" / 25 mm	54	70
	3/8" / 9.5 mm	43	57
	No. 200 / 75 µm	10	22

4. The maximum particle size in the 13 inch erosion layer shall not exceed 8 inches. Oversized material shall be removed b screening, hand removal, blading or other approved method.
5. Bulk samples, to be supplied by Contractor for testing (at an incidental cost to the project) to determine gradation, shall have sufficient weight to ensure an error no greater than 10%.
6. Test for dispersive clays (ASTM 4221). Erosion layer shall not contain dispersive clays.
7. Particle size analysis for materials retained on the 3-inch standard sieve shall be tested in accordance with ASTM D5519 Test Procedure A. The standard deviation for particle sizes greater than or equal to 3 inches shall be determined by tests conducted prior to

placement of material in the subject area. For materials passing the 3-inch standard sieve, particle size analysis shall be conducted in accordance with ASTM D422. Standard deviations for particle sizes less than 3 inches shall be calculated using the procedure defined in Section 14 of ASTM D6913.

8. Erosion layer materials for slopes less than or equal to 10% shall be deemed acceptable if the particle size band defined by ±2 standard deviations of the test data for the subject area fully overlaps the particle size distribution specified in this article.

PART 3 EXECUTION

3.01 EXAMINATION AND PLANNING

A. Owner shall make the on-site quarry, referred to as the Upper Canyon Quarry Site (UCQS) available to Contractor.

B. Contractor shall assure himself that the Quarry Limits are adequate for production of the required quantity of erosion layer material, processing and stockpiling activities and disposal of waste material.

C. Contractor shall prepare a Quarry Development Plan that will result in the safe and efficient production of the required quantity of suitably graded erosion layer materials that meets the specified durability criteria. The Plan shall include at a minimum:

1. Key map at scale of 1:12,000 showing quarry location relative to landfill closure work areas
2. General plan of the Quarry area at scale of 1:2,400 tied to the project coordinate system and datum showing explosives storage magazine location, surface structures, sanitary facilities, access routes and parking areas
3. Identification of any explorations (drill holes, pit explorations, test blasts, etc.)
4. Quarry excavation design plan and representative natural scale cross sections at scale of 1:1,200 inclusive of ramps, benches, berms, workspaces, access roads and haul roads including elevations, widths and inclinations
5. Quarry waste and material handling locations
6. Types of mobile and stationary equipment specific to the production of erosion layer material
7. Schedule indicating sequencing and duration of the work
8. Description of security procedures for the Quarry including explosive storage, transport, handling, and usage

3.02 PREPARATION

A. Contractor shall identify proposed location of explosive storage magazine.

B. Contractor shall secure the quarry site during development, operation and closure to prevent access by unauthorized persons by using such measures as fencing, signage and security patrols.

3.03 CONSTRUCTION PROGRESS DOCUMENTATION

A. Refer to section 01320

3.04 DRILLING AND BLASTING

A. Drilling and blasting operations shall comply with the requirements of NRS-455, NRS-476 and NRS-618. When blasting near buildings, structures, or utilities which may be subject to damage from blasting the contractor shall control the blasting operation by the use of properly designed delay sequences and allowable charge weights per delay so that the maximum peak particle velocity (PPV measured as the cumulative effect of vibration waves in three mutually perpendicular directions) at a point no further than 5,000 feet from the blasting does not exceed 1.00 inches per second and the maximum PPV at any existing structure shall not exceed 2.00 inches per second.

B. Contractor shall conduct pre-blast inspections of all residences, building, and other structures within a 5,000 foot radius of the proposed blasting operations. The pre-blast inspections shall document the existing conditions of both the exterior and interior of the structure including all defects such as crack, structural problems etc. The documentation shall include photographic, video, and written reports. The pre-blast inspections shall be conducted by a specialist that has at least three years of documented experience in pre-blast inspections and has successfully completed at least three projects of similar scope and complexity. Not later than the pre-construction conference, Contractor shall submit a resume of the proposed pre-blast inspection specialist for acceptance by Owner's Representative. Post-blast inspections shall be conducted by Contractor when adjacent property owners make written or oral claims of damage.

C. Contractor shall retain the services of a Blasting Consultant to assist in the blast design. The Blasting Consultant shall be an expert in the field of drilling and blasting who derives his primary source of income from providing specialized blasting and/or blasting consulting services. The Blasting Consultant shall not be an employee of Contractor, explosive manufacturer, or explosive distributor. Not later than the pre-construction conference, Contractor shall submit a resume of the credentials of the proposed Blasting Consultant for review and acceptance by Owner's Representative. The resume shall include a list of at least 5 quarry rock excavation projects on which the Blasting Consultant has worked in the past 10 years. The list shall contain a description of the project, details of the blast Construction Drawings, and names of the project owners with sufficient knowledge to verify the submitted information.

D. Contractor shall submit to Owner's Representative a Notice of Scheduled Blasting and a Blasting Plan for each blast at least 24 hours in advance of the planned time of blast detonation.

E. The Blasting Plan shall contain at a minimum:

1. A topographic plan showing the surface elevations at which the blast will be collared;
2. Typical scaled cross sections illustrating the depth elevations to which the blast will be excavated
3. A plan view of the areal extent of the blast showing hole layout and locations with diameter, spacing and burden dimensions
4. The proposed delay and detonation sequence with maximum charge per delay noted

5. A sketch indicating the type, quantity and distribution of explosive blasting agents, detonators, decking and stemming in each hole (or typical details for groups of similarly loaded holes)
6. An indication of the Blasting Consultant's concurrence with the Blasting Plan

F. Contractor shall protect wells, buried services and any other underground, overhead or surface structures from any vibration induced displacement, flyrock damage or overpressure impacts during blasting operations.

G. Contractor shall employ a Quarry Superintendent and a Lead Blaster. Contractor shall submit resumes evidencing that the Quarry Superintendent and the Lead Blaster have performed satisfactory work in similar capabilities for sufficient length of time to be fully qualified to perform their duties. The Quarry Superintendent shall have not less than 5,000 hours of demonstrated experience, and the lead blaster shall have not less than 2,500 hours of demonstrated experience on similar projects.

H. Contractor shall monitor each blast with an approved blasting seismograph immediately adjacent to the closest structure to the blast area but no further than 1,000 ft. from the blast area. The blasting seismograph shall be capable of recording particle velocity for the three mutually perpendicular components of vibration in the range generally found with controlled blasting. In addition, the blasting seismograph shall also be capable of measuring peak air blast over pressure. The blasting seismograph shall be operated by a qualified vibration specialist, subject to acceptance by Owner's Representative. The vibration specialist shall also interpret the seismograph record, and furnish a written report to the Owner's Representative prior to the next blast. The report should contain at a minimum the following:

1. Identification of the blast seismograph used
2. Name of the qualified blast vibration specialist
3. Distance and direction of the recording station from the blast area
4. Type of ground at the recording station, and the material on which the blast seismograph is placed
5. Maximum particle velocity for each component, and peak air blast overpressure
6. A dated and signed copy of the seismograph record

3.05 PROCESSING, STOCKPILING AND HANDLING

A. Contractor shall submit to Owner's Representative a plan indicating the location of proposed temporary buildings, processing facilities, erosion cover material stockpiles and waste material storage and disposal areas.

B. Contractor shall submit to Owner's Representative a list of proposed equipment for processing, stockpiling and handling (dozers, excavators, loaders, crushers, screens, shakers) with horsepower ratings for each piece of equipment.

C. Contractor shall comply with all local jurisdiction noise ordinance requirements.

3.06 TRANSPORTATION AND PLACEMENT OF EROSION LAYER

A. Erosion layer materials shall be transported and placed by Contractor so that each type is placed properly according to the specified gradation and placement method to prevent any segregation, breakage or mixing of different gradations.

B. Contractor operations can be stopped at any time by Owner's Representative, if it considered methods being utilized are insufficient to provide material with the required gradation and durability. Contractor shall revise its methods and equipment to achieve the specified requirements to the satisfaction of the Owner's Representative. There will be no compensation for lost time for changes in methods or equipment.

C. Contractor shall transport erosion layer materials in a manner that minimizes impact on the environment and existing infrastructure.

D. Contractor shall take necessary precautions to minimize dust production during processing, stockpiling, and handling of erosion layer material. Haul roads shall be sealed or surfaced or sprayed with water at frequent intervals so dust is not generated during transport.

E. Contractor shall keep records of all truckloads (recorded in cubic yards) delivered to the landfill area for each type of erosion layer material and submit copies of all such records to the Owner's Representative on a weekly basis.

3.07 CLOSURE AND ABANDONMENT

A. Contractor shall submit to Owner's Representative for review and acceptance a Quarry Closure and Abandonment Plan. This Plan shall include a topographic plan indicating the location, orientation and inclination of all final excavation faces and waste stockpile slope angles.

B. Contractor shall slope the quarry faces to a stable angle and shall remove any overhanging or potentially unstable blocks of rock from the slopes and submit a post-closure stability evaluation report.

C. Contractor shall grade all borrow areas and waste stockpile materials to prevent ponding of water and to create positive drainage away from the landfill cover if possible, or towards the landfill drainage channel system at slope inclinations not exceeding 10% if no alternative drainage is possible. Final drainage patterns shall be approved by the Owner's Representative prior to final grading.

D. Contractor shall block access to all ramps, benches and workspaces using surplus quarried rock with gradation equal or larger than that of the erosion layer material.

E. Contractor shall construct permanent fencing along the crests, margins and toes of any final slopes that are inclined at, or steeper than, 45 degrees. Fencing shall be 6 feet tall and in accordance with sections 616.03.01, 616.03.03, 724.02.01, and 724.03.05 of the standard specifications. Refer to sheet 6.3.2.1 (page R-58) of the NDOT standard Construction Drawings for details and material schedule for fencing.

F. Contractor shall remove from site all equipment, materials, buildings and storage facilities.

3.08 FIELD QUALITY CONTROL

A. Provide access for visual inspection, sampling and field testing of erosion layer materials by CQA Engineer.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION

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SECTION 02224

MATERIAL PLACEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Material properties, quality control testing requirements, and placement requirements for:

1. Soil Barrier Layer
2. Erosion Layer
3. Dam Embankment Material
4. Diversion Berm Embankment
5. Dam Toe Drain Material
6. Structural Fill Material
7. Riprap
8. Grouted Riprap
9. Sand Bedding Material
10. Nevada DOT Type 2, Class B Aggregate Base Material
11. Access Road Surfacing

B. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary to perform all material placement construction activities. Material from onsite borrow locations shall be utilized for the soil barrier layer, erosion layer, and dam general earthfill. The dam toe drain material and aggregate base can either be imported or created on site by proper means of crushing and screening M aterial from borrow areas located north of the landfill shall be utilized for construction of the dam. Landfill cover materials will be placed in two separate layers, a s oil barrier layer and erosion protection layer. Borrow source locations are indicated on the Construction Drawings.

C. Production and placement of dam embankment, toe drain, and erosion and soil barrier layers shall meet the specified gradation, thickness, and compaction requirements as described herein and on the Construction Drawings.

D. Production and placement of bedding material, general fill, and structural fill shall meet the specified gradation, thickness, and compaction requirements as d escribed herein and on the Construction Drawings.

E. Production and placement of the Type 2, Class B aggregate base shall meet the specified gradation, thickness, and compaction requirements as described the Nevada Department of Transportation Standards Specifications for road and Bridge Construction.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B. Section 02220 – Excavation and Grading

C. Section 02230 - Trenching

D. Section 02243 – Geotextile

E. Section 03101 – Concrete – CIP

F. Section 03411 – Concrete, Precast

1.03 REFERENCES

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

B. American Society for Testing and Materials (ASTM), most current versions:

1. ASTM C127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM C535 or ASTM C131 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
3. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
4. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
5. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
6. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
7. ASTM D2434 – Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
9. ASTM D2974 - Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
10. ASTM D4221 - Standard Test Method for Dispersive Characters of Clay Soil by Double Hydrometer
11. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
12. ASTM D4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating
13. ASTM D5519 – Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials
14. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
15. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. American Association of State Highway and Transportation Officials (AASHTO).

1. AASHTO T104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
2. AASHTO M43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction

1.04 DEFINITIONS

A. Maximum Dry Density: In the context of this Contract means the maximum dry unit weight determined in accordance with ASTM D698 or D1557.

B. Processed Material: Soil which has been mechanically crushed and screened at an area designated by the Owner's Representative. Disposal of material not meeting specification requirement for use in the landfill cover or dam construction shall be disposed of outside the limits of the landfill within the borrow area it originated from.

1.05 SUBMITTALS

A. Geotechnical Data: At least 14 days prior to placement of materials, submit geotechnical test results of each material to show conformance to specification requirements as specified for each type of material.

B. Submit in writing the source and gradations gradation at least 14 days prior to grouted riprap placement.

C. Submit in writing the grout mix design at least 14 days prior to grouted riprap placement.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the applicable provisions of the standards listed in Section 1.03.

B. Inspect and test work in compliance with the CQA Plan.

C. Contractor at his discretion may perform additional testing in addition to the requirements of the CQA Plan as necessary or advisable for his own purposes to control the quality of the Work.

D. Testing described in Section 1.05 A above is the responsibility of the Contractor.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and transport fill materials at all times in a manner and with equipment that will prevent intermixing of material types, segregation, or contamination.

B. Stockpile fill materials on site in locations approved by Owner's Representative.

C. Minimize stockpiling requirements as feasible. Transport material from source directly to final position where and when possible.

D. Prevent contamination by clays or dust of riprap surfaces that will be grouted.

1.08 EXISTING CONDITIONS

A. Obtain and process material for placement of the soil barrier layer, erosion layer, dam embankment and dam toe drain from the Borrow Area(s) shown on t he Construction Drawings or from an offsite source (Dam Toe Drain Material only).

B. Obtain sand bedding material for the culverts and the landfill piping and appurtenances and aggregate base from on site material processing or from an off-site source meeting specification requirements.

C. Obtain structural fill for box culverts, landfill gas piping and appurtenances (if needed) from on-site excavations or from onsite Borrow Area(s).

1.09 SAFETY

A. Contractor is solely responsible for performing work in a safe manner and complying with all applicable local, state and federal codes, ordinances, laws, and regulations.

PART 2 PRODUCTS

2.01 UNSUITABLE MATERIAL

A. Unsuitable materials means the following materials:

1. Trees, stumps, branches, or any other wood or lumber.
2. Wire, steel, cast iron, cans, drums, or any other foreign material.
3. Materials containing hazardous or toxic constituents.
4. Material not meeting specification requirements.
5. Materials containing gypsum (i.e., gypsiferous materials)

2.02 SOIL BARRIER LAYER

A. Materials shall contain no deleterious materials, debris, organic matter etc. and shall be obtained from an on-site source. Material with small amounts of gypsum is permitted.

B. Thickness Requirements -

1. Landfill final cover shall contain a soil barrier layer above all waste a minimum thickness of 2.5 feet. Coverage above waste includes the placement of soil barrier cover soils on top of any existing soil cover to equal a combined thickness of 2.5 feet. Contractor shall place soil barrier material in all locations and depths as shown on the Construction Drawings.

C. Gradation Requirements –

1. Contractor shall remove all rock from the top surface of the soil barrier soils to insure that 100% of the material passes the 4-inch (102 mm) sieve.
2. 90% to 100% of the remaining soils shall pass a 2-inch (102 mm) sieve.
3. 45% to 100% of the remaining soils passing the No. 4 (4.75 mm) sieve.

D. A minimum of 10% of soil particles shall pass the No. 200 (0.075 mm) sieve and a maximum of 75% of the soil particles shall pass the No. 200 sieve.

E. Plasticity Properties (ASTM D4318) – Soil barrier soils shall have a liquid limit between 0 and 45 and plasticity index between 0 and 25.

F. Dispersive Clays (ASTM D4221). Soil barrier layer clays shall be non-dispersive.

G. Existing in-place soil cover shall be considered as an acceptable soil barrier cover provided that:

1. Soils do not contain any exposed solid waste and/or deleterious materials.
2. The surface does not have any surface rock particles that project more than three inches above the mean soil surface. Existing surface soils with rock particles projecting more than 3 inches above the mean soil surface shall be bladed, picked or rolled to meet the requirement in accordance with Section 02220.

2.03 EROSION LAYER

A. Requirements for erosion layer materials are defined in paragraph 2.02 of Section 02222 of these Specifications.

2.04 DAM EMBANKMENT

A. Structural Fill

1. Materials shall be free of organic, gypsiferous, or other deleterious material and containing no ice, snow, or frozen material. Materials with small amounts of gypsum shall be permitted for use as earthfill in the dam embankment only after approval of the design engineer.
2. Materials to be obtained from on-site excavations from either the alluvium and/or colluvium borrow areas located north of the dam or from within the dam excavation footprint.
3. In general, the soils shall have 100% of the particles passing the 3 inch sieve, a minimum of 50% pass the no. 4 sieve and a minimum of 20% pass the no. 200 sieve. Up to 10 percent of particles between 3 and 6 inch in size inch may be allowed provided the compaction requirement noted below can be met. If construction quality assurance tests indicate that the particles larger than 3 inches make it difficult to meet the specified compaction, the contractor should remove the particles larger than 3 inches.

B. High Plasticity Fill

1. Materials shall be free of organic, gypsiferous, or other deleterious material and containing no ice, snow, or frozen material.
2. Materials to be obtained from on-site stockpiles.
3. High Plasticity Fill Materials shall have a plastic index >10 and 50% passing the #200 sieve.

C. Low Permeability Cutoff Wall Fill

1. Materials shall be free of organic, gypsiferous, or other deleterious material and containing no ice, snow, or frozen material.
2. Material to be low strength concrete with a 28-day compressive strength of 1,500 psi and slump of 4-inches ± 1. Material shall be placed in compliance with Specification 03101.

2.05 DIVERSION BERM EMBANKMENT

A. Materials shall be free of organic, gypsiferous, or other deleterious material and containing no ice, snow, or frozen material. Materials with small amounts of gypsum shall be permitted for use as earthfill in the berm embankments only if approved in advance by the Design Engineer.

B. Materials to be obtained from on-site excavations from either the alluvium and/or colluvium borrow areas located north of the dam or from within the dam excavation footprint.

C. The soil shall have 100% of the particles pass the 3 inch sieve, a minimum of 50% pass the no. 4 sieve and a minimum of 20% pass the no. 200 sieve.

2.06 DAM TOE DRAIN

A. Free of organic, gypsiferous, or other deleterious material and containing no ice, snow, or frozen material.

B. Materials to be obtained from on-site rock processing area or approved off site quarry.

C. The gravel shall be clean crushed rock processed to provide a gradation of rock with 100% of the particles passing the ¾-inch sieve, 10 percent of the particles passing the ½-inch sieve and contain less than 2% by weight passing the no. 200 sieve.

D. Gravel shall have a soundness of 12% maximum loss according to AASHTO T104 as stated in the Nevada Department of Transportation Standard Specification.

E. The dam toe gravel drain material shall have a minimum hydraulic conductivity of 0.1 centimeters per second according to ASTM D2434.

2.07 RIPRAP

A. Material may be obtained from on-site source locations.

B. Riprap materials shall not contain any deleterious materials, debris, organic matter, ice, snow, or frozen material.

C. Riprap shall be in accordance with the D_{50} as shown on Drawings.

D. Riprap shall meet the requirement of the Nevada DOT Standard Specifications Section 610.02.01, 610.03.01, 610.03.02, 610.03.03 and 610.03.04.

E. Material used for riprap shall be hard, durable, angular in shape, resistant to weathering and erosion, and free from spoils, cracks and organic matter.

F. The material for non-grouted riprap shall have a minimum of two fractured faces with neither width nor thickness of a single stone less than one-third its length.

G. The specific gravity of the riprap shall not be less than 2.5.

H. Materials from the Callville, Toroweap and Kaibab Formations shall be considered as materials for riprap with only prior approval of Owner's Representative. The riprap shall be fully cemented material. Only materials designated as hard (scratches leave only dust, requires many hammer blows to break) or very hard (difficult to scratch or break), shall be utilized. Moderately hard (crumbles with several hammer blows) or partially cemented materials are not acceptable.

I. The rock material shall have a minimum durability index of 52 based on ASTM D5312.

2.08 GROUTED RIPRAP

A. Riprap material shall satisfy all requirements of article 2.07 of this section.

B. The grout mix design shall have a minimum 28 day compressive strength of 3,000 psi.

C. The grout mix design should have a minimum air content of 5 percent..

D. The grout mix design shall contain a minimum of six bags of type II Portland cement per cubic yard of grout.

E. The grout mix design shall have 1.5 pounds of Fibermesh® or equivalent per cubic yard of grout.

2.09 STRUCTURAL BACKFILL

A. Material shall be obtained from on-site excavations.

B. Structural Backfill material shall not contain any deleterious materials, debris, organic matter, gypsiferous materials, ice, snow, or frozen material.

C. The following gradation requirements shall be met:

Particle Size	% Passing
¾-inch	100
#4 sieve	60 to 100
#40 sieve	20 to 60
#200 sieve	0 to 15

2.010 SAND BEDDING LAYER

A. Shall contain no de leterious materials, debris, organic matter, gypsiferous materials, ice, snow, or frozen material.

B. Shall be free of clay and non-plastic.

C. Having a maximum particle size of 3/8-inch.

D. Having a minimum of 95 percent passing the #4 standard sieve.

E. Having a maximum of 10 percent passing the #100 standard sieve.

Sieve Size	Percent Passing
3/8 in.	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

2.011 NEVADA DOT TYPE 2, CLASS B AGGREGATE BASE MATERIAL

A. The base material shall be in accordance with section 704.03.05 of the standard specifications.

2.012 LOW-PERMEABILITY BACKFILL

A. As specified in Part 3.07 of Section 02222, locally exposed beds of the Queantoweap and Pakoon formations within the impoundment area and along the western abutment should be delineated in the field during grading, and over-excavated to a minimum depth of 3 feet.

B. The over-excavated materials should be replaced with 2-foot-thick relatively low-permeability soil (with a hydraulic conductivity of $\leq 1 \times 10^{-5}$ cm/sec) and 1-foot-thick protective cover soil.

C. The low-permeability soil should be moisture conditioned to have moisture content of between 0 and +5 percent of the optimum moisture content measured from the modified Proctor tests before placement.

D. The soil should be placed in 8-inch loose lifts and compacted to 90 percent of the maximum dry density determined from the modified Proctor test.

E. The "Beazer Soil", which is currently available in an on-site stockpile, may be suitable for the relatively low permeability soil.

F. A 1-foot layer protective soil (on-site alluvium or colluvium) should be placed above the low-permeability backfill and compacted to 90 percent of the maximum dry density determined from the modified Proctor test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavation is complete and in compliance with slopes and dimensions shown on the Construction Drawings.

B. If excavation of unsuitable material is required, coordinate excavation with Owner.

3.02 SUBGRADE PREPARATION

A. Grade out soil berms and undulations on site to provide a smooth unyielding surface for the placement of either the barrier layer or erosion layer depending on area requirements.

B. Any rock particles projecting in excess of 3-inches above the surface shall be removed by blading, rolling, hand picking, or other method so the surface meets the requirement.

3.03 SOIL BARRIER LAYER

A. Prior to placement, the existing surface will be fine graded and cracks repaired as specified in Section 02220 Excavation and Grading. The area will then be inspected by the Owner's Representative and approved, or rework areas will be identified.

B. Place soil barrier layer to lines and grades shown on the Construction Drawings. Grades may be adjusted with approval of Owner's Representative as long as slope angles and lengths are maintained.

C. The minimum completed thickness for the soil barrier layer shall be 2.5 feet, including in place material approved by the Owner's Representative.

D. Barrier layer soils shall be placed in maximum 12-inch lifts prior to compaction.

E. Where barrier soils are to be placed over existing soils, the existing soil surface is to be scarified and moisture conditioned prior to placement of additional soils.

F. Barrier soils shall be compacted to a minimum 90 percent compaction by standard proctor (ASTM D698). Refer to CQAP for testing frequency.

G. In the case where nuclear gauge tests cannot be performed based on the particle size, four passes over the soil barrier layer with equipment providing a minimum ground pressure of 15.3 psi (CAT D8) is required.

H. Barrier soils shall be placed at drier than optimum moisture and conditioned as appropriate for compaction.

I. On existing slopes greater than 10 percent the top 12-inches of the soil barrier layer must be verified to comply with the specified material requirements stated in Section 2.3 above. Locations with excess amounts of gravel shall be processed with site soils to meet the requirements or additional soil barrier layer soils shall be placed. This requirement applies to areas of the side slopes of the landfill that have had retrofits and repairs.

J. Complete topographic survey of top of barrier layer and prepare staking plan to identify slopes less than 10% and slopes greater than or equal to 10%.

3.04 EROSION LAYER

A. Place erosion layer to meet thickness requirements based on the staking plan and verified by point on point grid survey. Grades may be adjusted with approval of Owner's Representative as long as the adjusted slopes and slope lengths do not exceed design parameters.

B. The minimum completed thickness varies based on slope angles and lengths as shown on the Construction Drawings.

C. Place in a single uniform lift and in such a manner as to avoid displacement of the underlying material.

D. Place stone riprap on the prepared surface by hand or mechanical means in a manner which will produce a well graded mass of stone.

E. For slopes greater than or equal to 10%, compact the erosion layer by passing a tracked piece of construction equipment over the layer with a minimum of 4 passes. The minimum ground contact pressure for the tracked equipment shall be 15.3 psi.

F. For slopes less than 10%, compaction shall be a minimum of 90% maximum dry density determined by ASTM D698.

3.05 DAM EMBANKMENT

A. Structural Fill

1. Place fill material for the diversion berm in such a manner as to achieve required compaction throughout the lines and grades shown on the Construction Drawings. The Contractor can overbuild the footprint and trim the slopes and crest to achieve the compaction to the lines and grades as shown on the Construction Drawings. Grades may be adjusted with approval of Owner's Representative.
2. Place in maximum 12-inch loose lifts.
3. Compact to minimum 90 percent relative compaction according to ASTM D1557 at minus one to plus three percent of optimum moisture content.
4. Fill shall be placed at drier than optimum moisture and conditioned as appropriate for compaction.

B. High Plasticity Fill

1. Place fill material in the core-trench/keyway in such a manner as to achieve required compaction throughout the lines and grades shown on the Construction Drawings. Additional high plasticity fill may be required based on foundation excavation.
2. Compact to minimum 90 percent relative compaction according to ASTM D1557 at plus three to six percent wet of optimum moisture content.

C. Low Permeability Cutoff Wall Fill

1. Place low permeability cutoff wall fill in the abutment excavations as shown in the Construction Drawings and as director by the OWNER"S REPRESENTATIVE.
2. Excavation shall be clean of all lose soils and debris as directed in Specification 02250 Foundation Treatment.
3. Concrete shall be placed as directed in Specification 03101.

3.06 DIVERSON BERM EMBANKMENT

A. Berm slope lengths shall be met with a slope tolerance in accordance with the plans. Berm slopes will be verified at 100 foot stationing along the berm on the top of soil barrier layer.

B. Following the slope verification of the diversion berm embankment, rip rap or grouted rip rap shall be placed to the minimum lining depth in accordance with the plans.

C. Place fill material for the diversion berm in such a manner as to achieve required compaction throughout the lines and grades shown on the Construction Drawings. The Contractor can overbuild the footprint and trim the slopes and crest to achieve the compaction to the lines and grades as shown on the Construction Drawings. Grades may be adjusted with approval of Owner's Representative.

D. A minimum berm embankment crown width of 4 feet shall be maintained.

E. Place in maximum 8-inch loose lifts.

F. Compact to minimum 90 percent relative compaction according to ASTM D1557 within the range of plus or minus three percent of optimum moisture content.

G. Fill shall be placed at drier than optimum moisture and conditioned as appropriate for compaction.

3.07 DAM TOE DRAIN

A. 12-oz/yd^2 geotextile (Section 02243) shall be placed at the bottom, sides, and top of the toe drain to minimize the potential for migration of fines from the dam embankment to the toe drain.

B. Place material for toe drain as shown on the Construction Drawings.

C. Place in maximum 12-inch loose lifts.

3.08 STRUCTURAL FILL

A. Place structural fill material for culvert facilities, to the lines and grades shown in the Construction Drawings. Grades may be adjusted with approval of Owner's Representative.

B. Place in maximum 8-inch loose lifts.

C. Compact to minimum 90% maximum dry density (ASTM D1557).

D. Structural fill shall be placed at drier than optimum moisture and conditioned as appropriate for compaction.

E. Means and methods for compaction immediately behind retaining walls and adjacent to concrete structures should be submitted to the Owner's Representative for approval prior to commencement of work.

3.09 RIPRAP

A. Place stone riprap on the prepared surface by hand or mechanical means in a manner which will produce a well graded mass of stone with a minimum practicable percentage of voids.

B. Place the stone so as to be in close conformity with the Construction Drawings.

C. Place riprap to full course thickness in one operation and in such a manner as to avoid displacement of the underlying base material.

D. Do not place riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation.

E. Produce a riprap course in which all sizes of material are evenly distributed and placed in their proper proportions. Hand placement or rearrangement of individual stones by mechanical equipment may be required to secure the results specified.

F. Replace any materials displaced by any cause to the lines and grades shown on the Construction Drawings at no additional cost to the Owner.

G. Control of gradation will be by individual inspection.

3.010 GROUTED RIPRAP

A. Place riprap to depth as indicated on the Drawing.

1. Distribute larger riprap stones uniformly.
2. Do not group stones as a substitute for one larger stone.
3. Arrange individual stones as necessary by use of equipment or by hand to maintain specified gradation and interlock.
4. Place stones to achieve a stone mass with a minimum thickness and height indicated on Drawings.

B. Maintain riprap at a minimum temperature of 50 degrees F and not more than 90 degrees F during grout placement and curing periods.

C. Thoroughly wet riprap and foundation surfaces, allowing excess water to drain, before placing grout mix.

D. Ensure that grout is thoroughly mixed, does not segregate, and does not begin to set during the placement process.

E. Deposit grout to fill all voids.

1. Place grout mix from bottom to top and pump sufficient grout to fill all voids between the riprap.
2. Grout shall penetrate to the subgrade. Use a pencil vibrator to fill all voids and between and under stones.

F. Keep exposed surfaces continuously moist for a seven day curing period.

1. Maintain moisture by sprinkling, fog spraying, or by covering with continuously moistened canvas or similar material.

3.011 SAND BEDDING LAYER

A. Place sand bedding material for all underground pipes to lines and grades shown on the Construction Drawings.

B. Place in maximum 8-inch loose lifts.

C. Compact to minimum 95 percent of maximum dry density as determined by ASTM D698.

D. Grade to smooth surface for pipe placement.

3.012 NEVADA DOT TYPE 2, CLASS B AGGREGATE BASE MATERIAL

A. Construction associated with placing and compacting Type 2, Class B Aggregate Base material shall be in accordance with section 302.03.03 of the Nevada DOT standard specifications for road and bridge construction.

B. Refer to Drawings for thickness requirements.

3.013 FIELD QUALITY CONTROL

A. Verify thickness of all layers, compaction requirements, and survey points.

B. Construction Quality Assurance testing as specified above in Article 1.6C

PART 4 MEASUREMENT AND PAYMENT

A. Not Used

END OF SECTION

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SECTION 02225

ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.

B. Referenced Standards include the following:

1. Nevada DOT Standard Specifications 2001.
   a. Section 401 Plantmix Bituminous Pavements
   b. Section 703 Bituminous Materials
   c. Section 705 Aggregates for Bituminous Courses
2. American Society of Testing and Materials (ASTM), Section D, most current versions
3. American Association of State Highway and Transportation Officials (AASHTO), 2006 Edition.

1.02 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the State of Nevada Department of Transportation (NDOT) Standard Specifications for Construction, 2001 Edition.

1.03 SUBMITTALS

A. Product Data: For each product specified, provide technical data and tested physical and performance properties.

B. Mix Designs: Certification, by responsible persons, of approval of each mix design proposed for the Work.

C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.04 QUALITY CONTROL

A. Installer Qualifications: Installer shall have completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of hot-mix asphalt shall have experience in similar projects and with a record of successful in-service performance.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
2. Asphalt Surface Course: Minimum surface temperature of 50 deg F (10 deg C) at time of placement.

PART 2 PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations in accordance with NDOT Standard Specifications for Construction, 2001 Edition Section 705.

B. Aggregate: Sound; angular crushed stone; crushed gravel; complying with Type 2C Plantmix Bituminous Surface Aggregate NDOT Standard Specifications Section 705.03.01.

2.02 ASPHALT MATERIALS

A. General: Use asphalt materials in accordance with NDOT Standard Specifications for Construction, 2001 Edition Section 703.

B. Asphalt Cement: Use viscosity grade AC-30 asphalt cement in accordance with Section 703.03.02 in the NDOT Standard Specifications.

C. Water: Potable.

2.03 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mix in accordance with NDOT Standard Specifications Section 401.

B. Provide mix that meets the requirements of the NDOT Standard Specifications Section 401.02.02 or approved equal.

C. Provide mix design to Engineer in English units. Provide definite single values for:

1. Percentage of aggregate passing each specified sieve.

2. Percentage of bitumen to be added (to 0.1%), by dry mass of aggregate.

3. Mix design properties required in Section 401.02.02 including compaction, stabilometer value, indirect tensile strength, indirect tensile strength (retrieved strength) and voids in mineral aggregate. Temperature of mixture leaving the mixer.

4. Minimum temperature of the mixture in the hopper of the paving machine.

5. Percentage of each aggregate bin used. (Bin percentages of less than 5% will not be allowed).

D. The mix design shall conform to the allowable tolerances in Section 705 of the NDOT Standard Specifications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is not wet, has been compacted, and is in suitable condition to support paving and imposed loads.

B. Proof-roll subgrade using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Owner's Representative shall examine any unsatisfactory conditions. Paving installation shall not begin without the Owner's Representative examination and approval of the subgrade.

3.02 HOT-MIX ASPHALT PLACING

A. Place hot-mix asphalt mix in accordance with NDOT Standard Specification Section 401.

B. Place a asphalt in two equal lifts thicknesses.

3.03 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

B. Place joints in accordance with NDOT Standard Specification Section 401.03.12.

3.04 COMPACTION

A. Compact in accordance with NDOT Standard Specification Section 401.

B. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement.

C. Compact hot-mix paving with hot hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

D. Compact to a minimum 92% of the theoretical maximum specific gravity and density of hot mix asphalt (AASHTO T209).

E. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.05 INSTALLATION TOLERANCES

A. Flatness: Use a 12 foot long straightedge laid on finished pavement surface. The asphalt concrete surface shall not vary more than ¼ inch from the lower edge of the straightedge.

B. Thickness: Compact each course to produce the thickness indicated on the Drawings within the following tolerances:

1. Surface Course: Plus 1/8 inch (3 mm), no minus.

3.06 FIELD QUALITY ASSURANCE

A. Testing will be performed in accordance with the Construction Quality Assurance Plan for his project.

B. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 02228

WASTE RELOCATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and appurtenances required to complete the work of relocating all waste materials during and as the result of the construction operations under this Contract, as specified or required. Areas anticipated to require waste relocation include the dam footprint and any channels alignment that during excavation require waste to be excavated to meet design grades.

1.02 RELATED SECTIONS

A. Section 02220 – Excavation and Grading

B. Section 02224 – Material Placement

C. Section 02230 - Trenching

1.03 APPLICABLE REGULATIONS

A. In order to prevent environmental pollution arising from the construction activities related to waste relocation activities, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws and regulations concerning waste exhumation and relocation, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

B. The Contractor is advised that the disposal of excavated material outside the Sunrise Mountain Landfill limits of waste is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor, or any person employed by the Contractor, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill and restore the area impacted at its own expense.

1.04 SUBMITTALS

A. Alternative Cover: At least 14 days prior to waste relocation activities, Contractor shall submit technical sheets on alternative cover methods for approval. All methods are to be approved by Clark County Department of Environmental Health prior to use.

PART 2 PRODUCTS

A. Not used

PART 3 EXECUTION

3.01 GENERAL

A. Exact depth of waste excavation is unknown in many areas. The waste will be excavated as need to meet design depths for ditches, pipes, and dam footing as necessary.

B. All waste materials within the dam footprint and along the channel alignments, including but not limited to, refuse, demolition waste material, trash, garbage, etc., shall be excavated to the lines and grades shown on the Contract Drawings by the Contractor and relocated to the Top Deck area within the existing limits of waste.

C. As excavation progresses, the remaining in situ waste must be covered at the end of each work day with a minimum of 6 inches of soil or approved alternative daily cover to control vectors and odor.

D. Relocated waste shall be placed and spread in maximum 3 foot lifts and compacted with a minimum of 5 passes of a tracked vehicle with a minimum ground pressure of 15 psi. Relocated waste, not reaching final grade, must be covered at the end of each work day with a minimum of 6 inches of soil or approved alternative cover to control vectors and odor.

E. After waste meets final grade, 2.5 feet of barrier layer soils shall be placed in accordance with Section 02224.

F. After barrier layer soils are placed, erosion layer material shall be placed in accordance with Section 02224.

G. If any waste or surplus material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, properly disposed of, and replaced with suitable fill material, compacted and finished with suitable erosion layer material, all at the expense of the Contractor.

   1. The Contractor is responsible for any fines, penalties, and damages associated with improper handling or disposal of waste material.

H. No materials shall be burned at the site.

I. Police area to clean up any waste that has blown out of the transport vehicles and deposit the waste in waste fill prior to covering with Soil Barrier Material.

PART 4 MEASUREMENT AND PAYMENT

A. Not Used

END OF SECTION

SECTION 02230

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes trenching as specified herein and as needed for burial of existing landfill gas system piping.

1.02 RELATED SECTIONS

A. Section 01052 – Health and Safety

B. Section 02200 – Excavation

C. Section 02224 – Material Placement

D. Section 02228 –Waste Relocation

1.03 REFERENCES

A. Nevada Department of Transportation Standard Specifications, 2001 Edition

B. Occupational Safety and Health Administration (OSHA).

1.04 SUBMITTALS

A. Submit manufacturer's product data for proposed buried marker tap at least 14 days prior to installation.

B. Submit manufacturer's product data for proposed vertical buried pipeline markers at least 14 days prior to installation.

PART 2 PRODUCTS

2.01 BARRIER LAYER

A. See requirements of Section 02224 - Material Placement.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely, safe, and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Comply with OSHA regulations and permit requirements.

3.02 GENERAL PROCEDURES

A. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.

B. Keep trenches and site construction area free from standing water.

C. Mark route of trench prior to execution.

3.03 TRENCHING

A. Comply with pertinent provisions of related sections.

B. Trenching for landfill gas pipes:

1. Trench to the minimum width necessary for proper installation of pipe with sides as nearly vertical as possible while maintaining compliance with OSHA regulations. Uniformly grade the bottom to provide uniform bearing for the pipe as shown on the Construction Drawings.
2. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove cobbles or other interfering objects, backfill the voids remaining after removal of the objects as directed by the Owner's Representative.
3. When the void is below the subgrade for the pipe bedding, use soil barrier materials to fill in the void.
4. When the void is in the side of the trench or open cut, use soil barrier materials to fill in the void.
5. No trenching shall occur in solid waste. Pipe shall be located at or above the solid waste line.
6. Remove interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

3.04 BACKFILLING

A. General:

1. Backfill trenches with bedding and soil barrier materials as shown on the Construction Drawings.
2. Reopen trenches which have been improperly backfilled. Refill and compact as specified, or otherwise correct to the approval of the Owner's Representative.
3. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.
4. Should any of the Work be so enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Bedding and Backfill around Pipes

1. Take special care in bedding and backfilling operations to not damage pipe.

2. Place soil barrier material to the thickness as shown on Drawings. Lightly tamp material under pipe haunches to compact.
3. Place backfill material to completely surround pipe without voids.
4. Place soil barrier material in accordance with Section 02224.
5. Embed tracer wire above the pipe.
6. Install vertical markers on 100 ft. centers along all pipe runs.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION

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SECTION 02231

VALVES

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall provide valves of the type and size at the locations shown on the contract Drawings.

1.02 RELATED WORK

A. Section 02232 – HDPE Pipe

1.03 SUBMITTALS

A. The CONTRACTOR shall submit documents for any proposed substitution in accordance with Section 01300, "Submittals".

1.04 WARRANTY

A. The Contractor shall assign to the Owner the warranties of the manufacturers of any of the valves used.

PART 2 PRODUCTS

2.01 BUTTERFLY VALVES

A. Unless otherwise specified, butterfly valves used in the landfill gas collection system shall be 150 lb. flat-faced flanged UV treated PVC butterfly valves with polypropylene disk, 316 stainless steel stem, and Viton liner or approved equal. White PVC valves exposed to the sun shall be painted with two coats of white latex paint to protect them from UV damage.

B. All bolting for valves installed above grade shall be zinc plated and for buried valves shall be 316 SS.

C. Unless specified otherwise on valve data sheets or on the Drawings, valves greater than 4 inches shall have a gear operator and valves 4 inches and less shall have a 10 position locking handle.

D. All valves and gear operators shall be right hand close.

PART 3 EXECUTION

3.01 INSTALLATION

A. When possible all butterfly valves shall be installed so that the disk rotates on the horizontal axis. Below grade butterfly valves without gear operator shall be installed with their axis in the vertical direction.

B. The inside diameter of HDPE pipe may be smaller than the diameter of the disk on a butterfly valve. If the size of the disk interferes with the inside diameter of the pipe, the CONTRACTOR may at his option either remove by machining excess material from the ID

of the HDPE flange adapter, or use thickest standard size HDPE flange adapters with a thickness that will allow the valve disk to clear the pipe provided the pipe rating resulting is suitable for the application.

C. Valve installation shall be per the manufacturer's specifications.

D. Locate and arrange valves to provide complete adjustment between fully open to fully closed position.

E. Install valves in at least the following locations:

1. On both sides of apparatus and equipment.
2. For shutoff of branch mains.
3. Where shown on the Contract Drawings.

F. Locate valves for easy accessibility and maintenance.

G. Install valves in closed position, with valve stems vertical

END OF SECTION

SECTION 02232

HDPE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All piping as shown on the Contract Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to, the following:

1. Landfill gas lateral, subheader, and header piping.
2. Landfill gas condensate piping.

1.02 REFERENCES

A. ASTM D3350 Standard Specification for Polyethylene (PE) Plastic Pipe and Fittings Materials.

B. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

C. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

D. ASTM D1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

E. ASTM D2513 Standard Specification for High Density Polyethylene (HDPE) pipe and fittings.

1.03 SUBMITTALS

A. Product Data: Within 15 calendar days after the CONTRACTOR has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 PRODUCTS

2.01 POLYETHYLENE (PE) PIPE

A. Provide PE pipe of SDR indicated on the Construction Drawings complying with ASTM D 2513 and ASTM D 3350, D 3287, and F 714, where applicable made from resins conforming to ASTM D 1248.

2.02 PE FITTINGS

A. Provide PE fittings complying with ASTM D2513 and ASTM D3350 and D3261, where applicable made from resins conforming to ASTM D1248.

B. Provide PE fittings of the same manufacturer and resin material as PE pipe.

C. Provide fabricated fittings fabricated from PE pipe with an SDR which are equal to or one rating heavier (thicker wall) than the pipe to which they are joined.

2.03 PE RESIN

A. Provide PE products made from a high density, high modulus resin conforming with cell classification PE 345434C or better in accordance with ASTM D3350.

2.04 CONDENSATE PIPING

A. Condensate drain lines for the condensate traps shall be HPDE, SDR 11, fabricated from materials as specified in paragraph 2.01 of this section.

2.05 MONITORING PORTS

A. Header Monitoring Ports:

1. Provide polypropylene quick-disconnect couplings, Colder Products or ENGINEER approved equal, 1/8-inch female shut-off with 1/4-inch male NPT end. Ports to match extraction wellhead monitoring ports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. Notify the Owner's Representative of such conditions and proposed corrective action before correcting unsatisfactory conditions.

3.02 PREPARATION

A. Lay out the piping systems in careful coordination with the Contract Drawings, determining proper elevations and locations for all components of the system and using only the minimum number of fitting bends to produce a satisfactorily functioning system. In special cases and with the approval of the Owner's Representative, bends in piping shown on the Contract Drawings may be eliminated by gradual deflection of straight pipe runs.

B. Follow the general layout shown on the Contract Drawings in all cases except where other work may interfere or field conditions deviate from conditions shown in Contract Drawings.

C. Obtain the approval of the Owner's Representative for the layout of all piping systems before and during pipe installation.

3.03 INSTALLATION

A. General:

1. Proceed as rapidly as other sitework activities will permit.
2. Installation shall occur with limited impacted to landfill gas system operations. A maximum of 10% of the landfill gas header system (measured by length) can be non-operational at one time.
3. No more than 20% of landfill gas collection system wells are allowed to be shut down at any one time for more than two weeks. Remaining wells to be operational at all times. Wellfield to be monitored by Owner.
4. Contractor to provide temporary piping if necessary to reconnect wells during shut down periods if needed to maintain positive pressure on the wellfield.
5. Preconstruction survey to stake all channel alignments and subsequently determine variance from design grades to allow for correction due to settlement of the landfill.

B. Thoroughly clean piping materials before installation. Cap pipe openings to exclude rodents and dirt until final connections have been made.

C. Cut pipe accurately, and work into place without springing or forcing.

D. Install landfill gas piping at a minimum of 3 percent slope unless otherwise noted on the Contract Drawing or approved by the Owner's Representative.

E. Provide sufficient expansion and contraction compensation, flexible couplings, and devices necessary for a flexible piping system, whether or not shown on the Contract Drawings.

F. Equipment Access:

G. Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.

H. Flange Connections:

I. Install gaskets centered on flanges and tighten bolts to torque requirements recommended by flange and/or valve manufacturer. Replace flanges damaged by overtightening, at no cost to the Owner.

J. Flexible couplings:

K. Install flexible couplings as pipe and pipe anchors are being installed at locations shown on the Construction Drawings. Flexible couplings shall be compressed or expanded to meet temperature conditions at the time of installation as shown on the Construction Drawings.

L. Bevel and clean both pipe ends.

M. Insert pipe ends into coupling cuffs 2-1/2 inches.

N. Install and tighten (but do not overtighten) hose clamps.

O. Polyethylene (PE) pipe and fitting:

P. Construct PE piping systems using butt fusion methods in accordance with the pipe and fusion equipment manufacturer's instructions. Allow for additional lengths of pipe for expansion and contraction.

Q. Provide appropriate fusion equipment for pipe size under construction.

R. Inspect PE pipe and fittings for cleanliness and damage prior to placing and joining. Remove and replace all damaged piping material.

S. Wipe clean both inside and outside surfaces of the two ends to be joined and remove dirt and foreign materials.

T. After cutting pipe ends, do not touch newly-faced surfaces.

U. Ensure that fusion tools are free of contaminants.

V. Heat the surfaces to be joined simultaneously and fuse together in accordance with time and temperature requirements recommended by the material manufacturer.

W. Allow butt fused joints to cool for time duration recommended by manufacturer.

X. Do not remove new joint from fusion equipment for an additional three minutes.

Y. Do not test, stress, pull, or lay new joint on ground for 10 minutes after removal from fusion unit.

Z. Visually inspect each new joint for misalignments, gaps, or voids in joint. Bead thickness and melt pattern shall comply with manufacturer's recommendations. Joints not meeting Owner's Representative approval shall be cut out and remade at no additional cost to the Owner.

3.04 PIPE SUPPORTS

A. Space supports for horizontal pipes as shown on the Contract Drawings.

B. Arrange pipe supports to prevent excessive pipe deflection, and to avoid excessive bending stress.

C. Anchor pipe supports in concrete slabs or footings, as shown on the Contract Drawings.

D. Space wood blocks for supporting LFG piping within the encased road crossings and elevated crossing to prevent excessive pipe deflection, and to avoid excessive bending stress.

3.05 TRENCHING AND BACKFILLING

A. Contractor shall conform to all requirements for Health and Safety as specified in Section 01052.

B. Contractor shall conform to trenching and backfilling procedures as specified in Section 02230.

C. Perform excavation of every description and of whatever substances encountered to depth indicated or as otherwise shown and specified. Grade trench bottoms to suit required piping

slopes. Grade as necessary to prevent surface water from flowing into trenches. Remove any water accumulating therein by pumping or other approved methods. Notify the Owner's Representative immediately of any continuous water flow into trench. Sheet and brace excavations as necessary to fully protect workmen and adjacent structures and permit proper installation of work. Under no circumstances lay pipe or install appurtenances in water, without approval of the Owner's Representative. The presence of ground water in soil or the necessity of sheeting or bracing of excavations shall not constitute a condition for which any increase may be made in contract price.

D. Excavate trenches to the necessary width for proper laying of pipe. Backfill over excavations using methods and procedures specified for backfilling the lower portion of trenches. When wet or unstable material is encountered at bottom of trench, remove such material to depth required as directed by Owner's Representative and backfill to proper grade with suitable approved material. Grade the bottom of trenches accurately to provide uniform bearing and support for each piping section at every point along its entire length. Remove stones and all other protrusions from trench bottom.

E. Place bedding material to dimensions shown in Drawings. Bedding material shall be carefully placed in bottom of trench, so as to ensure a uniform thickness below the pipe.

F. Backfill pipe trenches with the backfill materials shown and specified, and compact as shown and/or specified.

G. Embed tracer wire above LFG collection pipes.

H. Install vertical markers on 100 ft. centers along all pipe runs.

I. After backfill is completed, remove unused excavated and backfill materials to areas designated by the Owner's Representative.

3.06 PRESSURE TESTING

A. Before pressure testing, blow the pipe clean of dirt and debris and remove from systems equipment which would be damaged by test pressure. Replace equipment after testing. Systems may be tested in sections.

B. Pressure tests shall be performed on the following piping systems and specified parameters:

LFG Collection	Compressed Air or Water	10 PSI
HDPE Condensate	Water	100 PSI

C. Conduct all pressure testing in accordance with the pipe manufacturer's recommendations and procedures. Test pressures shall be contained for a minimum of 1-hour, with no change in pressure, except that calculated due to temperature change.

D. Locate and repair all leaks. Correct leaks by replacing faulty materials with new material.

E. Repeat pressure testing until all piping systems pass. Perform additional pressure tests after repair of each system at no cost to the Owner's Representative.

F. Test solenoid and pressure relief valves for proper operation at settings indicated. T est pressure relief valves three times.

G. The Contractor will be responsible for notifying the Owner's Representative at least 48 hours in advance so that the Owner's Representative may be present during testing.

3.07 PROTECTION

A. Protect all installations and materials from damage until final acceptance by the Owner's Representative.

B. Prevent debris from entering into piping systems during installation.

END OF SECTION

SECTION 02238

ROCKFALL BARRIER FENCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rockfall barrier fence as specified herein and as needed for protection of storm water channel.

B. A medium impact system shall be installed that is designed to hold at a minimum 134,000 foot-lbs service load, and designed for a minimum 200,000 foot-lbs ultimate load. The fence shall be a minimum of 6 feet tall.

1.02 RELATED SECTIONS

A. Section 01025 – Measurement and Payment

1.03 REFERENCES

Not Used

1.04 SUBMITTALS

A. Submit manufacturer's product data, installation procedures, drawings, and specifications for proposed rockfall barrier fence and all incidentals associated with construction at least 60 days prior to installation.

B. Submit steel certifications for structural members at least 14 days prior to installation.

C. Contractor must submit previous work experience with Rockfall Barrier fencing 60 days prior to installation of the approved system.

PART 2 PRODUCTS

2.01 GEOBRUGG GBE 1000

A. The Geobrugg GBE 1000 system or approved equal shall be used in areas shown on the plans where debris fence is needed along specific parts of the rockfall channel. The system should include all manufacturer supplied materials and be constructed to manufacturers specifications by experienced personnel who have had previous experience with rockfall fence systems.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely, safe, and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 GENERAL PROCEDURES

A. The installation of the Geobrugg GBE 1000 or approved equivalent shall be constructed to the manufacturer's specifications, guidelines, suggested practices, and with the manufacturer supplied materials, fasteners, cables, brakes and other incidentals to the rockfall barrier fence.

PART 4 MEASUREMENT AND PAYMENT

A. Not Used

END OF SECTION

SECTION 02243

GEOTEXTILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the general requirements for the manufacture, supply, installation, and quality control (QC) of geotextiles associated with the construction of the toe drain (or blanked drain) within the detention dam embankment.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B. Section 02220 – Excavation and Grading

C. Section 02224 – Material Placement

D. Section 03101 – Concrete – CIP

E. Section 03411 – Precast Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
2. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
3. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
4. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile
5. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
6. ASTM D5199 - Standard Test Method for Measuring Geotextiles
7. ASTM D5261 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

1.04 DEFINITIONS

A. Geotextile: S ynthetic fiber filter fabric for use in geotechnical filter, strength and/or separation and erosion control applications.

1.05 SUBMITTALS

A. Product Data: Include installation, handling, storage, and repair instructions. Submit 14 days prior to shipment to the site.

B. Certificates: Certifying that geotextile meets or exceeds specific requirements. S ubmit 14 days prior to shipment to the site.

C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's Representatives name and registered with manufacturer. Submit 14 days prior to installation.

D. A copy of the Manufacturer's quality control (QC) plan.

E. Manufacturing QC certificates for each production run. T he certificates shall identify the origin and the manufacturer of the resin. The certificates shall be signed by responsible parties employed by the manufacturer (such as the production manager). Tests shall be performed at the frequency indicated in the Manufacturer's QC Plan.

F. The QC certificates shall include roll numbers and identification, sampling procedures, and results of quality control tests verifying that minimum values for each of the properties listed in is the table in this section are achieved. T he Manufacturer quality control tests to be performed include the tests specified in Article 2.01 of this section.

G. Manufacturer's certification that the geotextile products meet or exceed specified requirements and are 100% free of needles.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the construction quality assurance (CQA) plan.

1.07 QUALIFICATIONS

A. Geotextile shall be supplied by a Geotextile Manufacturer meeting the following qualification requirements:

1. The Geotextile Manufacturer shall be responsible for the production and delivery of geotextile rolls and shall be a well-established firm with more than two years experience in the manufacture of geotextiles. The Geotextile Manufacturer shall submit a statement to the CQA Consultant listing:
2. Certified minimum average roll property values of the proposed geotextiles and the test methods used to determine those properties.
3. Projected delivery date of the material for this project.

B. The Geosynthetic Installer shall meet the requirements of the CQA Plan

1.08 ENVIRONMENTAL REQUIREMENTS

A. Install geotextile in dry conditions and in accordance with manufacturer's instructions. Suspend installation operations whenever climatic conditions, as determined by Owner's Representative, are unsatisfactory for placing geotextile to the requirements of this Specification.

PART 2 PRODUCTS

2.01 GEOTEXTILE

A. Geotextile Filter for Dam Toe Drain shall have the following minimum properties:

GEOTEXTILE PHYSICAL PROPERTIES

Fabric Property	ASTM Test Method	Qualifier	Units	Values
Mass Per Unit Area	D5261	min. average	oz/sy	12
Trapezoidal Tear Strength	D4533	min. average	lbs	115
Grab Strength	D4632	min. average	lbs	300
Puncture Resistance	D4833	min. average	lbs	140
Permittivity	D4491	min. average	s^{-1}	0.80
AOS	D4751	max. average	mm	0.15

B. All geotextiles shall be a non-woven, triple-punched, needle-punched polyester or polypropylene fabric free from needles or other foreign material.

2.02 CONFORMANCE TESTING

A. Material that arrives at the site will be sampled and conformance tested by the CQA Engineer at a minimum frequency of one per 200,000 square feet of material produced and supplied to the project with a minimum of one sample per production lot. Materials may be sampled at the plant at the discretion of the Owner. As a minimum, the following tests shall be performed on samples of the geotextile:

1. Mass per unit weight (ASTM D5261)
2. Grab strength (ASTM D4632)
3. Puncture resistance (ASTM D4833)
4. Permittivity (ASTM D4491)
5. Apparent opening size (AOS) (ASTM D4751)

B. Conformance tests shall include those properties listed in the Table above.

C. If a test result is not in conformance with the specifications, all material from that production lot represented by the failed test will be rejected. Rejected material may be minimized by bounding the non-conformance material with additional passing tests conducted by the geosynthetic CQA laboratory. Additional tests shall be conducted at no additional cost to the Owner.

D. Rejected material shall be removed from the site and replaced at no cost to Owner.

2.03 DELIVERY, STORAGE, AND HANDLING

A. Handling, storage, and care of the geotextiles following transportation to the site shall be the responsibility of the Installer. The Installer shall be liable for all damage to the materials incurred prior to final acceptance of the liner system by the CQA Engineer.

B. The Installer shall be responsible for storage of the geotextile at the site after the material is delivered. The geotextile shall be stored off the ground and out of direct sunlight, and shall be protected from mud, dirt, dust, and any additional storage procedures required by the Geotextile Manufacturer.

C. All rolls of geotextile shall be identified at the factory with the following:

1. Manufacturer's name
2. Product identification
3. Lot Number
4. Roll number
5. Roll dimensions

D. Geotextiles shall be handled in such a manner as to ensure they are not damaged in any way.

E. Precautions shall be taken to prevent damage to underlying materials during placement of the geotextile.

F. After unwrapping the geotextile from its cover, the geotextile shall not be left exposed for a period in excess of 30 days.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to geotextile placement, roll the subgrade surface with a smooth drum steel or pneumatic roller so that it is free of irregularities, loose earth, and abrupt changes in grade (excluding the dam gravel toe drain). Provide the necessary equipment and personnel to maintain an acceptable supporting surface during material installation.

B. Ensure that subgrade soils have met all required compaction criteria and have been approved by the Owner's Representative.

C. Examine geotextile for defects including rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or handling.

D. Remove defective or damaged geotextile.

3.02 INSTALLATION

A. Notify Owner's Representative at least 24 hours in advance of intention to commence placement of geotextile.

B. Obtain approval of the Owner's Representative prior to installation of the geotextile. Install geotextile in all locations shown on the Construction Drawings.

C. Unfold or unroll the geotextile in accordance with manufacturer's instructions, directly on the prepared base, in conditions which will prevent damage to both the geotextile and the base grade. Unsuitable conditions include, but are not limited to, moderate to high wind conditions.

D. The overlap dimensions and the method of joining adjacent sheets shall be in strict conformance with manufacturer's instructions. Secure the geotextile to the base grade in accordance with manufacturer's instructions unless specially selected for their ultraviolet light resistance, do not expose geotextile to sunlight for more than 72 hours, or as recommended by the manufacturer.

E. Position and deploy geotextile to minimize handling. Lay smooth and free of tension, stress, folds, or creases. Protect properly placed geotextile from displacement, contamination by surface runoff, or damage, until and during placement of overlaid materials.

F. Place geotextile by unrolling onto graded surface and retain in position as specified.

G. Do not permit passage of vehicular traffic directly on geotextile at any time.

H. Geotextile seams shall be continuously sewn. Geotextile seams shall be overlapped a minimum of 6 inches prior to sewing. No horizontal seams shall be allowed on slopes steeper than 5 horizontal to 1 vertical. In lieu of continuously sewn seams, the contractor may overlap all seams by two feet.

I. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile, shall be used for all sewing. The seams shall be sewn using Stitch Type 401. The seam type shall be Federal Standard Type SSa-1.

J. The Contractor and Geosynthetics Installer shall examine the entire geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Such foreign objects shall be removed and damaged geotextile shall be repaired or replaced at no cost to Owner.

K. Use care not to damage underlying materials during installation.

L. Prevent the geotextile from accumulating excessive dust.

M. The Geosynthetics Installer shall be responsible for field handling, storing, deploying, seaming or connecting, temporary restraining (against wind), anchoring, and other aspects of geotextile installation.

N. The Contractor shall accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed system.

O. No equipment shall operate directly on the geotextile.

P. Do not permit placement of materials directly over the geotextile until the Owner's Representative has inspected and approved installation of the geotextile.

3.03 REPAIRS

A. Any holes or tears in the geotextile shall be repaired using a geotextile patch consisting of the same geotextile.

B. On slopes inclined steeper than 10 horizontal to 1 vertical, patches shall be sewn into place with a minimum 6-inch overlap.

C. On slopes inclined at 10 horizontal to 1 vertical or less, patches may be heat-bonded with a 6-inch overlap in all directions

3.04 FIELD QUALITY CONTROL

A. Verify that the weather conditions (air temperature, non-excessive wind, and lack of precipitation) are acceptable for placement.

B. Inspect the geotextile in place for tears, overlaps, and consistency before Contractor may place materials thereon. Identified sections damaged will be removed and replaced at no cost to the Owner.

PART 4 MEASUREMENT AND PAYMENT (NOT USED)

END OF SECTION

SECTION 02250

FOUNDATION TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

The Work of this Division of the Specifications shall comprise supply of all labor, materials and equipment, and performance of all Work necessary for treatment, including surface compaction, cleaning, placement of slush grout and dental concrete, and other preparation of earth and rock foundations within the footprint of the embankment and other excavations.

Foundation treatment is required in the following locations:

A. In overburden and on rock located beneath the footprint of the embankment.

B. In overburden and on rock located within the Principal/RCC Spillway excavations.

C. In excavations for concrete structures.

D. In the abutment cutoff walls.

1.02 RELATED SECTIONS

A. Not used.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM): D1140 Standard Method of Test for Amount of Material in Soils Finer than the No. 200 Sieve.

B. D1556 Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

C. D4253 Standard Test for Maximum Index Density and Unit Weight of Soils using a Vibratory Table.

D. D4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

E. D2167 Standard Test Method for Density of Soil in Place by the Rubber-Balloon Method.

F. C150 Standard Specification for Portland Cement.

G. C94 Standard Specification Ready Mixed Concrete.

H. C404 Standard Specification for Aggregate for Masonry Grouts.

I. D422 Standard Method for Particle-Size Analysis of Soils.

1.04 DEFINITIONS

For purposes of this Specification, the following definitions shall apply:

A. Waste: Waste means all materials contained within the limits shown on the Construction Drawings that has not been formed or deposited by geologic processes.

B. Surface Compaction: Surface Compaction means method of compacting loose soil particles into a more dense state with conventional heavy vibratory rollers and/or compactors.

C. Slush Grouting: Slush Grout shall be composed of neat cement grout or cement, sand and water. The ratios of the materials may vary as directed by the Owner's Representative, but the ratio of sand to cement shall not exceed two (2) parts sand to one (1) part cement.

D. Dental Concrete: Dental Concrete shall be lean mix concrete conforming to the applicable sections of Division 3.

E. Overburden: Overburden means all materials bounded in plan by limits shown on Construction Drawings and between surface of natural ground after stripping and surface of bedrock.

Publications listed in this section form part of this Specification by reference.

1.05 SUBMITTALS

A. If CONTRACTOR intends to have part or all of earth and/or rock foundation treatment performed by a qualified subcontractor, submit subcontractor's name, qualifications, record of previous jobs of a similar nature, personnel to be involved in work, and other pertinent information to Owner's Representative for approval with bid.

1.06 QUALITY ASSURANCE

A. Not used.

PART 2 PRODUCTS

B. Not used.

PART 3 EXECUTION

3.01 PREPARATION

A. General Foundation Preparation Requirements

1. Foundation treatment shall be carried out to lines and grades shown on the Construction Drawings or as otherwise directed by Owner's Representative. Owner's Representative reserves right to alter horizontal dimensions of zones or to realign dividing lines between zones requiring different degree of treatment at any time prior to or during construction where such changes are considered necessary by Owner's Representative.
2. Perform blasting operations in a careful manner so as not to cause damage to rock foundations of structures, create new fractures in the surrounding rock or damage completed concrete work or grout curtain.
3. If, in opinion of the Owner's Representative, damage has occurred to rock foundations, grout curtain or structures, repair damage to satisfaction of Owner's Representative.
4. Schedule foundation preparation such that required fill may be placed immediately after preparation.

5. Use, stockpile or dispose of excavated material in locations shown on Drawings and approved by Owner's Representative.

B. Earth Foundation Preparation

1. When the material has been stripped from the dam embankment area, the surface shall be inspected by the Owner's Representative prior to compaction. Any unsuitable material such as organic matter or soft clay, etc. shall be removed as directed by Owner's Representative.

2. In areas of embankment fill and concrete structures, the groundwater level shall at all times, unless otherwise directed by the Owner's Representative, be maintained at a minimum depth of three (3) feet below the base of the initial excavation and subsequent levels of fill placement.

3. If the surface layer of soil has a moisture content greater than two (2) percent above optimum modified Proctor (ASTM D1557) moisture content, the surface shall be scarified to a depth between nine (9) inches and twelve (12) inches and allowed to dry to the required moisture content.

4. If the moisture content is between minus one (-1) percent and plus two (+2) percent of optimum modified Proctor (ASTM D1557) moisture content, the surface shall be compacted by a minimum of six (6) passes of a twenty (20) ton cleated foot or sheepsfoot roller before fill placement.

5. If the foundation soils are granular in nature they shall be compacted by at least four (4) passes of a minimum twenty (20) ton vibratory tamping foot or smooth drum roller (or equivalent acceptable to the Owner's Representative) before fill placement.

6. The Owner's Representative shall approve all areas of the foundation prior to placing fill material. If any foundation areas show excessive pumping or rutting, in the opinion of the Owner's Representative, underlying materials shall be removed and replaced to the satisfaction of the Owner's Representative.

C. Rock Foundation Preparation

1. After excavation of waste, overburden, and\or alluvial\colluvial materials has been completed to expose the rock surface, remove all loose and objectionable material using appropriate hand excavation tools and equipment. All open or filled joints shall be hand cleaned with bars, spades, high velocity air, and water jets as directed by Owner's Representative and as shown on Drawings.

2. Wash clean all contact areas of all dirt, mud, debris, oil, grout spillage or other materials with broom, air and water jets, immediately before surface treatment or placement of materials.

3. Following cleanup, treat rock foundations to correct rock defects, irregularities, and gypsum seams with slush grout or dental concrete, as directed by Owner's Representative.

4. Slush grout shall consist of one (1) part cement to two (2) parts sand with sufficient water such that it can be broomed into joints and cracks. Slush grout shall be used to fill thin surface joints, cracks and fractures.

5. Where rock or soil foundations are susceptible to weathering when exposed to atmosphere, they shall be covered with slush grout as soon as exposed.

6. Do not run heavy equipment over slush grouted areas for a minimum of 24 hours after placement unless directed or approved otherwise by the Owner's Representative.
7. Concrete, formwork, and concrete placement shall conform to Division 3. Class "C" concrete, having a compressive strength of not less than 1,500 psi, shall be used as dental concrete in the treatment of the rock foundations.
8. Fill with dental concrete any pothole, cavity or any opening where contiguous embankment material cannot be placed and compacted as specified.
9. The slope of dental concrete used to correct overhangs and steep faces shall not be steeper than the slopes shown on the Drawings. Dental concrete placed within formwork shall be anchored to foundation by means of rock dowels grouted into rock, and contact between rock and concrete shall be grouted with a cement-bentonite grout mix as approved by the Owner's Representative.
10. Dowels shall be new deformed billet steel bars complying with ASTM A615, Grade 60. Dowels shall be embedded into the rock to the depth shown on the Drawings or as directed by the Owner's Representative. Dowels shall be held rigidly in place with an epoxy grout or other means approved by the Owner's Representative.
11. Finished surface of dental concrete used for backfill shall be flush with adjoining rock.
12. Replace materials which have been damaged or have deteriorated prior to placement of impervious fill, general fill, or fine filter.
13. Avoid accumulation of grout and concrete on surfaces where such materials are not required. All wastage and spillage outside of concrete areas shall be removed and the surface cleaned.
14. All foundation preparation shall be completed prior to placing of earth fill, rock fill, or fine filter material in or on areas concerned.
15. The Owner's Representative shall approve all areas of the foundation prior to placing fill material.

D. Foundation Preparation Under Concrete Structures

1. After excavation of soft alluvial materials and overburden has been completed in the foundation area for concrete structures, remove all loose and objectionable material as directed by Owner's Representative.
2. The groundwater level shall at all times, unless otherwise directed by the Owner's Representative, be maintained at a minimum depth of three (3) feet below the base of the initial excavation and subsequent levels of fill placement.
3. Compact soil foundation surfaces by at least four (4) passes of a minimum twenty (20) ton vibratory smooth drum roller or equivalent, or as directed by Owner's Representative.
4. If the foundations under concrete structures are rock, clean rock surfaces to receive concrete by means of stiff brooms, picks, hammers, high velocity jets of air and water and other means satisfactory to Owner's Representative. Clean and open out cracks, fissures, lenses and pockets and fill with slush grout, or other approved material as directed by Owner's Representative.

E. Foundation Preparation Low Permeability Concrete Cutoff Wall

1. After excavation of the abutment cutoff wall materials (soil and rock) has been completed, all loose and objectionable material remaining in the excavation shall be removed by use of excavation equipment or vacuum truck.. The total depth and width of excavation shall be monitored and recorded. Excavation records logging materials encountered during the work shall be documented as part of the work.

2. The groundwater level shall at all times, unless otherwise directed by the Owner's Representative, be maintained at a minimum depth of three (3) feet below the base of the excavation and subsequent levels of fill placement.

3.02 GROUNDWATER AND SURFACE WATER CONTROL

A. In the event that groundwater or surface water is encountered in excavation areas, the CONTRACTOR shall control the water by the use of well points, drainage ditches, sumps, pumping or any other method acceptable to the Owner's Representative. Control of water shall enable foundation preparation to be performed and completed as specified herein and continued so that concrete and fill material can be placed and compacted to the required density and moisture content as described in other sections of these Specifications.

B. In local areas of the abutment trenches, it may be necessary to pump out standing water that has accumulated since the completion of the foundation preparation. In these areas, clean all surfaces and remove all debris and sediments to the satisfaction of the Owner's Representative. No separate payment will be made for these activities.

END OF SECTION

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SECTION 02722

CORRUGATED METAL PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of furnishing and installing new corrugated galvanized metal pipe culverts at locations shown in the Construction Drawings and in accordance with the requirements of these Specifications.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 01400 – Quality Control

C. Section 02220 – Excavation and Grading

D. Section 02224 – Material Placement

E. Section 02243 - Geotextile

F. Section 03101 – Concrete – Cast in Place

G. Section 03411 – Precast Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM), most current versions.

1. ASTM A760 – Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
2. ASTM A 49 – Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe.
3. ASTM A796 – Structural Design of Corrugated Steel Pipe. Pipe Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications.

B. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M 36 – Standard Specification of Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains

1.04 SUBMITTALS

A. Submit to the Owner's Representative for approval at least 14 days before the start of work, complete, detailed shop drawings of all Corrugated Metal Pipe (CMP) and appurtenances, a list of materials to be furnished, the names of the suppliers, and the proposed dates of delivery of the materials to the site.

B. Submit to the Owner's Representative the CMP Manufacturer's certification of compliance with these Specifications for all materials delivered to the site

C. Submit to the Owner's Representative in writing documentation from the CMP Manufacturer on the metallic properties used to manufacture the CMP, connections, pipe arches prior to transporting any CMP to the site.

PART 2 PRODUCTS

2.01 CORRUGATED METAL PIPE

A. CMP shall be galvanized corrugated steel pipe conforming to AASHTO M-36 and ASTM A760. Sizes and locations of CMP are shown on the Construction Drawings.

B. CMP down drains shall have a Manning's n value equal to 0.013.

C. Steel sheet used in fabrication of the pipe shall have a protective metallic coating of zinc (galvanizing), aluminum, consisting of either 55% aluminum-zinc alloy or zinc-5% aluminum mischmetal alloy.

PART 3 EXECUTION

3.01 HANDLING AND PLACEMENT

A. Comply with the CMP Manufacturer's recommendations for handling, storing, and installing CMP, connections, pipe arches, etc.

B. Exercise care when transporting, handling and placing CMP and connections, such that they will not be cut, kinked, twisted, or otherwise damaged.

C. Ropes and fabric or rubber-protected slings and straps shall be used as necessary when handling CMP. Chains, cables, or hooks shall not be inserted into the pipe ends as a means of handling pipe.

D. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no circumstances shall pipe or connections be dropped into trenches or dragged over sharp and cutting objects.

E. CMP shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports. The pipes shall be stored out of direct sunlight.

F. The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of CMP or connections is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges, and scratches. Sections of pipe with excessive cuts, gouges, or scratches shall be removed and the ends of the pipe re-connected at no cost to the Owner.

3.02 INSTALLATION

A. All CMP and fittings shall be installed in accordance with the manufacturer's instructions.

B. Carefully examine all pipe and fittings for cracks, damage, or defects before installation. Defective materials shall be immediately removed from the site and replaced at no cost to the Owner.

C. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.

D. Field-cutting of pipes, where required, shall be made with equipment specifically designed for cutting CMP. Cuts shall be carefully made, without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth.

E. All pipe and fittings shall be laid or placed to the lines and grades shown on the Construction Drawings, with bedding and backfill material placed appropriately, as shown on the Construction Drawings and as specified in this Section.

F. No pipe shall be laid until the Owner's Representative has approved the bedding conditions.

G. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

H. Blocking under piping shall not be permitted unless specifically accepted by the Owner's Representative for special conditions.

I. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

J. Structural fill shall be placed around pipe in accordance with Section 02224.

3.03 JOINTS AND CONNECTIONS

A. Bell and Spigot:

1. CMP will have bell and spigot configurations that shall incorporate an integral bell that is permanently installed at the factory to one end of the pipe, while the other end of the pipe serves as a spigot.

2. The bell shall be connected to the pipe by welding or with mechanical fasteners. Mechanical fasteners and steel in the bell shall meet all requirements in ASTM A760 for the size pipe indicated on the Construction Drawings.

B. Other joining systems may be used with proper submittals and approval from the Owner's Representative.

3.04 INSPECTION

A. Owner's Representative shall have free access to inspect all CMP prior to being covered with Structural Fill. Inspection may include an examination of the pipe considering workmanship, finish and appearance for qualities as stated in ASTM A760.

B. On a random basis, Owner's Representative may take CMP samples for chemical analysis and metallic coating measurements for check purposes. These samples will be secured from the fabricated pipe or from sheets of the material used in fabrication of the pipe from the manufacturer.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION

SECTION 03100

CONCRETE CHANNEL LINING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of furnishing and installing new concrete channel lining at locations shown in the Construction Drawings and in accordance with the requirements of these Specifications.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B. Section 02224 – Material Placement

C. Section 03101 – Cast in Place Concrete

1.03 REFERENCES

A. ACI standard, building code requirements for Reinforced Concrete Structures ACI 318

B. Section 501.03.09 Nevada DOT Standard Specifications

1.04 DEFINITIONS

A. Not used.

1.05 SUBMITTALS

A. Submit the following to the Owner's Representative for review and approval at least 14 days before intended placement.

1. Concrete mix designs.
2. Manufacturer's recommended installation procedures which, when approved by the Owner's Representative, will become the basis for accepting or rejecting actual installation procedures used for the Work.
3. Curing agent manufacturer data
4. Joint filler manufacturer data
5. Reinforcing steel mill certs
6. Concrete batch tickets

B. Distribute approved mix designs to testing laboratory, batch plant, the Site, the Owner, and the Owner's Representative.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Not Used.

1.07 SEQUENCING AND SCHEDULING

A. Sequence and schedule channel lining activities with work of other Sections.

B. Sequence and schedule channel lining activities such that access to working areas is maintained at all times.

C. Line areas with concrete shown on Construction Drawings in an approved sequence. Submit proposed sequencing changes to the Owner's Representative in writing. Such changes, if approved, will be authorized by the Owner's Representative in writing.

D. Do not allow or cause any of the work performed to be driven on. This is only designed for storm water.

1.08 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. Installer shall have a minimum of 5 years experience with concrete Work similar in material, design, and extent to that indicated for this Project.

2. Design Mix Engineer: Engineer having minimum 10 years documented experience in determining concrete design mix, licensed in the State of Nevada. Design Mix Engineer shall stamp and seal mix designs and make determinations regarding maximum slump, additives, and water added to mix at the site.

3. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

D. Standards: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 347 R - Guide to Formwork for Concrete.

E. Do not commence placement of concrete until mix designs have been reviewed and approved by the Owner's Representative, and all governmental agencies having jurisdiction, and until copies of the approved mix designs are at the Site and the batch plant.

F. Three concrete test cylinders will be taken by an independent testing laboratory for every 150 cubic yards of concrete placed, but not less than one set per day. One of the test cylinders

shall be tested at 7 days for 70 percent of design strength and the remaining two shall be tested at 28 days for full design strength.

PART 2 PRODUCTS

2.01 FORMWORK

A. Design, erect, support, brace, and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.

B. Construct formwork to the exact sizes, shapes, lines, and dimensions shown on the Construction Drawings, and as required to obtain accurate alignment, location, grades, and level and plumb work in the finished structure.

2.02 CONCRETE

A. The class, strength, mix, curing and testing of concrete shall conform to provisions of ACI 308 unless otherwise specified in plans or in these specifications.

B. Comply with the Following as Minimums:

1. Portland Cement: ASTM C150, Type II/V, low alkali.
2. Aggregate, General:
3. ASTM C33, uniformly graded and clean.
4. Do not use aggregate known to cause excessive shrinkage.
5. Aggregate, Coarse: Crushed rock or washed gravel with maximum size between 3/4 inch and 1 1/2 inch, and with a minimum size number 4 sieve.
6. Aggregate, Fine: Natural washed sand of hard and durable particles varying from fines to particles passing a 3/8 inch screen, of which at least 12 percent shall pass a 50-mesh screen and no more than 3 percent shall pass the number 200 sieve.
7. Water: Shall conform with ASTM C1602/C1602M-06 Standard Specification for Mixing Water Used in Productions of Hydraulic Cement Concrete

C. Provide concrete with the compressive strengths shown on the Construction Drawings. When such strengths are not shown on the Construction Drawings, provide minimum compressive strength of 4,000 psi.

2.03 BASE MATERIAL

A. Nevada DOT Type II B base material, thickness as shown on drawings

2.04 CURING AGENT

A. Concrete lined channels will be cured by application of a liquid membrane-foaming curing compound (white pigmented) upon completion of the concrete finish.

2.05 CONCRETE JOINTS

A. Two methods are acceptable, panel type lining and continuously reinforced lining.

B. Panel Type Lining:

1. If contractor proposes panel type lining it must be compliant with the Clark County Storm Water Design Manual.

C. Continuously Reinforced Lining:

1. Expansion joints every 100 feet with cutoff walls.
2. Expansion joints to be added at point of fixity and changes in cross section or alignment.
3. Cutoff walls to extend a minimum of 3 feet below the bottom of the concrete slab.

2.06 JOINT FILLER

A. Joint Filler Elastomer: 100% solids polyurea filler. Shore A shall be 75 or higher. Tensile 620 psi, elongation minimum of 450% per ASTM C412.

1. JOINT TITE 750; L&M Construction Chemicals, Inc.
2. Spall Pro 2000; Metzger McGuire

2.07 REINFORCING STEEL

A. Comply with the Following as Minimums:

1. Bars: A STM A615, grade 60 u nless otherwise shown on the Drawings, using deformed bars for number 3 and larger,
2. Welded Wire Fabric: ASTM A185,
3. Bending: ACI 318.

B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the CRSI "Manual of Standard Practices."

C. Do not use reinforcement having any of the following defects:

1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances,
2. Bends or kinks not indicated on the Drawings or required for this Work,
3. Bars with cross-section reduced due to excessive rust or other causes.

D. Steel reinforcing shall be at a minimum grade 60 deformed bar.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavation is complete and in compliance with slopes and dimensions shown on the Construction Drawings.

3.02 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. If required, insert below a height limitation, usually 60 inches (1500 mm), for dropping concrete in forms.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.03 BASE MATERIAL

A. Top six inches of barrier layer material and six inches of base material to be compacted to 90 percent of maximum dry density as determined by ASTM D1557.

3.04 CURING

A. All curing shall be completed in accordance with Section 501.03.09 of the Nevada DOT Standard Specifications

3.05 JOINT FILLER

A. Filler must be applied to expansion joint and tooled in.

3.06 REINFORCING STEEL

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Refer to drawings for size and spacing of steel reinforcement.

F. Longitudinal steel shall be placed on top of transverse steel.

3.07 EXPANSION JOINTS

A. All joints must be detailed with approved joint filler.

B. Saw cutting of expansion joints will not be permitted.

3.08 CONSTRUCTION JOINTS

A. Construction joints are required for all cold joints and where the lining thickness changes. Refer to drawings for detail of construction joint.

B. Reinforcement shall be continuous through the joint and concrete lining shall be thickened at the joint as necessary.

C. Contraction joints shall be tooled and sealed (saw cutting of contraction joints will not be permitted.

3.09 CUT OFF WALLS

A. Cutoff wall shall be provided at both the upstream and downstream terminus of the channel lining.

B. Transverse cut off walls shall be placed at each expansion joint and shall extend 3 feet below the slab. It shall extend along the length of the cross section.

C. Longitudinal cut off walls shall be placed as shown on the construction drawings. The cut off wall shall extend a minimum of 2 feet below the slab.

3.010 CONCRETE FINISH

A. Concrete channel lining shall have a light broom finish. Excessive working or wetting of the finish shall be avoided.

3.011 TESTING

A. Provide strength tests of concrete Samples in accordance with reference document in Article 1.08.

B. Prepare standard test cylinders from concrete batches specified by the Owner/Owner's Representative, and test samples in accordance with ASTM C39.

C. Submit certified test results to the Owner's Representative.

D. If any one of the samples fails to meet the specified 28-day minimum ultimate compressive strength, all concrete poured on that day will be assumed to be defective and cores from selected areas shall be taken as directed by the Owner/Owner's Representative, and tested in accordance with ASTM C42.

E. If the compressive strength of the concrete cores fails to meet the specified strength test criteria, the in-place concrete will be considered defective and shall be removed or adequately strengthened as directed by the Owner/Owner's Representative.

F. Perform all required additional coring, testing of cores, and repair work pertaining to defective concrete at no additional cost to the Owner.

G. Concrete channel lining shall have a light broom finish. Excessive working or wetting of the finish shall be avoided.

END OF SECTION

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SECTION 03101

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Detention dam spillway riser
5. Detention dam RCC spillway concrete appurtenances

1.02 RELATED SECTIONS

A. Not Used.

1.03 REFERENCES

A. ACI standard, building code requirements for Reinforced Concrete Structures ACI 318.

B. Section 501 Nevada DOT Standard Specifications.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of manufactured material and product, including accessory products.

B. Design Mixes: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Review of mix designs by Architect and/or Owner's Representative shall in no way relieve the Contractor of responsibility for the performance of the concrete.

C. Shop Drawings:

1. Steel Reinforcement: Show details of fabrication, bending, and placement. Drawings shall be prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
2. Delete paragraph below if not required. Usually only required on complex projects.
3. Formwork: Prepared by, or under the supervision of, a qualified professional engineer detailing fabrication, assembly, and support of formwork. Drawings shall indicate dimensions, materials, bracing, and arrangement of joints and ties.

4. Joints: Show proposed location of construction joints, expansion/contraction joints and control joints and obtain approval from Architect prior to construction.

D. Samples: Submit 4 inch long samples of expansion/contraction joint and control joint.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Material Certificates: Signed by manufacturers certifying that the following items comply with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Bonding agents.
7. Adhesives.
8. Epoxy joint filler.
9. Joint-filler strips.
10. Repair materials.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. Installer shall have a minimum of 5 years experience with concrete Work similar in material, design, and extent to that indicated for this Project.
2. Design Mix Engineer: Engineer having minimum 10 years documented experience in determining concrete design mix, licensed in the State of Nevada. Design Mix Engineer shall stamp and seal mix designs and make determinations regarding maximum slump, additives, and water added to mix at the site.
3. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

D. Standards: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 347 R - Guide to Formwork for Concrete.

E. Do not commence placement of concrete until mix designs have been reviewed and approved by the Owner's Representative, and all governmental agencies having jurisdiction, and until copies of the approved mix designs are at the Site and the batch plant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Reinforcement: Deliver reinforcement to the Project site in a manner that will prevent bending and damage. R einforcement shall be bundled, tagged and marked to facilitate sorting and placing. Tags shall indicate bar sizes, lengths, grade and other information corresponding to markings shown on placement diagrams.

B. Storage and Protection: Store materials at the site off the ground and in a manner to prevent damage to the materials.

1.07 SUBMITTALS

A. Submit the following to the Owner's Representative for review and approval at least 14 days before intended placement.

1. Concrete mix designs.
2. Materials list of items proposed to be provided under this Section.
3. Manufacturer's specifications and other data needed to prove conformance with the specified requirements.
4. Manufacturer's recommended installation procedures which, when approved by the Owner's Representative, will become the basis for accepting or rejecting actual installation procedures used for the Work.

B. Distribute approved mix designs to testing laboratory, batch plant, the Site, the Owner, and the Engineer.

1.08 PROJECT CONDITIONS

A. Rain protection: Do not place concrete during rain unless adequate protection has been provided.

B. Cold weather protection: Comply with ACI-306R.

C. Hot weather protection: Comply with ACI-305R.

PART 2 PRODUCTS

2.01 CONCRETE

A. Concrete shall be composed of cement, fly ash (if required), fibermesh (if required), admixtures (if required), fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accordance with the requirements of this Section, and shall be suitable for the specific conditions of placement. Concrete shall have a compressive

strength as specified on the Construction Drawings or as specified below. In general the following classes of concrete are specified for use on the project:

1. Class "3000" Concrete: Class "3000" concrete shall have a compressive strength of not less than 3,000 psi, and shall be used for embedding waterstops in RCC and for principal spillway pipe backfill concrete.
2. Class "4000" Concrete: Class "4000" concrete shall have a compressive strength of not less than 4,000 psi, and shall be used for concrete structures on the roller compacted concrete (RCC) spillway including, but not limited to the ogee weir, chute and baffle blocks, approach slab, and stilling basin slab.

2.02 FORMWORK

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 inch x 3/4 inch.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Debond Form Coating as manufactured by L&M Construction Chemicals, Inc.
      b. Crete Lease 880 as manufactured by Cresset Chemical
      c. Nox-Crete as manufactured by Nox-Chem

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

   1. Furnish ties that, when removed, will leave holes not larger than 1-inch in diameter in concrete surface.

2.03 REINFORCEMENT

A. Steel Reinforcement Bars: ASTM A 615, deformed.

   1. Grade: As indicated on General Structural Notes and Drawings.

2. If not indicated, Grade shall be 60 ksi.

B. Plain-Steel Welded Wire Fabric: ASTM A 185

1. Wire: Plain steel, ASTM A82.
2. Gages and Configuration: As indicated on General Structural Notes.

C. Reinforcement Accessories:

1. Bar Supports: Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete:
   a. Concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
2. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.04 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II, provide Type V at locations in contact with soil, alkali content not to exceed 0.6 percent.

B. Fly Ash: AS TM C 618, Class F. The use of fly ash shall be approved by the Owner's Representative.

C. Aggregate:

1. Normal Weight: ASTM C 33, free from deleterious material and meeting the limits in Table 3 of ASTM C 33 for the weathering region applicable to the project site. Coarse aggregate should be size number 57 or 67 unless otherwise specified in the Contract Documents.

D. Water: Potable and complying with ASTM C1602/C1602M-06.

E. Concrete Admixtures: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials.

1. Admixtures containing calcium chloride are not permitted.
2. Air-Entraining Admixture: ASTM C 260.
3. Water Reducing Admixtures: ASTM C 494 Type A water reducing admixtures and Type G and F high-range water reducing admixtures.

2.05 CHEMICAL ANCHORS

A. Steel dowels anchoring Concrete into bedrock shall be anchored into bedrock by the use of Hilti HIT RE 500 Adhesive Epoxy, or approved equivalent.

2.06 ACCESSORIES

A. Water: Potable.

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

1. Acceptable Products: Subject to compliance with requirements, provide one of the following:

    a. Sure Film; Dayton Superior Corporation.

    b. Eucobar; Euclid Chemical Co.

    c. E-Con; L&M Construction Chemicals, Inc.

    d. Confilm; Master Builders, Inc.

    e. SikaFilm; Sika Corporation.

C. Leveling Agent: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Acceptable Products: Subject to compliance with requirements, provide one of the following:

    a. Sonoflow; Sonneborn

    b. Flo-Top; Euclid

    c. Ardex K-15; Maxxon Corporation

    d. Levelex; L&M Construction Chemicals

    e. Levelayer 1; Dayton-Superior

D. Repair Topping – Exposed Locations: T raffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

E. Curing Materials: Provide one of the following methods as appropriate to indicated finish and as recommended by floor treatment and finish manufacturers. Verify that specified curing compound is compatible with the floor finish material(s) and adhesive(s) that will be applied to floor surface prior to delivery of curing compound to jobsite. If it is determined that the curing compound is not compatible, notify Architect immediately.

1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

2. Moisture-Retaining Cover: A STM C 171, polyethylene film or white burlap-polyethylene sheet.

3. Curing Compound: Water based, dissipating resin, ASTM C 309, Type 1, Class B.

    a. Curing compound shall meet California's Rule 66 for VOC content.

    b. Products: S ubject to compliance with requirements, provide one of the following:

        i. Cure R; L & M Construction Chemicals, Inc.

        ii. Rez Cure J-11W/J-9-A; Dayton Superior Corporation.

        iii. Kurez VOX; Euclid Chemical Co.

iv. 1100; W. R. Meadows, Inc.

F. Curing and Sealing Compound: ASTM C 1315, Type 1, membrane forming.

1. Interior: ASTM C1315, Class B.

a. Acceptable Products: Subject to compliance with requirements, provide one of the following:

i. VOCOMP-30; W. R. Meadows

ii. Super Aqua Cure VOX; Euclid

iii. Dress & Seal WB #30; L&M Construction Chemicals

iv. Safe Cure and Seal J-19; Dayton Superior

G. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

H. Joint Filler Elastomer: 100% solids polyurea filler. Shore A shall be 75 or higher. Tensile 620 psi, elongation minimum of 450% per ASTM C412.

1. JOINT TITE 750; L&M Construction Chemicals, Inc.

2. Spall Pro 2000; Metzger McGuire

I. Bonding Agent: ASTM C 1059, capable of humid curing and bonding to damp surfaces, of type, class and grade to suit requirements:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Interior: PVA Type, ASTM C1059, Type 1

i. EVERWELD; L&M Construction Chemicals, Inc.

ii. Weldcrete; Larsens

b. Exterior and Interior (acrylic):

i. Acryl 60; Chem-Rex

ii. Intralok; W.R. Meadows

iii. Ad Bond J40; Dayton Superior

iv. Everbond; L&M Construction Chemicals, Inc.

J. Nails, Spikes, Lag Bolts, Through Bolts, and Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.07 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): As indicated on General Structural Notes and Drawings.

2. Slump:

Type of structural section	Slump (inches)
Massive sections	2 ± 1
Thick slabs, thick walls (>12 inches)	3 ± 1
Thin slabs, thin walls (12 inches or less)	4 ± 1

D. Slump Tolerances: Slump tolerances per ASTM C 94, Section 6 as follows:

1. When project specifications for slump are written as a "maximum" or "not to exceed" requirement:

	If 3 inches or less	If more than 3 inches
Plus tolerance	0	0
Minus tolerance	1-1/2 inches	2-1/2 inches

2. When project specifications for slump are not written as a "maximum" or "not to exceed" requirement:

Slump Specified	Tolerance
2 inches and less	+/- 1/2 inch
More than 2 inches through 4 inches	+/- 1 inch
More than 4 inches	+/- 1-1/2 inch

E. Cementitious Materials: Maximum percentage, by weight, of cementitious materials other than portland cement:

1. Fly Ash: 15 percent.

F. Maximum Water-Cementitious Materials Ratios: As indicated in General Structural Notes and Drawings or as approved by Owner's Representative.

G. Air Content:

1. Total air content requirements shall be in accordance with Table 1 of ASTM C 94 for the maximum size of aggregate and exposure conditions.

2. Add air-entraining admixture at manufacturer's prescribed rate.

3. Air content shall be sampled from the transportation unit at the point of discharge and shall be within a tolerance of +/- 1.5% of the specified value per Section 7 of ASTM C 94.

4. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

H. Admixtures: Use admixtures according to manufacturer's written instructions.

I. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. Not more than 90 minutes shall elapse from time water is introduced into the concrete mixture until completion of placement.
2. Water shall not be added at any later time. Do not add water to mix that has stiffened to increase its workability.
3. Discharge of the concrete shall be completed within 90 minutes from the time of batching.
4. Delivered concrete temperature shall be in accordance with ACI 304, 305R and 306R.

2.08 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Permanently Exposed Locations: Class A, 1/8 inch.
2. Surfaces to receive other finishes: Class B, 1/4 inch.
3. Concealed Locations: Class C, 1/2 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Chamfer exterior corners and edges of permanently exposed concrete unless otherwise indicated on Drawings.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Locate temporary openings in forms at inconspicuous locations.

1. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

L. Provide formed openings where required for items to be embedded in or passing through concrete work.

M. Locate and set in place items which will be cast directly into concrete.

N. Coordinate Work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

O. Place and secure anchorage devices and other embedded items in accordance with Manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.02 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Formwork for beam soffits, joists, slabs, and other structural elements, that support the weight of concrete shall remain in place until concrete has achieved the following:

1. 28-day design compressive strength or as required by General Structural Notes and Drawings.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete..

3.03 SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.05 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. If required, insert below a height limitation, usually 60 inches (1500 mm), for dropping concrete in forms.

E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.08 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.09 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after initial placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If forms are removed prior to end of curing period, continue curing using curing methods specified herein.

D. Unformed Surfaces: Begin curing immediately after finishing concrete using curing methods specified herein.

E. Curing Methods: Cure concrete according to ACI 308.1, by one or a combination of the following methods. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written

instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

F. Sealer:

1. At areas indicated on Drawings, provide 2 coats of sealer.
2. Surface must be clean, dry and free of loose dirt, oil, wax, curing and parting compounds and other foreign matter.
3. Apply each coat in accordance with Manufacturer's printed instructions.

3.010 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturers written instructions.

1. Defer joint filling until concrete has aged a minimum of 30 days.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install joint filler per manufacturer’s recommendations. Overfill joint and trim joint filler flush with top of joint after hardening.

3.011 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas concealed from view. Do not patch, repair or replace exposed architectural concrete except upon written direction of Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Concealed Locations: Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension. Remove defective concrete to a depth of 3/4-inch to 1-inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Surfaces exposed to view: Repair defects by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Surfaces that affect concrete's durability and structural performance: Repair defects upon direction of Owner’s Representative.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.012 ROCK ANCHOR DOWELS

A. After Rock Foundation Treatment Rock Anchor Dowels shall be anchored by the following methods:

1. Drill hole using carbide or diamond core bits.
2. Clean hole with a nylon wire brush; for core bits, flush with water then immediately remove standing water.
3. Insert air nozzle into bottom of hole and blow out hole using compressed air.
4. Inject adhesive into hole, starting at the bottom until ½ to 2/3 full.
5. Insert dowel; twist during installation.
6. Do not disturb dowel during specified gel time and initial cure time.

3.013 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than 5 compressive-strength tests for each concrete mix, testing shall be conducted from at least 5 randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of 4 standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test 2 laboratory-cured specimens at 7 days and one at 28 days and hold one cylinder for additional information, as required.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hou rs of testing. R eports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

3.014 DEFECTIVE MATERIAL

A. Submit certified test results to the Owner's Representative.

B. If any one of the samples fails to meet the specified 28-day minimum ultimate compressive strength, all concrete poured on that day will be assumed to be defective and cores from selected areas shall be taken as directed by the Owner, and tested in accordance with ASTM C42.

C. If the compressive strength of the concrete cores fails to meet the specified strength test criteria, the in-place concrete will be considered defective and shall be removed or adequately strengthened as directed by the Owner.

D. Perform all required additional coring, testing of cores, and repair work pertaining to defective concrete at no additional cost to the Owner.

3.015 PROTECTION

A. Protect finished surfaces from stains or abrasions. Protect surfaces or edges by leaving forms in place or by providing temporary covers. P rotect concrete from rain, flowing water or mechanical injury.

B. Protect floor slabs from the droppings of plaster, paint, dirt, and other marring by covering with polyethylene plastic sheet, well lapped and sealed. At locations indicated to remain exposed in final construction, provide a continuous covering of 1/2 inch particle board, joints tightly butted and cut to sizes tight to wall construction, over entire floor area over polyethylene plastic sheet.

3.016 CLEANING

A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

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SECTION 03113

REINFORCED CONCRETE PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of furnishing circular or elliptical, reinforced concrete pipe, siphons, and conduits of the size, classes, and dimensions and at locations shown on the Construction Drawings or established by the Owner's Representative and in accordance with ASTM C76, ASTM C655, or ASTM C507, with design basis in accordance with Section 708, "Concrete and Clay Pipe and Drains," and where indicated in these specifications.

B. The installation shall conform to the AASHTO LRFD Bridge Construction Specifications and these specifications.

1.02 Related Sections

A. Section 02222 – Excavation and Grading

B. Section 02228 – Material Placement

C. Section 02230 - Trenching

PART 2 PRODUCTS

2.01 NDOT PIPE MATERIAL

A. Materials and their use shall conform to NDOT Subsection 601.02.01, "General," and the requirements below.

B. Prior to the use of these materials, the Contractor shall submit to the Owner's Representative for approval a document certifying that the material meets these specifications and NDOT Section 708, "Concrete and Clay Pipe and Drains," from an authorized source approved by the Interagency Quality Assurance Committee (IQAC).

C. Flared end sections (precast) shall conform to the details and dimensions shown on the Construction Drawings and, except for shape, shall conform to the material requirements of this section for reinforced concrete pipe.

D. Rubber gaskets are required for all circular pipes and mastic for elliptical. Rubber gaskets shall conform to NDOT Subsection 707.03.06, "Rubber Gaskets."

E. If joint mortar is required, it shall be as specified in NDOT Subsection 501.03.12, "Mortar," Class "C."

1. Sand shall conform to NDOT Subsection 706.03.04, "Grout and Mortar Sand."
2. The materials shall be mixed to a consistency suitable for the purpose intended.
3. All mortar shall be used within 30 minutes after the mixing water has been added.

4. Admixtures of hydrated lime, fire clay, diatomaceous earth, or other approved inert material may be used in the mortar to facilitate workability if the Contractor elects.
5. The amount of admixture to be added shall be the quantity determined by the Owner's Representative.

1.02 REINFORCED CONCRETE PRESSURE PIPE MATERIAL

A. The principal spillway pipe and fittings shall be designed by the manufacturer to withstand the specified external loads and internal pressures. Design shall be by ASTM C361 for Reinforced Concrete Low Head Pressure Pipe. Pipe design shall be as published in the standard.

B. Principal Spillway pipe shall be designed in accordance with ASTM 361 for the site conditions for the following loads:

1. Soil Unit Weight = 130 lbs per cubic foot.
2. RCC Unit Weight = 150 lbs per cubic foot.

C. Joints

1. The pipe joints shall conform to the requirements of the applicable specification for the pipe. They shall be bell-and-spigot type or double-spigot-and-sleeve type and shall have a positive groove in the spigot to contain the rubber gasket. The size and shape of the groove shall be such that it prevents displacement of the gasket by either internal or external water pressure when the joint is in any position within the required range of movement capability. Joint sleeves, also referred to as collars or coupling bands, shall conform to the requirements for bell rings in the applicable pipe specification.
2. The joints shall be constructed to permit relative movement of the adjoining pipe sections with no reduction of watertightness. The joint length and the limiting angle defining the required capability of relative movement at each joint shall be no less than specified.
3. Joint length refers to the permissible axial movement in the joint. It is defined as the maximum distance through which the spigot can move, relative to the bell or sleeve, from the fully engaged to the fully extended condition of the joint when the adjoining pipe sections are in parallel, concentric alignment. The joint is considered to be fully engaged when the spigot is inserted as far as it will go into the bell or sleeve and is fully extended when it is inserted the least amount that will ensure full confinement of the gasket and complete watertightness.
4. Joint length specified for double-spigot joints refers to the permissible movement in each of the spigot-to-sleeve connections, not the sum of the two.
5. The limiting angle of the joint is defined as the maximum deflection angle between adjoining pipe sections the joint will permit before the outer surface of the spigot comes into direct contact with inside of the mating bell or sleeve. If both spigot-to-sleeve connections of a double-spigot joint permit angular movement, the limiting angle of the joint is the sum of the two deflection angles permitted by the two connections.

D. Gaskets

1. The pipe joint gaskets shall conform to the ASTM C361 requirements. They shall be endless rubber gaskets having circular cross section. The cross-sectional diameter of the gaskets shall conform to the pipe manufacturer's recommendation for the type and size of pipe furnished.

PART 3 EXECUTION

3.01 GENERAL

A. Construction methods shall conform to Subsection 601.03.01, "Earthwork," through Subsection 601.03.06, "Extending Existing Culverts," and shall meet the requirements below. All pipe installations shall conform to the workmanship and inspection requirements of the AASHTO LRFD Bridge Construction Specifications and this specification as applicable.

B. No pipe shall be laid that is excessively cracked (in accordance with Subsection 603.03.07, "Inspection"), checked, spalled, or damaged, and all such sections of pipe shall be permanently removed from the work. Pipes that show defects due to handling shall be rejected at the site of the installation regardless of prior acceptance.

C. Reinforced Concrete Pressure Pipe shall be constructed as specified in the sections below for Reinforced Concrete Pressure Pipe.

3.02 EARTHWORK

A. Where pipes are to be installed in new embankment (projection), the embankment shall first be constructed to the required elevation as set forth below. The height of embankment to be constructed in advance of installing the pipe may be varied when permitted by the Owner's Representative.

B. In the case of pipes 24 inches or less in diameter, the roadway embankment shall be constructed to an elevation of 6 inches above the grade proposed for the top of the pipe, after which the trench shall be excavated and the pipe installed.

C. In the case of pipes more than 24 inches in diameter, the roadway embankment shall be constructed to an elevation of 30 inches above the grade proposed for the bottom of the pipe, after which the trench shall be excavated and the pipe installed.

D. When pipe having bells or hubs is used, cross trenches shall be excavated for them to prevent non-uniform loading of the joints.

3.03 LAYING CULVERT PIPE

A. Construction installation shall comply with the AASHTO LRFD Bridge Construction Specifications; NDOT Section 208, "Trench Excavation and Backfill"; and this subsection.

1. The installation shall be conducted by a certified supervisor/foreman at the crew level who is responsible for the work.
2. The certified person is the designated installation inspector for the Contractor and shall generate a daily report attesting to the workmanship for each of the installation components described below.
3. This does not relieve the Contractor of responsibility for other Quality Control aspects of this and other specifications.

B. Installation Components:

1. Bedding.
2. Pipe Condition.
3. Pipe Installation.
4. Haunch Compaction.
5. Complete Pipe Zone Compaction.

C. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe. Blocking shall not be used to bring the pipe to grade.

D. Pipe sections shall be checked for alignment and grade at the time of joining the sections.

1. Pipe laying shall begin at the downstream end of the pipeline except for extensions of existing pipes.
2. Place the bottom of the pipe in contact with the shaped bedding throughout its full length.
3. The first section of pipe to be laid shall be firmly placed to the designated line and grade at the outlet end with the groove end or bell end pointing in the direction to be followed by the pipe laying.
4. Maintain the manufacturer's recommended minimum and maximum cover at all times unless otherwise shown in the contract.
5. Pipe will be inspected before any backfill is placed.
6. Ensure that no rocks greater than 3 inches or other rigid or jagged material is present in the bedding material where pipe may be laid directly on the material.
7. Take up and relay or replace pipe that is out of alignment, unduly settled, or damaged.

E. The interior of the pipe shall be kept free of dirt, and other foreign material as the pipe laying progresses, and left clean at the completion of the work. Any pipe, which is not in true alignment or which shows any undue settlement after laying, or is damaged, shall be taken up and re-laid at the Contractor's expenses.

F. Backfill: Prior to placing backfill material, all lifting holes in concrete culverts shall be completely filled with grout.

3.04 RUBBER GASKETED JOINTS

A. Circular reinforced concrete culvert pipe shall use rubber or neoprene gasketed joints.

B. Rubber gaskets shall not be exposed to the direct rays of the sun for more than 72 hours.

1. The Contractor shall make every effort to provide a concrete-to-concrete connection and pull the pipe completely home.

C. Should gapping occur due to changes or corrections in horizontal or vertical alignment or radius turns, the gaps shall not exceed the gap tolerance indicated in Table 1.

D. If pipes are laid that exceed these tolerances, the inner annular space between the pipe sections shall be completely filled with cement mortar (where pipe diameters allow for entry).

E. If pipes are laid that exceed the tolerances in Column 2, the pipe will need to be removed and re-laid or an acceptable concrete collar will need to be installed.

Table 1 - Maximum Joint Gap Tolerances[1]		
	Column 1	**Column 2**
Inner Diameter of Pipe	**Maximum Joint Gap Tolerance**	**Maximum Joint Gap Tolerance (with Grouting)**
12-inch to 36-inch	5/8 inch	3/4 inch
42-inch to 48-inch	7/8 inch	1-1/8 inch
54-inch to 90-inch	1 inch	1-1/4 inch
96-inch	1- 5/8 inch	1-3/4 inch
Above 96-inch up to 144-inch	As recommended by Manufacturer	As recommended by Manufacturer

F. Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space.

G. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar, except that pipes less than 24 inches in diameter may be pointed inside by brushing smooth and removing all surplus mortar.

H. The rubber gasket shall be the sole element depended upon to make the joint watertight for the purposes intended.

3.05 SIPHONS AND PRESSURE PIPE

A. Reinforced concrete pipe used for siphons or pressure pipe shall be laid in accordance with the above provisions, be connected by flexible, watertight rubber gasket joint and, prior to backfilling, be subject to the following hydrostatic test:

1. The pipeline shall be filled with water at a hydrostatic head of that required to maintain the design pressure.
2. The pressure head shall be maintained for a period of not less than 24 hours and any visible leak or other defects that develop under test shall be corrected by the Contractor at no additional cost to the Contracting Agency.
3. Sweating that does not develop into a flow or drip will not be considered as leakage.
4. The test shall be repeated until all leaks or other defects are eliminated

3.06 JUNCTIONS

A. All junctions of laterals with a main line or junctions of 2 or more main lines, which are not made in a manhole or concrete junction structure, shall be in a manufactured wye or tee.

B. The wye or tee shall be of the same material as the conduits to which they are joined, and shall have the same or greater stiffness as the pipe.

[1] In no case shall maximum joint gap tolerance exceed ½ of the length where the gasket seats within the pipe

3.07 INSPECTION

A. All pipe joints and lengths shall be 100 percent inspected.

1. Inspection and testing shall be performed by the Contractor during and after installation to ensure proper performance.
2. Installation, placement, and compaction of bedding and backfill materials shall comply with this section.
3. During the initial phases of the installation process, inspection shall concentrate on detecting improper practice and poor workmanship.
4. Errors in line and grade, improper assembly, and improper backfill techniques shall be corrected prior to placing significant backfill or trench fill.
5. Bell/spigot joints shall be properly assembled to prevent the infiltration of soil fines.
6. Gaskets shall be properly seated to prevent groundwater infiltration and shall appear uniformly oriented around the pipe.
7. Shallow cover installations shall be checked to ensure the minimum cover level is provided.

B. After the pipe has been bedded and backfilled to subgrade level, internal quality inspection shall be paid for and performed by the Contractor a minimum of 30 days after final backfill has been placed and prior to final acceptance by the Contracting Agency.

1. The line shall be cleaned and inspected for cracks and joint gaps using visual physical measurement or other devices, including but not limited to calibrated television or video cameras, subject to approval by the Owner's Representative.
2. Cracks in pipes (both longitudinal and circumferential) that are less than 0.10 inch in width are generally considered non-structural flaws and need not be repaired.
3. Cracks that are equal to or exceed 0.10 inch in width shall require an evaluation by a Nevada licensed professional engineer.
4. The Contractor's engineer shall provide a recommendation regarding removal or repair subject to approval by the Contracting Agency.
5. Pipe joints and lengths that do not meet the specification shall be repaired or pipe replaced at no additional cost to the Contracting Agency.

C. All inspection results shall be submitted and approved by the Owner's Representative before final payment.

1. Any replacement pipe shall also be subject to the same testing.
2. All inspection and testing results shall be submitted to the Owner's Representative for approval.

D. The Owner's Representative shall be allowed access to randomly inspect at least 10 percent of the total number of pipe runs.

3.08 REINFORCED CONCRETE PRESSURE PIPE

A Laying the pipe

1. The pipe shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges. Concrete blocks and wedges used to temporarily support the pipe during placement of concrete bedding or cradle, or both, shall be a class of concrete equal to or stronger than the concrete used to construct the bedding or cradle. Bell and spigot pipe shall be laid with the bells or grooves facing upstream unless otherwise specified in section 7 or shown on the drawings. When precast pipe risers and other similar precast pipe structures are installed before pipe installation, pipe may be installed in the downstream direction with the belled end upstream. Adequate bell clearance in the subgrade/bedding shall be provided.

2. Just before each joint is connected, the connecting surface of the bell and spigot or spigots and sleeve shall be thoroughly cleaned and dried. Also, the rubber gasket and the inside surface of the bell or sleeve shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to ensure a uniform volume of rubber around the circumference of the pipe. The joint shall be connected in accordance with the manufacturer's instructions. When the spigot has been seated to within 0.5 inch of its final position, the position of the gasket in the joint shall be checked around the entire circumference of the pipe by means of a metal feeler gauge. In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected. After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of pipe shall be adjusted to line and grade.

A. Filling joints

1. Before the placement of the bedding or cradle, the exterior annular space between the ends of the pipe sections shall be cleaned and completely filled with joint sealing compound. Before the compound is applied, the surface against which it is to be placed shall be cleaned of all dust, lubricant, and other substances that would interfere with a bond between the compound and the pipe. If recommended by the manufacturer of the compound, the concrete surface shall be coated with a primer in accordance with the manufacturer's recommendations. Primers shall be applied to the concrete surface only and shall not come in contact with the gasket or gasket sealing surface. Unless the compound or primer is specifically recommended for use on moist concrete, the surface shall be dry when the compound or primer is applied.

2. The joint sealing compound shall be allowed to cure until it is sufficiently firm to prevent the entry of concrete or earth into the joint.

B. Pressure testing

1. Before placing concrete or earth backfill around the conduit joint to be tested or filling the pipe joints, the joint shall be tested in accordance to ASTM C 1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Sewer Line. The test pressure shall 25 psi. Any joints showing leaks shall be relaid or repaired, and the joint shall be retested. The procedure shall be repeated until the joint passes the test.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

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SECTION 03411

CONCRETE - PRECAST

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, and equipment necessary for the completion of the following items:

1. Precast Concrete Box Culverts
2. Precast Concrete Box Principal Spillway Riser
3. Additional items not listed above.

B. Contractor shall review all other Sections of these Specifications for instructions related to work under this Section.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B. Section 02220 - Excavation

C. Section 02778 – Geomembrane

D. Section 03101 – Concrete – CIP

E. Section 02243 – Geotextile

1.03 REFERENCES

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

B. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
3. ACI 319 - Recommended Practice for Use of Metal Supports for Reinforcement.
4. ACI 347 - Recommended Practice for Concrete Framework.
5. ACI 380 - Standard Practice for Curing Concrete.

C. American Society for Testing and Materials (ASTM):

1. ASTM A 185 – Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Requirement.
2. ASTM A 497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Requirement.

3. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Requirement.
4. ASTM C 33 – Standard Specification for Concrete Aggregates.
5. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. ASTM C 143 – Standard Specifications for Slump of Hydraulic Cement Concrete.
7. ASTM C 150 – Standard Specification for Portland Cement.
8. ASTM C 231 – Standard Specification for Air Content of Freshly Mixed Concrete by the Pressure Method.
9. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.
10. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

D. American Association of State Highway and Transportation Officials (AASHTO).

E. Concrete Reinforcing Steel Institute (CRSI).

1.04 SUBMITTALS

A. Concrete Mix Design: Submit concrete mix design(s) 14 days prior to installation.

B. Material Certification: Submit certification that all reinforcing meets the specified requirements 14 days prior to shipment to the site.

C. Product Data: Submit manufacturer's data sheets for all sealants and curing compounds 14 days prior to shipment to the site.

1.05 QUALITY ASSURANCE

A. Qualifications of precast concrete manufacturer, all work included herein shall be manufactured by a competent and reputable manufacturer.

1.06 DELIVERY STORAGE AND HANDLING

A. Pre-cast items shall be handled, lifted and/or supported at points designed for that purpose or at supporting points at which the work will set when in service. Such supporting points shall insure against any detrimental deflection overstressing and cracking or chipping of concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete:

1. Unless otherwise specified or noted on the Construction Drawings use 4000 psi sulfate-resistant concrete for all dam structures.
2. Unless otherwise specified or noted on the Construction Drawings use 3000 psi sulfate-resistant concrete as specified under Section 03101.

2.02 FABRICATION

A. All pre-cast concrete items shall be shop fabricated in accordance with these specifications and with the Contract Documents.

B. Forms for pre-cast items shall be of rigid construction, true in required shape and provide close control of dimensions and details. They shall be thoroughly cleaned and prepared before each casting. Forms shall be constructed with tight joints and smooth surfaced and in a manner that will permit removal without defacing the cast concrete.

C. All reinforcing shall be free from loose and flaky rust, oil, grease and other coatings. Reinforcing shall be accurately positioned and securely held in place by devices that will not be exposed on or mar exposed surfaces.

D. All plates, inserts, etc., shall be galvanized. They shall be provided, located and anchored as required by the contract and approved Shop Drawings.

E. Concrete shall be compacted and vibrated as required to insure contact with all of the reinforcement and to flow the concrete in place completely filling all corners and angles of the forms.

F. After removal from the forms pre-cast items shall be moist cured and protected from premature drying.

G. Care must be taken so that items mounted in/on the pre-cast structures are accounted for. Pipe penetrations into the structure may be cored in the field or pre-cast. Other items, such as opening man-way hatches shall be pre-cast.

PART 3 EXECUTION

3.01 ERECTION

A. Erection shall be done by workers skilled in this type of work. All surfaces of the work on which Contractor's work is to bear shall be inspected, to see that they are in proper condition and location for installation of Contractor's work prior to starting erection. The pre-cast work shall there-on be placed, plumbed, and fastened.

PART 4 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION

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SECTION 03600

ROLLER COMPACTED CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work shall consist of furnishing all plant, material, tools and equipment, and performing all labor for the mixing, transporting, forming, placing, compacting, and curing of roller compacted concrete (RCC) as required to construct the dam. Grout enriched concrete and bedding mortar needed to perform work under this section will be considered incidentals to the unit price.

1.02 RELATED SECTIONS

A. Not Used

1.03 DEFINITIONS

A. Roller Compacted Concrete (RCC): Roller compacted concrete is a combination of crushed rock and sand having a controlled gradation to which cementitious materials are added. The material is blended with water to a zero slump consistency which can be hauled in dump trucks and/or transported by conveyor belt, spread in horizontal layers with earth-moving equipment, and compacted with a vibratory roller.

1.04 REFERENCES

A. Applicable Publications

1. "Roller-Compacted Concrete," Symposium Volume Of The American Society Of Civil Engineers, May 1985.
2. "Roller-Compacted Concrete," Symposium Volume Of The American Society Of Civil Engineers, February 1988.
3. "Roller-Compacted Concrete," Symposium Volume Of The American Society Of Civil Engineers, February 1992.

B. AMERICAN CONCRETE INSTITUTE

1. ACI 207.5, Roller-Compacted Mass Concrete
2. ACC 211.1, Standard Practice For Selecting Proportions For Normal, Heavyweight, And Mass Concrete
3. ACI 214, Recommended Practice for Evaluation of Test Results of Concrete
4. ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305, Hot Weather Concreting
6. ACI 306, Cold Weather Concreting
7. ACI 308, Standard Practice for Curing Concrete
8. ACI 309, Guide for Consolidation of Concrete
9. ACI 318, Building Code Requirements for Structural Concrete

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS

1. ASTM C 31, Practice For Making And Curing Concrete Test Specimens In The Field
2. ASTM C 33, Specification for Concrete Aggregates
3. ASTM C 39, Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C 40, Test Method for Organic Impurities in Fine Aggregates for Concrete
5. ASTM C 42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
6. ASTM C 87, Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
7. ASTM C 94, Specification for Ready-Mixed Concrete
8. ASTM C 127, Test Method for Specific Gravity Absorption of Coarse Aggregate
9. ASTM C 128, Test Method for Specific Gravity Absorption of Fine Aggregate
10. ASTM C 131, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
11. ASTM C 138, Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete
12. ASTM C 143, Test Method for Slump of Hydraulic Cement Concrete
13. ASTM C 150, Standard Specification for Portland Cement
14. ASTM C 156, Test Method for Water Retention by Concrete Curing Materials
15. ASTM C 172, Practice for Sampling Freshly Mixed Concrete
16. ASTM C 173, Test Method for Air Content of Freshly MixedConcrete by Volumetric Method
17. ASTM C 192, Practice for Making and Curing Concrete Test Specimens in the Laboratory
18. ASTM C 227, Test Method for Potential Alkali Reactivity of Cement Aggregate Combinations (Mortar Bar Method)
19. ASTM C 231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
20. ASTM C 260, Specification for Air-Entraining Admixtures for Concrete
21. ASTM C 289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
22. ASTM C 295, Guide for Petrographic Examination of Aggregates for Concrete
23. ASTM C 470, Specification for Molds for Forming Concrete Test Cylinders Vertically
24. ASTM C 494, Specification for Chemical Admixtures for Concrete

25. ASTM C 535, Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
26. ASTM C 566, Test Method for Evaporable Moisture Content of Aggregate by Drying
27. ASTM C 595, Standard Specification for Blended Hydraulic Cements
28. ASTM C 618, Specification for Coal Fly Ash and Raw or Calcined Natural pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
29. ASTM C 685, Specification for Concrete Made by Volumetric Batching Continuous Mixing
30. ASTM C 1040, Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods
31. ASTM C 1260, Standard Test Method for Potential Alkali Reactivity of Aggregate (Mortar Bar Method)
32. ASTM C 1170, Test Methods for Determining Consistency and Density of Roller-Compacted Concrete Using a Vibrating Table
33. ASTM C 1435, Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer
34. ASTM D 421 Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
35. ASTM D 422 Standard Test Method for Particle-Size Analysis of Soils
36. ASTM D 3042, Test Method for Insoluble Residue in Carbonate Aggregates
37. ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

PART 2 MATERIALS

2.01 CEMENTITIOUS MATERIAL

A. Portland cement shall be the cementitious materials incorporated in the RCC. It shall be furnished in bulk to the job site. Portland cement shall conform to the requirements of ASTM C150 and C595, Type V, except as supplemented or modified by this specification. Only one brand and mill of cement shall be used.

B. The source of cement shall consistently supply material with similar chemical and physical properties. The Owner's Representative may perform quality assurance sampling and testing at any time. Access shall be granted to the Owner's Representative to inspect storage and to sample cement as needed to perform construction quality assurance testing. Quality assurance testing shall not be a substitution for the CONTRACTOR's construction quality control activities.

C. Materials not meeting specifications shall be removed promptly from the job site. Materials, which have not been used within three (3) months after sampling and testing, shall be re-tested at the CONTRACTOR's expense. All rejected materials shall be promptly removed from the job site, including those that have been incorporated into the work.

D. The CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE for approval, within ten (10) days after the "Notice to Proceed", the source from which the cement will be obtained. The source of the cement shall be capable of producing cement of the quality required herein and shall be capable of producing the quantity of cement required to produce RCC at the scheduled rates. A certified mill test report shall be submitted for each type of cement, and/or blended cement that will be used to produce RCC. The certified mill test report shall contain, as a minimum, evidence that the cement, or blended cement conforms to the chemical and physical properties set forth in the Material Specification.

E. Transportation to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will completely and thoroughly protect the cementitious materials from exposure to moisture and adverse weather conditions.

F. The temperature of cement when delivered to the job site shall not exceed 160°F. The temperature of air (if that handling process is used) to transport cement into storage containers or silos shall not exceed 180°F. The temperature of the air will be determined by measuring the temperature on the outside of the transport pipe with a surface thermometer. It is assumed that the air temperature is approximately equal to the temperature of the outside of the transport pipe.

G. Immediately upon receipt at the job site, cement shall be stored in dry, weather-tight, ventilated structures. All storage facilities shall be subject to approval and shall permit easy access for inspection and identification. Sufficient cement to complete a minimum of 5 days of placement, at the typical production rate being experienced, shall be stored onsite at all times. All on site storage facilities and connection hoses shall be properly labeled with readily visible signage. In order that cement does not become unduly aged after delivery, the CONTRACTOR shall use those materials which have been stored at the site for the longest period of time before using materials most recently delivered to the site.

2.02 AGGREGATES

A. Aggregates shall conform to the requirements of ASTM C33 unless otherwise specified or unless an aggregate source and quarry is designated in Subsection 3.021 of this specification. The CONTRACTOR shall submit in writing, to the OWNER'S REPRESENTATIVE, the results of tests showing that the physical and chemical properties of the aggregate(s) conform to ASTM C33.

B. The CONTRACTOR shall submit in writing to the OWNER'S REPRESENTATIVE, his planned aggregate source, production, transportation, and storage procedures. This submittal shall be made a minimum of 14-days prior to the start of aggregate production operations or, if the aggregate is being obtained from a commercial quarry, prior to developing the onsite stockpile. Anticipated peak production capacity, normal production capacity, and onsite storage volumes shall be indicated. Acceptance of the CONTRACTOR's Plan will not relieve the CONTRACTOR of the responsibility for completing the work as specified.

C. As a minimum, a 14-day supply of aggregates, based on the average weekly production rate, shall be stockpiled at the mixing plant location or other approved location prior to commencing with RCC placement.

D. Aggregates shall be stored in stockpiles at the designated storage areas. Separators such as timbers, boards or pre-cast concrete panels shall be used between adjacent stockpiles to

prevent contamination and intermixing between the stockpiles of dissimilar materials. The CONTRACTOR shall be responsible for providing a system that reliably and consistently stockpiles the aggregates and later allows the withdrawal of the aggregates from the stockpiles without contamination or segregation. Segregated or contaminated aggregates that are not representative of the stockpiles will not be allowed in production of RCC.

E. The aggregate for the RCC mix shall have a maximum particle size of 2 inches (50 millimeters). The CONTACTOR shall develop a mix design including aggregate particle size limits as part of submittals for acceptance by the OWNER'S REPRESENTATIVE. In general, the aggregates that are introduced into the RCC mix should be within the limits provided in the table below. Optimization of the grain size distribution by the CONTRACTOR shall be permissible provided the specified design strength is achieved and the RCC mix does not segregate during placement.

SIEVE SIZE	PERCENT PASSING
50 mm	100
39 mm	85-100
19 mm	60-100
9 mm	40-80
#4	32-60
#8	26-42
#16	20-36
#30	14-30
#50	8-24
#100	4-20
#200	4-15

F. These gradation limits apply to the total aggregate weight used in a unit volume of RCC and not to the weight of aggregate in any one-size group.

G. Unless otherwise specified, the fines (material passing the #200 sieve), shall have less than 2% clay content.

H. The amount of flat and elongated particles with a length-to-width or width-to-thickness ratio greater than three, as determined by ASTM D 4791, shall not exceed 25 percent on any individual sieve size nor a weighted average of 20 percent for all of the sieve sizes in the total gradation.

I. Sampling shall be in accordance with ASTM D75.

J. During the pug mill calibration operation, samples will be taken from the pug mill discharge point. After the mill is calibrated and during normal production, samples shall be taken from the flowing stream of bins or the plant discharge. Samples may be taken from the plant-feed conveyor belt when it is not practical to obtain the sample from the plant discharge.

K. When obtaining samples from discharge points or conveyor belts is not practical, samples may be obtained from stockpiles. In order to insure reasonable consistency with each stockpile, samples for combined gradation tests that are taken from the stockpiles will be obtained from various parts of the stockpiles.

2.03 WATER

A. Water incorporated in mixing or used for curing RCC shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances. Water shall conform to the requirements of ASTM C1602/C1602M-06.

2.04 ADMIXTURES

A. It is not intended to routinely use admixtures with this specification; however, the capability for adding a water-reducing and/or set-retarding admixture shall be provided. The type of admixture(s) to be used will be subject to approval by the OWNER'S REPRESENTATIVE. The CONTRACTOR shall provide the OWNER'S REPRESENTATIVE, within ten (10) days after the "Notice to Proceed", written notice of intent to use admixture(s) including the type and source of admixture(s) intended for use. Admixtures shall be furnished in unopened containers with original manufacturer's labels attached.

B. Water-reducing, set-retarding admixtures shall conform to the requirements of ASTM Specification C494 Types A, B, D, F, or G.

C. Vinsol resin or equal to produce a uniform dispersion of very fine bubbles, as an Air Entraining Agent in accordance with ASTM C260, can be used.

2.05 CURING COMPOUND

A. Curing compound shall be an aqueous solution of sodium silicate, with non-acid, penetrating agents, reacting chemically with free lime in concrete to form a hard, non-dusting surface which shall not inhibit bonding with future finishes. The curing compound shall meet the requirements of ASTM C309. Unless otherwise specified, the compound shall be type 2. Curing compound shall be furnished in containers that have not been previously opened and that have the original manufacturer's labels attached.

PART 3 CONSTRUCTION REQUIREMENTS

3.01 RCC PLACEMENT PLAN

A. The RCC Placement Plan shall be submitted to the OWNER'S REPRESENTATIVE within ten (10) days after the "Notice to Proceed". RCC production shall be defined as the mixing of RCC to be incorporated into the work and the placing of RCC within the neat lines and grades of the structure(s). The plan shall include all of the submittals that are required prior to beginning RCC production. These submittals are:

1. The source from which the cementitious materials will be obtained along with a certified mill test report for each type of cement, and/or blended cement that will be used to produce RCC.
2. The aggregate shall conform to the requirements of ASTM C 33. The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where the potential for reaction exists, the chemical method of test, ASTM C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM C 33, Appendix A1. Aggregates indicated by any of the above to be potentially reactive shall not be used.
3. The planned aggregate source, production, transportation, and storage procedures.

4. When applicable, the type and source of admixtures and curing compound intended for use.

5. The names and qualifications of the foreman and plant operator or the person who will direct the batching, mixing, and placing of RCC.

6. A statement of materials and mix proportions to be used in manufacturing the job mix.

7. Seven and 28-day compressive strength test results for each of the three mixes produced in the mix design program.

8. The mix production plan and schedule for placing successive lifts to minimize cold joints.

9. The conveyor system design and layout if used, and other methods and equipment to be used for handling, hauling, and depositing the mix on the RCC fill without contaminating the lift surfaces.

10. Plan for forming specified vertical surfaces.

11. Plan for contraction joint installation.

12. List of equipment to be used for placing, spreading, and compacting RCC.

3.02 PERSONNEL

A. Competent personnel with adequate experience shall direct the CONTRACTOR's RCC operation to insure that the job mix design and the batching, mixing, and placing operation conforms to this specification. As a minimum, there shall be a foreman who is responsible for all aspects of the RCC operation and a plant operator who is solely responsible for batching and mixing. Both the foreman and the plant operator shall have experience on at least one previous RCC job.

B. The CONTRACTOR shall provide written evidence, satisfactory to the OWNER'S REPRESENTATIVE that the foreman and plant operator or the person directing the RCC operation has the experience necessary to conduct or direct the work to be performed as herein specified. The CONTRACTOR shall submit, to the OWNER'S REPRESENTATIVE, the names and qualifications of the foreman and plant operator or the person who will direct the batching, mixing, and placing of RCC.

3.03 MIX DESIGN

A. General

1. The CONTRACTOR shall be responsible for the mix design and the selection of the source of all materials to be used in the design mix. The materials shall be elected based on tests that certify the materials meet the gradation and quality requirements of the specifications. An adequate supply of all materials shall be readily available for construction of the RCC works required by the contract. The CONTRACTOR shall furnish the OWNER'S REPRESENTATIVE a statement of the materials and mix proportions, including all admixtures, to be used in manufacturing the RCC. The

statement shall include conclusive evidence, satisfactory to the OWNER'S REPRESENTATIVE, that the proposed materials and mix proportions selected comply with the requirements specified herein and will produce roller compacted concrete of the quality, consistency and strength specified. The materials and proportions so stated shall constitute the job mix.

2. After a job mix has been designated, neither: the source, character or grading of the aggregates, nor the source, mill, type, brand or quantity of the cement, nor the type, brand or quantity of the admixture(s) used shall be changed without concurrence of the OWNER'S REPRESENTATIVE. Any change will constitute a new job mix. A new job mix shall be supported by conclusive evidence, satisfactory to the OWNER'S REPRESENTATIVE, that the proposed materials and mix proportions selected comply with the requirements of the specifications and will produce roller compacted concrete of the quality, consistency and strength specified.

3. The OWNER'S REPRESENTATIVE may exercise discretion in allowing or requiring minor modifications to the job mix. Minor modifications such as changes to the amount of water or cementitious materials in the mix will not constitute a new job mix.

4. The CONTRACTOR shall conduct the mix design program at a materials testing laboratory that is staffed by American Concrete Institute (ACI) Certified Concrete Laboratory Testing Technicians.

5. A minimum of three separate mixes shall be developed in the laboratory. Each mix will have a cementitious materials content that is different from the other two mixes. A compaction curve shall be developed for each mix to determine the optimum water content for that mix. The compaction curve shall be developed according to ASTM D 1557 using Method C.

6. Ten compressive strength cylinders from each RCC mixture shall be prepared in accordance with ASTM C 1435. Two cylinders of the RCC mixture shall be tested at 1 day, two cylinders shall be tested at 7 days, two cylinders shall be tested at 14 days, and four cylinders shall be tested at 28 days for compressive strength in accordance with ASTM C 39. The written test results shall be furnished to the OWNER'S REPRESENTATIVE within 24 hours of testing.

7. The average 28-day compressive strength of at least one of the mix designs shall be 80% to 100% of the minimum specified strength. The 28-day compressive strength of at least one of the mix designs shall be 100% to 120% of the minimum specified strength. The 28-day compressive strength of the remaining mix design shall approximate the strength of the average between the other two mixes.

B. Mix design Parameters

1. Type V Portland cement shall be used in the design of the mix.

2. The minimum compressive strength for the RCC mixture shall be as specified in Subsection 3.021 of this specification.

3. Unless otherwise specified in Subsection 3.021:

   a. Pozzolan shall comprise at least 25 percent (by weight) but shall not exceed 50 percent (by weight) of the cementitious materials.

   b. The remainder of the cementitious materials shall be comprised of the specified cement.

3.04 MIX PLANT

A. General

1. The mixing plant shall either be a batch-type or a continuous-flow pugmill with a twin shaft paddle-type mixer. It is the CONTRACTOR's responsibility to obtain and maintain equipment and personnel capable of handling this type of mix and of producing RCC that complies with the requirements of this specification.

2. In general, the plant shall conform to the guidelines and requirements of ASTM C 685.

3. At the mixing time necessary to meet the specified uniformity, the plant shall have adequate capacity to produce RCC at a rate that will conform to the production schedule. A minimum capacity of 150 tons per hour shall be required.

4. The plant shall have demonstrated satisfactory reliable performance on similar mixes on other RCC projects with little or no down time due to mixer breakdown or other production related problems, not including normal maintenance. Satisfactory reliable performance of the plant shall be documented by mixer uniformity tests from a recent job within the last year showing that the proposed plant produced a mix of similar proportions that met the requirements for production rate and uniformity set forth in this specification.

5. When satisfactory reliable past performance of the plant cannot be documented, the plant may be approved contingent on the results of uniformity tests that are conducted after the plant is set up and calibrated for this work.

6. The CONTRACTOR shall select the plant to be used and determine its layout. Within ten (10) days after the "Notice to Proceed", for the start of RCC production, the CONTRACTOR shall submit a mix production plan to the OWNER'S REPRESENTATIVE for concurrence. The mix production plan shall include as a minimum:

    a. A layout, relative to the placement site(s), and schematic drawing of the plant along with a n arrative description providing its peak capacity, normal anticipated production rate, and results of most recent uniformity tests conducted within the previous 12 months.

    b. A narrative description and a layout of the methods of handling aggregates and delivering concrete to the placement site(s).

    c. The type and expected number of pieces of equipment required for all operations of mixing, transporting, and placing.

13. The CONTRACTOR shall have the mixing plant in-place and in operating condition a minimum of five days prior to the construction of the test section that is specified in Subsection 3.08 of this specification.

14. The plant and all related equipment, feed belts, and other appurtenances shall be located in an area that is not subject to inundation by floodwaters. Conveyor belts (if used) to transport the mix to the placement area shall be assembled on elevated ground, waste or fill materials, or on raised footings and/or frames so that if the area around the belt is temporarily inundated by flood waters, no damage occurs to the equipment which would result in construction delay.

15. The CONTRACTOR shall perform, at no additional expense to the OWNER, all necessary shakedowns and trial runs of the mixing and proportioning equipment, including uniformity tests if required, so that when production begins a mix of the quality required by these specifications is consistently produced. RCC material not meeting these specifications shall be rejected and shall be removed and disposed of at the CONTRACTOR's expense. Payment will not be made for RCC material that is rejected.

B. Specific Plant Requirements

1. Accuracy - Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering the RCC mix. Delivery of materials as they are discharged from the mixer and from any gob hoppers shall be within the tolerances shown in Table 03600-1 below.

TABLE 03600-1:

TOLERANCES IN PROPORTIONING THE VARIOUS INGREDIENTS

Material	Tolerance
Pozzolan, mass	+/- 2 %
Cement, mass	+/- 2 %
Aggregate, mass	+/- 3 %
Water, mass or volume	+/- 1 %
Admixture, mass or volume	+/- 3 %

16. Admixture Dispensers - A volumetric dispenser shall be provided for measurement of admixtures. It shall be equipped with the necessary calibrated devices that will permit convenient checking of the accuracy of the dispensed volume of the particular admixture. The dispensing devices shall be capable of repetitively controlling the admixtures to the accuracy specified. Piping for liquid mixtures shall be free from leaks, with the proper valve(s) to prevent backflow or siphoning. Valves and related equipment shall be clean and maintained in good working condition. The dispensing system shall include a device or devices that shall indicate the flow of the admixture, or provide a convenient means for visually observing the admixture during the process of being batched or discharged. The system shall be capable of ready adjustment to permit varying the quantity of admixture to be dispensed. The dispenser shall be interlocked with the batching and discharge operations so that each admixture is separately added with a portion of the mixing water in a manner to insure uniform distribution of the admixtures throughout the materials entering the mixer.

17. Aggregate Bins - A separate bin shall be provided for each gradation of aggregate supplied for the RCC job mix. The bins shall be so arranged and operated that a uniform gradation of aggregate is provided for the RCC job mix. The bins shall have steep side slopes, large gate openings and be capable of discharging the aggregates at a uniform rate without clogging, even under damp conditions.

18. Cement Silos - The storage silo(s) shall be weather-tight to prevent moisture from accessing the cement. Silos shall be constructed so materials can be removed at a uniform rate without clogging or bridging of the materials. Each Silo and silo feed hose shall be clearly marked to minimize errors during the refilling process.

19. Cement, and Aggregate Feed – For a continuous-flow pugmill, the cement, and aggregates shall be uniformly, continuously, and simultaneously fed at the appropriate ratios for the desired mix design into the mixer by belt, auger, or other acceptable method. Aggregate may be fed onto a single belt from bins through openings at the bottom of the bins. Each opening shall be provided with a gate that can be locked at the necessary opening size to provide the correct feed rate. The bins shall be of sufficient size to insure a uniform flow of aggregate at an essentially constant rate. Cement shall be fed continuously by a feed device that is adjustable to insure a uniform flow of cement at an essentially constant rate for proportions established by the design mix. The feed shall be capable of gradual adjustment while in operation.

20. Mixing Mechanism – The mixing mechanism shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixing mechanism shall produce a no-slump mix that meets the requirements for mix uniformity as determined by performing the uniformity tests shown in Table 03600-2.

21. Mix Record - The plant shall be capable of continually producing a RCC mix record. The record shall show the amount of cement, water, aggregate, and admixture that is processed through the plant during a specific time interval. The record shall be reported as saturated surface dry weight of each ingredient over a specific time interval. The RCC mix record shall be produced at all times when the plant is producing a mix. A copy of the mix record shall be submitted to the OWNER'S REPRESENTATIVE prior to the start of the next production shift.

22. Noise Pollution – Where the plant is operating near a populated area, attention shall be given to reducing noise and/or only operating the plant during the times specified to limit the effects of noise pollution as per local regulations.

23. Pollution Control - The mix plant(s) shall be constructed so that materials that may produce dust can be charged into storage bins and dispensed into the mixer with minimum air pollution. Dust covers and suppressers of augers and conveyor belts and other conveyances shall be required. Plant emissions shall be within the limits established by applicable federal, state, and local regulations.

24. Uniformity Tests - Materials produced during the uniformity tests shall not be used as part of the test section. When a continuous-feed, continuous-discharge pugmill is used, the three uniformity tests shall be taken from RCC produced near the beginning, the middle, and the end of a production run where the materials are

continuously fed to the mixing compartment and the RCC is continuously produced for a minimum time period of one minute. When a batch-type or compulsory pugmill is used, the three uniformity tests shall be taken from materials produced from three separate batches. Each batch shall be similar in size, be produced by charging the mixer in a similar manner, and be mixed at the same mixing speed and mix retention time as the other two batches.

a. The manner in which the mixer is charged, the size of each batch, the mixing speed, the mix retention time and any other aspect that might effect the uniformity of the mix shall be representative of a normal production run.

b. Where the mix being tested is for the sole purpose of conducting uniformity tests, samples may be taken at the mixing plant. On jobs where uniformity tests are required during production runs, the individual tests should be taken at intervals of 5 minutes or more and all samples for testing shall be taken from the placement area following spreading of the material.

TABLE 03600-2:

REQUIREMENTS FOR UNIFORMITY

Test	**Allowable Maximum Difference (See Note Below)[1]**	**ASTM Standard**
Water content of full mix (% by weight)	15 %	D2216 D3017 D4643 D4944 D4959
Coarse aggregate content (plus No. 4, % by weight)	15 %	C94 (Annex)
Density (kilograms per cubic meter) of full mix	2 %	C138[2]
Compressive strength at 7-days (MPa)	25 %	C31, C39

Notes:

[1] *The maximum allowable difference = (maximum value – minimum value) divided by the average of three tests.*

[2] *The minimum size of the measure shall be 0.014 cubic meter.*

25. Water Dispenser - A suitable water facility shall be provided which will be capable of dispensing the mix water within the specified requirements. The mechanism for delivering water to the mixers shall be free from leakage when the valves are closed. The meter may be an in-line volumetrically activated flow meter adapted to read the weight of water being added in pounds per minute. The valve shall be capable of gradual adjustment during the mixing process to compensate for varying moisture contents in the aggregates.

3.05 MIXING

A. General

1. The mixing compartment shall not be charged at a rate that exceeds the capacity of the mixer as recommended by the manufacturer. The mixing mechanism shall be operated at the speed designated by the manufacturer.
2. All supply bins and silos shall be kept sufficiently full to insure a uniform flow of aggregate, and cement at an essentially constant rate.
3. The mixing mechanism shall be maintained in satisfactory operating condition, and shall be cleaned after each production run to prevent the buildup of hardened concrete that would hamper performance. Should any mixer at any time produce

unsatisfactory results, its use shall be promptly discontinued until it is repaired or otherwise corrected.

4. All material produced from the beginning of start-up shall be wasted until a uniform mix of the required proportions is consistently being discharged from the mixer.

5. The pug mill shall be calibrated so the required gate openings, auger speed, and valve openings for each mix are known. After the pugmill has been calibrated and has produced a mix of the uniformity specified herein, the mix retention time shall not be reduced.

B. Uniformity

1. Uniformity shall be monitored by visual inspection at a minimum of once per hour by Contractor's staff experienced in the placement of RCC. If a uniformity problem is suspected, the contractor shall conduct the uniformity tests listed in Table 03600-2. Refer to the subsection entitled "Mixing Mechanism" in Subsection 3.04 for specific requirements for uniformity testing.

2. Although a seven day compressive strength test result is required to complete the test for uniformity, the work may proceed without waiting on the compressive strength results if:

   a. there is documentation of satisfactory reliable past performance of the mixing plant as discussed in Subsection 3.4 of this specification,

   b. the results of the other three tests listed in Table 03600-2 are within the allowable maximum difference.

3. Adjustments shall be made to the mixing plant when uniformity test results indicate that the requirements for uniformity are not being met. For a continuous-feed, continuous-discharge pugmill, adjustments in rotation speed of the mixing paddles, angle of the paddles, feed rates and/or any other available adjustments shall be made as necessary to obtain the required uniformity and consistency of the RCC mix. For a batch-type or compulsory pugmill, adjustments in individual batch quantity, mix retention time, angle of the paddles and/or any other available adjustments shall be made as necessary to obtain the required uniformity and consistency of the RCC mix.

4. Failure to consistently produce a mix of the uniformity specified herein shall result in a discontinuation of the mixing operation until the plant can be made to produce a mix of the uniformity specified herein or until the plant can be replaced with a plant that is capable of consistently producing a mix of the uniformity specified herein.

5. If RCC of questionable uniformity was placed as part of the RCC structure, the extents of the RCC shall be documented. The engineer shall be consulted prior to placement of subsequent RCC in this area.

C. Sampling

1. The CONTRACTOR shall provide suitable facilities and labor for obtaining representative samples of materials as they enter the mixer, are discharged from the mixer, are discharged from the gob hopper and are placed on the lift surface. These samples will be used for the CONTRACTOR's construction quality control and for the OWNER'S REPRESENTATIVE's construction quality assurance testing. The CONTRACTOR shall furnish all necessary platforms, tools, and equipment for obtaining samples.

D. Reporting

1. Batch reports shall be provided to the OWNER'S REPRESENTATIVE before start up of the next day's operation. Reports shall include, at a minimum, the volume of each batch and the cement content, water, admixtures, and aggregate quantities. The amount of cement delivered daily shall also be reported.

3.06 FOUNDATION PREPARATION

A. General

1. Prior to the start of RCC placement, the foundation shall be excavated or filled to the specified neat lines and grades. The foundation shall be free of any organic or loose materials. All surfaces where RCC installation is specified shall be damp and have a surface temperature not less than 35°F. No RCC shall be placed in water or on soft foundation material.

B. Rock Foundations

1. Rock foundations shall be excavated to at least the level shown on the drawings. Additional excavation may be specified by the Owner's Representative where rock conditions are considered unsuitable. The rock surface shall be cleaned and prepared as specified in Technical Specification 02250. The slope of the finished foundation surface shall not be steeper than one horizontal to one vertical. Vertical faces shall be thoroughly cleaned and filled with concrete to provide the specified slope. Areas to receive concrete or dental grout will be determined by the Owner's Representative after close inspection of the cleaned surface.
2. The rock foundation shall be damp prior to placement of RCC and a bedding mortar layer shall be placed over the entire rock foundation surface that will receive RCC.
3. Underdrain
   a. When RCC will be placed on top of the underdrain drainfill surface, the drainfill shall be damp prior to placement of RCC. Drainfill surface shall raked smooth and be free of contaminates. CONTRACTOR shall be permitted to utilize a geonet or woven geotextile on top of the drainfill surface to hold drainfill in place during RCC placement. Geonet or woven geotextile shall a sufficient open area to not restrict the flow of water into or out of the drainfill layer.

3.07 CONVEYING AND HAULING

A. General

1. The RCC mix shall be conveyed from mixer to placement area as rapidly as practicable by methods that prevent segregation, contamination, and loss of water. Conveyor belt delivery from the mixing plant to the active lift surface is not required but is preferred. A written explanation of the proposed methods and equipment for handling, hauling, and depositing the mix shall be provided to the OWNER'S REPRESENTATIVE.
2. The total length of time from the end of mixing until the RCC has been placed, spread and compacted shall not exceed 60 minutes.

3. If necessary, the CONTRACTOR shall provide baffles at the discharge end of conveyors and within hoppers to limit free falls of mixed RCC to a maximum of 5 feet, and at other locations where the potential for excessive segregation may occur.

B. Temporary Storage Containers

1. Gob hoppers shall be provided for storage wherever the mixed RCC is temporarily accumulated prior to being loaded into hauling equipment and when direct conveyor systems do not otherwise provide continuous non-segregated delivery to the final placement location. Gob hoppers shall be conveniently located near the mixer or central dispatch point.

2. Gob hoppers shall have side slopes and gates that allow free flow of RCC without segregation or choking. Gob hoppers shall be totally emptied of one mix prior to being utilized for a mix with different proportions.

3. Telephone, radio or other acceptable communication shall be provided between all interim storage hoppers, the batch plant control location, and the placement site(s). The CONTRACTOR shall provide the OWNER'S REPRESENTATIVE and/or OWNER Inspector the same form of communication that will allow the OWNER'S REPRESENTATIVE and/or OWNER to monitor the CONTRACTOR's communications during RCC placement.

C. Conveyor Belts

1. Personnel that are fully experienced with belt delivery of mass concrete shall design the conveyor belt system. Vertical lifts of the RCC mix may be accomplished with bucketed conveyors. Steep inclines of the conveyor belt may require using conveyor belts with cleats. Within ten (10) days after the "Notice to Proceed", the conveyor system design and layout shall be submitted to the OWNER'S REPRESENTATIVE for review. The submittal shall include as a minimum: location, capacity, speed, reach, and pivot points for all belts.

2. Conveyor belts shall be operated at speeds that meet production requirements and do not segregate materials. RCC shall not be exposed on any belt for a period exceeding five minutes without being protected from the drying elements of wind and sun. RCC shall not be exposed on any belt when it is raining unless it is protected from rain.

D. Chutes

1. Chutes will not be permitted unless approved by OWNER'S REPRESENTATIVE. Elephant trunks or tremies will be permitted, if vertical drop is less than 40 feet.

E. Hauling Equipment

1. Equipment will not be permitted to track mud or other contaminants onto previously placed RCC. Hauling equipment will not be allowed on the RCC surface when rutting is observed and shall be removed immediately if it begins to rain. Hauling equipment will not be permitted to traverse any lift surface without special measures being implemented to protect in-place RCC from contamination. This may require the use of clean crushed rock for surfacing haul roads, cleaning contaminated haul roads, washing tires and undercarriage of vehicles prior to driving onto RCC, preventing hauling equipment from travelling onto the RCC and other measures determined to be needed.

2. Track type haul vehicles that damage the RCC surface will not be permitted on previously compacted RCC.
3. Trucks may be either bottom-dump or rear-dump equipped. Rear dumps have a tendency to contribute to segregation at the outer edges of the deposited RCC mix. Segregation resulting from the vertical drop from the truck bed shall be corrected by reworking during spreading operations.
4. Equipment shall be maintained in good operating condition and shall not be permitted onto the RCC surface when vehicle fluids are leaking or when there is a potential for contamination to the RCC.
5. All hauling vehicles shall be operated in a manner which precludes tight turns, sudden stops, or other operating activities that may damaged previously compacted RCC.

3.08 TEST SECTION

A. The CONTRACTOR shall construct a test section as part of the RCC placement operations. Unless otherwise specified, the test section shall be installed at locations proposed by the CONTRACTOR.

B. The test section is intended to serve as a practice, training, and orientation area, to prove the effectiveness of the mix and placement methods, and to establish that the apparent maximum density (AMD) of the RCC can be obtained in the fill. It shall be at least 20 feet wide, 5 feet high and 50 feet long and shall allow the complete RCC placement and compaction operation to be conducted with the equipment operating at normal operating speeds.

C. As a minimum, the test section shall be used to demonstrate the various techniques, materials, and equipment to be used in placement, joint treatment, compaction, and quality control. Additional techniques, materials, and equipment shall be demonstrated in the test section as specified in Subsection 3.021. Information gained will be used to evaluate the practical effectiveness of various construction methods and equipment, to make adjustments to the mix design, and to determine the AMD of the fill as defined in Subsection 3.021. The CONTRACTOR shall allow for numerous stops and starts to facilitate the testing that is required to determine the AMD.

D. When the test section is founded on soil, a minimum of two one foot lifts will be placed and tests for determining the AMD shall be conducted on the uppermost lift. As directed by the OWNER'S REPRESENTATIVE, joint treatment/bedding mix shall be used between lifts.

E. A vertical section shall be used to determine the adequacy of the procedures to construct formed vertical surfaces, using the same type of forms that will normally be used in the construction of the dam. The finish and appearance of formed vertical surfaces shall comply with the requirements stated in Subsection 3.17.

F. The CONTRACTOR shall extract eight, six inch diameter core samples from a portion of the test section that has been installed to the specified density. The CONTRACTOR shall test four samples each for 7 and 28 - day compressive strengths in accordance with ASTM C 42. *(Note: Core specimens shall be taken at six days and 27 days after the RCC is placed and compacted, respectively).* The strength tests shall be reported for the OWNER'S REPRESENTATIVE's evaluation. If a core shows sign of damage prior to testing it shall not be tested and an additional core sample shall be obtained.

G. The OWNER'S REPRESENTATIVE and CONTRACTOR shall closely monitor activities and provide an informal critique and review session prior to commencing with RCC placement operations.

3.09 PLACING AND SPREADING

A. Schedule

1. The RCC mass shall be constructed in as nearly a continuous non-stop operation as is practical. The rate of rise on any placement day, shall be a minimum of one lift of one foot per day over the entire RCC placement area.
2. The CONTRACTOR shall schedule work activities so that RCC placement at sites where seasonal water flows could normally be expected will be avoided. The initial part of production operations may be considered a demonstration period during which time additional quality control and/or quality assurance testing may be necessary.
3. Meeting the scheduled dates and production rates, including the aggregate production requirements, is necessary to obtain the desired in-place material properties and to minimize cracking potential from internally developed thermal stresses. Failure of the CONTRACTOR to meet these requirements may require additional restrictions and/or requirements, at the CONTRACTOR's expense, to ensure production of an equivalent final quality of in-place material. These additional restrictions and requirements may include, but not be limited to, use of surface protection and insulation, cooling of the RCC mixture, and placing RCC curing specified hours only.

B. Weather

1. Roller compacted concrete shall not be placed when the ambient temperature drops below 35°F unless the surface temperature of the foundation or previously placed RCC and the temperature of the RCC mix remains above 40°F. If the ambient temperature drops below 35°F and the surface of any RCC less than seven (7) days old is less than 40°F, the RCC surface shall be covered and protected with approved materials until the ambient temperature attains 35°F.
2. Roller compacted concrete shall not be placed during rainy weather. Placement during a light mist may continue when covered belt conveyors rather than hauling vehicles are used to convey the mix. Placement will not be permitted when rainwater begins to accumulate on compacted RCC surfaces. In adverse weather conditions such as heavy rain, severe cold, heavy snow, etc., an interruption in placing operations might be required to meet the requirements as herein specified.

C. Maximum Temperature of RCC

1. The maximum temperature of the RCC at time of placement shall be as specified in Subsection 3.021. The temperature shall be determined at the lift surface prior to spreading and compacting. The RCC temperature shall be measured every hour when the temperature is within two degrees of the specified limit. Introduction of chilled water and/or ice, shading and/or cooling of the aggregates, or other measures may be required to control RCC temperature.

D. Layout of the Placement Area

1. Placing lanes for the RCC shall be maintained parallel to the main axis of the embankment. When multiple paving lanes are used, the forward edge of each lane shall not be more than 60 feet in advance of the adjacent lane.
2. As nearly as is practical, the CONTRACTOR shall complete the current lift before starting the succeeding lift.
3. As placement of a lift progresses, the exposed edges shall be kept "live" by progressively placing outward. See Subsection 3.12 for further requirements related to the location and treatment of edge joints.

E. Placement

1. Roller compacted concrete mix shall be placed as near the final location for spreading as possible. Placement of RCC concrete shall be such that concrete will be off loaded by a single dump action in a stationary position. Dump load will be placed at the end of the top lift and spread in a smooth continuous motion to extend the lift. Belt placement shall discharge with a sp reading action that does not segregate the material. Do not discharge material directly against any formwork. Height of dumps or piles shall be a maximum of 3 feet. At isolated or confined placement locations the RCC may be deposited and spread up to a maximum distance of 50 feet provided segregation does not occur. T he CONTRACTOR shall modify operations, as necessary, to prevent segregation.

F. Spreading

1. Unless otherwise specified, spreading operations shall be completed within 10 minutes following dumping. T he finished layer shall be smooth and uniform resulting in a compacted layer of approximately one foot thick.
2. Spreading shall be accomplished with a track type bulldozer using street pads or highly worn cleats in a manner that will not cause damage to previously compacted RCC. Track-type spreading equipment shall operate only on non-compacted material surfaces. Equipment shall not crab or turn on compacted RCC. A front-end loader should be available to assist with deposition and spreading of materials as needed in confined areas, near abutments, and at other locations as may be required.
3. The equipment shall be maintained in good operating condition without any loss of vehicle fluids or other contamination onto the RCC material.
4. Spreading shall be performed in a manner that precludes segregation. When large aggregates segregate to the edge of a layer to be compacted, the aggregates shall be removed and/or re-blended into the RCC by spreading onto the non compacted surface.
5. RCC mix, bedding mix, or concrete shall not be placed on a previous placed layer where compaction operations are incomplete or where density may need to be verified by additional testing.

3.010 COMPACTION

A. General

1. The specified minimum in-place wet density of the RCC shall not be less than 98% of the AMD nor less than 96% of the theoretical air free density (TAFD). The AMD

shall be determined as described in Subsection 3.10.B. T he TAFD Shall be determined as described in Subsection 3.10.C.

2. Compacted RCC having an in-place wet density of less than the minimum specified density shall be re-rolled during a period not to exceed 30-minutes from the time the material is spread. If the minimum specified density cannot be achieved following this effort, the RCC shall be rejected and removed from the structure.

3. In general, large width self-propelled, smooth, steel-drum vibratory rollers (drum width greater than 4 feet wide) shall be used in open areas. Small vibratory rollers (drum width less than 4 feet wide) including walk-behind rollers shall be used within one to 3 feet of slope faces and at irregular areas at the abutments. Manually directed power tampers shall be used for compacting in any area that cannot be reached with the drum of a vibratory roller and near forms. Rollers shall not be operated in the vibratory mode until they are in motion.

4. All compacting equipment shall be kept in good operating condition at all times and will not be allowed to drip or spill contaminants onto the RCC.

5. Care shall be taken when placing RCC over and around embedded conduits so that the placement and compaction of RCC do not damage the conduits. Small vibratory equipment and hand tools shall be used to ensure that material placed in constricted areas, such as under the haunches of conduits, is compacted to the specified density.

B. Apparent Maximum Density:

1. The apparent maximum density (AMD) is the maximum RCC density that can be attained by compacting the RCC with the primary roller. The primary roller is described in Subsection 3.10.D. The initial AMD of the RCC shall be determined from the test section. To determine the AMD, each layer of the RCCshall be compacted with a minimum of four passes of the primary roller within a 10-minute period from the time the material is spread. *(Note: The act of rolling forward past a point and then rolling in reverse past the same point is considered two passes.)* As the test section is being compacted by the primary roller, in-place wet density tests shall be made at depths of 4, 8, and 12 inches in conformance with the procedures set forth in ASTM C 1040. A minimum of two sets of tests shall be obtained after each pass of the primary roller until the maximum density of the lift is achieved and the density readings at 4, 8, and 12 inches indicate that maximum density has been attained for the full depth of the lift. The AMD of the control section will then be determined from the average of the in-place density at six locations selected or approved by the OWNER'S REPRESENTATIVE.

C. Theoretical Air Free Density:

The theoretical air free density (TAFD) is the maximum density that can be attained for a specific RCC mix. Knowing the specific gravity of each ingredient that is in the mix, the value for TAFD is calculated as follows:

1. Obtain the specific gravity (G_s) of each ingredient that is in the RCC mix.

2. Obtain the saturated surface dry weights of each ingredient processed through the pugmill over a specific time period. The length of the time period is irrelative as long as it is the same for each ingredient.

3. Calculate the volume of each ingredient from the values obtained in Step (2). The volume of an ingredient is calculated by the following equation:

$$V = W_{ssd} / (G_s \text{ x density}_{\text{water}})$$

Where V = volume in ft3, Wssd = the saturated surface dry weight of the ingredient in ton, Gs = specific gravity of the ingredient, and density water = 62.4 lbs/ft3.

4. Divide the total weight from Step (2) by the total volume from Step (3) to determine the TAFD in lbs./ft3.

D. Compaction Equipment

1. The CONTRACTOR shall submit, as part of the RCC placement plan, a list of compaction equipment that will be used. All compaction equipment shall be approved by the OWNER'S REPRESENTATIVE prior to being delivered to the site.
2. All equipment including compaction equipment used in the RCC fill shall be maintained in good operating condition at all times. Equipment shall not drip or spill oil or other contaminants onto the RCC. Any equipment found to contaminate the RCC shall be removed from use and the contaminated RCC shall be removed and replaced at the expense of the CONTRACTOR.
3. Primary Rollers - The primary rollers shall be a smooth steel, double drum large self propelled vibratory rollers. The rollers shall transmit a dynamic impact to the surface through a smooth steel drum(s) by means of revolving weights, eccentric shafts, or other equivalent methods. Compactors shall have static weights of not less than 10 tons. and a minimum dynamic force of at least 2 tons per foot of drum width at the operating frequency used during construction. Compactors shall operate at a vibrating frequency of at least 1500 cpm (cycles per minute), have a drum diameter of 4 to 6 feet, have a drum width of 4 to 7 feet, and have an engine horsepower of at least 120. The roller should be capable of producing a vibration amplitude between 0.03 and 0.07 inches. The roller shall not travel at greater than 2 feet per second. If demonstrated as part of the test section (in comparison to a compactor that meets the requirements for Primary Roller as specified herein) alternative primary rollers are permissible. The primary roller selected shall achieve compaction of the RCC with the least number of passes.
4. Within the range of the operational capability of the equipment, the CONTRACTOR shall select the combination of vibrating frequency and speed of operation, which results in the maximum density at the fastest production rate while meeting all requirements specified herein.
5. Secondary Rollers and Power Tampers – The secondary rollers shall be small vibratory rollers and tampers, which are capable of operating adjacent to a vertical face. Secondary rollers shall be used to compact the RCC at areas where the large vibratory roller cannot maneuver.
6. Secondary rollers shall produce a dynamic force of at least 1.6 tons per linear foot of drum width.
7. Tampers shall develop a force per blow of at least 1.6 tons per square foot.
8. The CONTRACTOR shall maintain at least one secondary roller and two tampers in good operating condition at the site during RCC placement.

9. The amount of rolling and tamping required shall be whatever is necessary to attain the specified minimum specified in-place wet density. The use of small vibratory rollers and manually directed power tampers may require that the material be compacted in lifts that are thinner than the maximum specified lift thickness in order to achieve the minimum specified in-place wet density throughout the full depth of the lift.

10. Vibratory plate compactors may be used to smooth and level the surface, but shall not serve as a substitute for vibratory rollers and power tampers

3.011 LIFT JOINTS

A. General

1. The entire roller-compacted concrete mass shall be constructed so that it hardens and acts as one monolithic structure without discontinuous joints or potential planes of separation. To guard against discontinuous joints or potential planes of separation attention must be given to the condition of the lift joints prior to the placement of a subsequent lift of RCC on the joint.

B. Joint Condition

1. This specification identifies three joint conditions: fresh joint, intermediate joint, and cold joint. The condition of a joint is dependent on the joint maturity. Joint maturity is defined as the product of the average surface temperature (AST) in Fahrenheit and the time of exposure (TE) in hours. Joint maturity is expressed in degree-hours (deg F-hr) and is calculated as:

   Joint maturity in deg F-hr = (AST) x (TE).

2. AST shall be determined by measuring the temperature in degrees Fahrenheit, of the RCC surface each hour after placement and determining the average of the temperature measurements for the specific TE. A surface thermometer shall be used to measure the surface temperature. T he temperature shall be measured at the location where it is expected that the surface temperature is the greatest relative to the remaining lift surface.

3. The TE shall be the period of time beginning when compaction is completed and ending when the subsequent layer of RCC covers the lift surface.

   a. Fresh joint – A fresh joint is a joint having a maturity of 400 deg F-hr or less. In lieu of determining the deg F-hr, a fresh joint may be defined as a joint with a TE of four hours or less.

   b. Intermediate joint - An intermediate joint is a joint having a maturity greater than 400 deg F-hr but less than or equal to 1500 deg F-hr. In lieu of determining the deg F-hr, an intermediate joint may be defined as a joint with a TE of greater than four hours but less than 16 hours.

   c. Cold joint - A cold joint is a joint having a maturity of over 1500 deg F-hr. In lieu of determining the deg F-hr, a cold joint may be defined as a joint with a TE of 16 hours or more.

C. Joint Treatment

1. All joint surfaces shall be kept in a clean, uncontaminated, and continuously moist (not in an overly watered) condition until placement of the succeeding layer of RCC. Operable water nozzles from trucks or distribution lines which provide overlapping water mists shall be maintained on the placement area at all times. They shall be used as necessary to prevent joint surfaces from drying and shall be supplemented as necessary by mists from hand-held hoses to reach inaccessible areas. The mist or spray shall not be applied in a channeled, pressurized, or other manner that erodes the fresh RCC surface. It also shall not be applied at a rate, which causes ponding at the surface.

2. Cleaning of previously placed RCC layers if required may be accomplished by pressurized water or air, power brooming, or other method provided the surface of the in-place layer is not damaged by this operation and provided the resulting surface affords a good bond between the two layers of RCC.

3. If a layer of fine dust develops on the surface or the surface becomes dry, rutted or contaminated, Treatment Method I, II or III shall be implemented. In this case the treatment method selected shall be the method specified in Subsection 3.021 that affords the highest degree of treatment.

4. Joint treatment shall be performed immediately before the placement of RCC on the joint. The required treatment is designated in Subsection 3.021.

5. Treatment Method I – Remove any loose materials and contaminants from the surface

6. Treatment Method II – Remove any loose materials and contaminants from the surface. Pressure wash to expose the aggregate. The pressure and timing shall be regulated so that the paste is removed from a portion of the surface, but the aggregate is not loosened or undercut.

7. Treatment Method III – Remove any loose materials and contaminants from the surface. Using air Pressure or water pressure wash (as directed by the OWNER'S REPRESENTATIVE) the surface of the RCC lift to expose the aggregate. The pressure and timing shall be regulated so that the paste is removed from a portion of the surface, but the aggregate is not loosened or undercut. After the surface is cleaned and the aggregate is exposed, maintain the surface in a damp condition. Prior to the placement of RCC the surface shall be covered with a layer of the bedding mix that is specified in Subsection 3.013. The bedding mix shall be covered with RCC while the mix can be easily moved with a broom, is plastic, and has not set. In no case shall the bedding mix remain uncovered for a period exceeding 30 minutes. Bedding mix that does not meet these requirements shall be removed, and the surface re-cleaned. The thickness of the bedding mix shall be the average thickness specified in Subsection 3.013. The bedding mix shall be deposited as closely as possible to its final position and spread with a minimum of lateral movement to prevent segregation. It shall be worked into corners and angles of forms and around embedded items in a manner that will guard against segregation. Should segregation of the bedding materials occur, the segregated bedding mix shall be removed, the surface re-cleaned and a non segregated mix applied.

8. Separate payment shall not be made for joint treatment.

3.012 EDGE JOINTS

1. In addition to the requirements for lift joints set forth in Subsection 3.11, transverse edge joints (i.e. joints that are perpendicular to the direction of travel) at stoppages of work shall be trimmed straight and beveled at an inclination of one horizontal to one vertical. Transverse joints of adjacent lanes shall be offset by at least 10 feet to prevent establishing seepage paths in the structure. When lanes or areas of RCC are placed in adjacent layers, the longitudinal joints (i.e. joints that are parallel to the direction of travel) shall be trimmed within three hours of placement. RCC removed by brooming, smoothing, or trimming layers shall be wasted. Edge joints with a joint maturity greater than 3 hours shall require Bedding Mortar as specified for Treatment Method III, Section 3.011.

3.013 BEDDING MORTAR

A. All rock foundations, RCC lifts identified in the Construction Drawings, and all lift/edge joints requiring joint treatment method III shall be covered with a layer of mortar just prior to the RCC placement. The mortar shall be sand/cementitious material with a minimum strength at 28 days of 3000 psi and have slump of 7 to 9 inches. Bedding mortar placed on rock foundations shall be between 1 to 2-inches thick. Bedding mortar placed on RCC joints shall be between 0.25 and 0.75 inches thick. The CONTRACTOR shall be responsible for the mix design and the selection of the source of all materials to be used in the mortar mix. The materials shall be selected based on tests that certify the materials meet the quality requirements of the specifications. The CONTRACTOR shall submit in writing to the OWNER'S REPRESENTATIVE, his bedding mortar mix design, planned aggregate source, production, transportation, and storage procedures. This submittal shall be made a minimum of 14-days prior to the start of aggregate production operations or, if the aggregate is being obtained from a commercial quarry, prior to developing the onsite stockpile. Anticipated peak production capacity, normal production capacity, and onsite storage volumes shall be indicated. Acceptance of the CONTRACTOR's Plan will not relieve the CONTRACTOR of the responsibility for completing the work as specified.

3.014 TRANSVERSE CONTRACTION JOINTS

A. Transverse contraction joints shall be made only at locations shown on the drawings. The CONTRACTOR shall submit in writing to the OWNER'S REPRESENTATIVE for approval, his transverse contraction joints construction procedure, joint fill materials, equipment to be used. The followings are some potential construction procedures:

1. Alternative 1

Forcing galvanized sheet metal panels into the uncompacted RCC lift surface with a backhoe-mounted vibratory blade to form a line of sheet metal in the lift extending from upstream to downstream.

2. Alternative 2

Placing a sheet panel wrapped with PVC sheeting at the intended joint location. After RCC is carefully placed on each side, the steel panel is removed, leaving the PVC sheeting at the desired joint location. The RCC is then compacted.

3. Alternative 3

Cutting the transverse contraction joints with a joint inserter at the intended joint location after RCC is compacted. For a lift of 1 ft thick, cut the top 8-inches and leave the bottom 4-

inches lift continuous. And then remove the joint inserter and leave the metal panel in the joint. Repair the RCC surface at the top of the joint and proceed with the RCC placement.

3.015 WATERSTOPS

A. Waterstops shall be installed at locations shown on the drawings. Waterstops shall be held firmly in the correct position as the RCC is placed and shall be installed in accordance with manufacturer's written instructions. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized as recommended by the manufacturer. Joints shall be watertight and shall provide a cross-section that is dense and free of porosite with tensile strength of not less than 80 percent of the unsplices materials. Intersecting waterstop joints shall be prefabricated and supplied by the same manufacturer providing the waterstop.

3.016 CURING AND PROTECTION

A. General

1. The surface of any RCC layer upon which subsequent RCC will be placed shall be maintained continuously damp and at a temperature not less than 40°F until completion of RCC placement for that layer.
2. All exposed completed RCC surfaces shall be maintained in a continuously moist curing environment for a minimum of fourteen (14) days following placement or treated with a specified or approved curing compound. Curing compound shall be thoroughly mixed before applying and be agitated during application. Except as otherwise specified in Section 3.021, the compound shall be applied at a pressure of 70 to 100 psi. A continuously agitating pressure sprayer shall be used for application at a uniform rate of not less than 0.65 gallons per square foot of surface. Manual hand pump sprayers shall not be used unless otherwise specified. A soft-bristled brush or paint roller may be used in areas that are near surfaces that are not to be sprayed. The compound shall form a uniform, continuous, adherent film that shall not check, crack, or peel and shall be free from pinholes or other imperfections.
3. The surfaces of RCC layers upon which subsequent layers will be placed shall be protected from erosion by rain and potential damage that may be caused by construction traffic. Any surface that is damaged to the extent the coarse aggregate is undercut shall be treated as a cold joint.
4. Failure to continuously cure the RCC as specified for the entire curing period shall result in a suspension of further RCC placement. RCC placement may resume when the contractor fully demonstrates his ability and commitment to this highly critical aspect of the work. Resumption of RCC placement is contingent on a written request from the CONTRACTOR to the OWNER'S REPRESENTATIVE and the written response from the OWNER'S REPRESENTATIVE approving that the work may resume.

B. Insulation and Protection

1. The temperature of RCC that is less than 14 days old shall be maintained at or above 40°F. When ambient temperatures are expected to be below 35°F, protective measures shall be implemented to protect the RCC from freezing. The protection shall remain in-place until ambient temperatures remain above 40°FC. The protective measures shall provide for uninterrupted moist curing of the in-place RCC for the specified period. As seasonal conditions warrant, prior to placing RCC the

CONTRACTOR shall prepare and submit, to the OWNER'S REPRESENTATIVE, a written plan outlining the method that will be implemented to provide protection from freezing.

3.017 VERTICAL SURFACES

A. All exposed vertical RCC surfaces that are formed shall be dense with 90% of the surface free from honeycomb, and uniform in appearance. The in-place density at the corners and edges shall be equal to or greater than specified minimum in-place wet density. T he CONTRACTOR shall submit a plan for obtaining vertical surfaces. Forming is not required for vertical surfaces that will have permanent backfill placed against them.

B. A horizontal working surface shall be provided for the construction of vertical sidewalls. The minimum width of this working surface is 8 feet.

3.018 GROUT ENRICHED RCC

A. In lieu of using concrete grout enriched RCC (GE-RCC) can be used for the pipe penetrations in the RCC chute to properly seal around the pipe penetration. The GE-RCC shall be constructed by the CONTRACTOR in accordance with the following and as may be modified with experience found during the test section and with agreement of the OWNER'S REPRESENTATIVE.

B. RCC shall be spread and the surfaced leveled off without applying any pre-compaction by machine or personnel standing on the loose RCC surface. A water - cement grout of 1:1 by weight shall be poured uniformly over the RCC surface approximately 3 m in advance of the poker vibrators, or so as to give sufficient time for the grout to soak down into the RCC lift before the vibrator is inserted into the treated zone. If thicker grouts are used then it may be necessary to reduce its viscosity by the addition of an approved chemical additive such as a superplasticiser and/or assist penetration of the grout by hand-rodding holes at about 200 millimeters intervals through the RCC lift using a steel rod just ahead of applying the grout. Use of a light hand placed frame outlining the width and length of facing to be dosed when using buckets will assist in controlling the quantity of grout applied. Typically 15-20 liters grout per square meter is required.

C. The poker vibrator shall be adequately sized so that it will mobilize the treated RCC similar to its mobilization of conventional concrete. Sufficient time shall be given at each location for the GE-RCC to be fully mobilized to the bottom of the lift before the poker is slowly lifted and re-inserted in the adjoining area. On completion there should be a thin surficial layer of grout/laitance evident on the surface, excess should be avoided.

D. A sample of the compacted GE-RCC should be extracted immediately following its compaction and a slump test done, the slump should not exceed 25 millimeters, the material should then be used to manufacture test samples for strength testing. Mixing of grout shall be done in a high speed mixer and continually agitated until used to prevent settlement of the cement. Grout consistency can be verified by filling a clear plastic bottle and observing the relative proportions of set/settled cement and water.

E. Immediately following compaction of the GE-RCC the parent/untreated RCC adjoining it shall be roller compacted with the roller overlapping the GE-RCC by about 50 mm, up to this point, rolling of the adjacent RCC should not be any closer the one roller width from the GE-

RCC activity to prevent any pre-compaction or reduction of voids in the RCC which is necessary for the penetration of the grout though the full lift thickness.

F. The procedure of placing RCC, hand leveling the surface, rodding to the bottom of the lift, applying the grout, soaking in of the grout, and poker vibration should be carried forward as a single 'operation', with each of the activities spaced apart on the basis of the time needed to actually undertake them. On occasions when the RCC is delivered fresh, is highly workable (low end of the Vebe time) less grout will be required to enable the poker vibrator to activate the GE-RCC, in some cases no grout at all may be necessary.

G. On removal of the forms any honeycomb or voided areas of GE-RCC shall be dug back to competent dense material and repaired to the approval of the OWNER'S REPRESENTATIVE. Occurrence of such areas shall be less than 1% of the exposed surface.

H. The mix design for the grout and the adopted method of placing, mixing and vibrating shall be demonstrated by the CONTRACTOR in the test section. At least 7 days prior to placement of the first batch of RCC, the CONTRACTOR shall submit the proposed method of grout placement and the equipment to the OWNER'S REPRESENTATIVE.

3.019 TOLERANCES

A. Except as supplemented or modified by this section, tolerances shall be as required by other applicable sections of this specification. There shall be no underbuild in any finished work. This specification defines two levels of tolerance.

1. Tolerance Level 1: The allowable overbuild of all exposed surfaces shall be 1 inch except that the allowable overbuild of a finished crest shall be 0.05 inches.
2. The thickness of compacted lifts of RCC shall be within one inch of the thickness specified.
3. Tolerance Level 2: During placement, limit gradual overbuilds of the exposed face to 1 inch.
4. After trimming and cleaning, limit gradual overbuild of the exposed RCC face to 6 inches.
5. Do not exceed 4 inches in 50 feet variation in an unformed exposed RCC surface, after trimming and cleaning, as measured in a straight line along the length and width of the face, nor 4 inches over the entire length and height of the structure.
6. The elevation of any horizontal RCC surface shall be within plus 2 inches of the specified grade except that the elevation of a finished crest shall be placed to within plus 1 inch of the specified elevation.

3.020 CLEAN-UP OF SPILLAGE

A. No separate compensation and no measurement will be considered for all loose gravel and un-compacted material shall be removed from the structure. All loose material that falls into the basin or accumulates at the toe shall be removed for proper disposal. The CONTRACTOR shall remove all excess spillage and loose material without recycling into the mix.

3.021 SPECIAL CONSIDERATIONS

During RCC activities special considerations should be given to the following:

A. Aggregates for the RCC mix shall be prepared and tested in accordance with ASTM D421 and ASTM D422.

B. All RCC used in the construction of the dam shall be placed in horizontal lifts that are a maximum of one foot in thickness after compaction.

C. The maximum temperature of the RCC at the time of placement shall not exceed 85°F.

D. The Contractor shall remove and replace damaged or defective roller compacted concrete. The OWNER'S REPRESENTATIVE will determine the required extent of removal, replacement or repair and advise the CONTRACTOR, in writing, of this determination.

E. Prior to starting repair work the CONTRACTOR shall obtain the OWNER'S REPRESENTATIVE's approval of his plan for making the repair. The appropriate methods described in Chapter VII of the Concrete Manual, Bureau of Reclamation, U. S. Department of the Interior, shall be used as the primary reference for repairs. If approved in writing by the OWNER'S REPRESENTATIVE, proprietary compounds for adhesion or as patching ingredients may be used. Such compounds shall be used in accordance with the manufacturer's recommendations.

F. Lift Joints - Joint Treatment, Treatment Method III shall apply for intermediate joints and cold joints.

G. Lift Joints - Joint Treatment, Treatment Method I shall apply for fresh joints.

H. The minimum 28-day compressive strength of the RCC shall be 2500 psi.

I. Where a curing compound to be used as a method of meeting the Curing and Protection specification for the RCC, the CONTRACTOR shall submit all data sheets, manufacturer's recommendations and other relevant information pertaining to the curing compound intended for use to the OWNER'S REPRESENTATIVE for approval prior to it's use on site.

J. Tolerance Level 1 shall apply as well as tolerances specified in Subsection 3.19.

K. Approval of the CONTRACTOR's repair shall not be considered a waiver of the OWNER's and/or OWNER'S REPRESENTATIVE's right to require complete removal of defective work if the completed work does not produce concrete of the required quality and appearance.

L. The step height on the downstream face of the RCC dam can be modified from that shown on the Construction Drawings to accommodate the CONTRACTOR'S means and methods, but the maximum compacted lift thickness shall not exceed 12-inches.

M. If the testing indicates that the 28 day compressive strength of any lift or portion of any lift is less than 2000 psi, then payment for the RCC will be reduced in proportion to the reduction in strength to a minimum of 1500 psi. Any lift or portion of any lift that has test results lower than 1500 psi shall be removed and replaced at no additional cost to the Owner.

N. In-place density of the RCC via ASTM C1040 shall be completed every 100 cubic yards or once per lift or once per day, whichever is greater.

O. A set of four RCC cylinders shall be fabricated and tested for compressive strength via ASTM C1435 and C39 every 1000 cubic yards or once per lift or once per day whichever is greater. Test one (1) cylinder at 7 days for information. Test two (2) cylinders at 28 days for compliance. If one of the cylinders shows evidence of improper sampling, molding, curing, or testing, it shall be discarded and the remaining cylinder tested.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

A. Not used.

END OF SECTION