

Technical Specification

Received

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EPD Watershed Protection Branch

Glen Emerald Dam Rehabilitation  
DeKalb County, Georgia

*Prepared for:*

DeKalb County  
1950 W Exchange Place  
Tucker, Georgia 30084

*Prepared by:*

Kimley-Horn and Associates, Inc.

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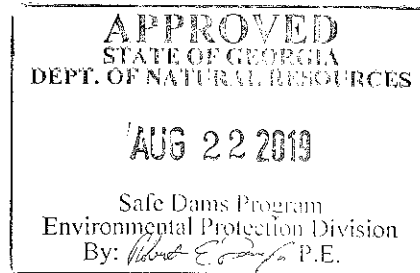


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SECTION 00432 – MEASUREMENT AND PAYMENT

PART I – GENERAL

1. SCOPE

- A. This section describes measurement and payment of lump sum and unit rate items of work.

PART 2 – MEASUREMENT

1. LUMP SUM ITEMS

- A. The Contractor shall furnish all materials, equipment, labor and incidentals necessary to complete the lump sum item of work. Lump sum items shall include all appurtenances necessary to complete the item of work and make the item of work operational if applicable. The item of work shall not be deemed complete until the Engineer has approved the item of work.

2. UNIT RATE ITEMS

- A. Additional Type C Silt Fence – Additional Type C Silt Fence shall be measured by the linear foot of additional silt fence required above and beyond the Type C Silt Fence shown on the Drawings. Contractor shall satisfy all requirements for maintenance of existing silt fence prior to requesting measurement of Additional Type C Silt Fence.
- B. Undercut & Dam Embankment Excavation – Undercut & Dam Embankment Excavation shall be measured as the in-place volume of earth material located under the proposed toe of dam, base of spillway and existing back slope of the dam that contractor removes to the limits as shown on the Drawings or as directed by the Geotechnical Engineer. The Geotechnical Engineer must be given 24 hour notice of contractor's intent to perform undercut or dam embankment excavation so Geotechnical Engineer can make Undercut & Dam Embankment Excavation measurement.
- C. Dam Fill – On-Site Borrow – Dam Fill – On-Site Borrow shall be measured as the in-place compacted volume of dam embankment fill that comes from the on-site borrow sites. The dam fill material must be satisfactory material suitable for the intended use as determined by the Geotechnical Engineer. The Geotechnical Engineer must be given 24 hour notice of contractor's intent to perform dam fill from on-site borrow sources so Geotechnical Engineer can make Dam Fill-On-Site Borrow measurement.
- D. Dam Fill- Off-Site Borrow – Dam Fill – Off-Site Borrow shall be measured as the in-place compacted volume of dam embankment fill that comes from an off-site borrow site. The dam fill material must be satisfactory material suitable for the intended use as determined by the Geotechnical Engineer. The Geotechnical Engineer must be given 24 hour notice of contractor's intent to perform dam fill from off-site borrow sources so Geotechnical Engineer can make Dam Fill-Off-Site Borrow measurement. All On-Site borrow material shall have been exhausted prior to Contractor requesting measurement of Dam Fill – Off-Site Borrow.
- E. Additional C-33 Drain Aggregate – Additional C-33 Drain Aggregate shall be measured as the in-place, compacted volume of additional C-33 drain aggregate required for extra depth toe drain, widened or lengthened foundation drain, widened or lengthened chimney drain or widened or lengthened pipe collar. The limits of extra depth toe drain, widened or lengthened foundation drain, chimney drain or pipe collar shall as determined and measured by the Geotechnical Engineer. The Geotechnical Engineer must be given 24 hour notice of contractor's intent to perform additional C-33 drain aggregate placement so Geotechnical Engineer can make Additional C-33 Drain Aggregate measurement.

- F. Existing Spillway Excavation and Recomposition - Existing Spillway Excavation and Recomposition shall be measured as the in-place volume of compacted earth material to the limits shown on the Drawings or as directed by the Geotechnical Engineer. Measurement shall be made of recomposed volume. The Geotechnical Engineer must be given 24 hour notice of contractors intent to perform existing spillway excavation and recomposition so Geotechnical Engineer can make a measurement of the Existing Spillway Excavation and Recomposition.
- G. New Spillway Excavation and Recomposition – New Spillway Excavation and Recomposition shall be measured as the in-place volume of earth material excavated from the dam embankment and recomposed to the limits shown on the Drawings or as directed by the Geotechnical Engineer. Measurement shall be made of recomposed volume. The Geotechnical Engineer must be given 24 hour notice of contractors intent to perform new spillway excavation and recomposition so Geotechnical Engineer can make a measurement of the New Spillway Excavation and Recomposition.
- H. 30" Heavy Rip-Rap – 30" Heavy Rip-Rap shall be measured per square yard of in-place rip-rap.
- I. 24" GDOT Type 3 Rip-Rap - 24" GDOT Type 3 Rip-Rap shall be measured per square yard of in-place rip-rap.

**PART 3 – PAYMENT**

- A. Mobilization – Payment for Mobilization shall include the transportation to and from the work site as many times as required by the contractor for the utilization of the equipment desired by the contractor. This item shall include any permits required to transport equipment on public right-of-ways. This item shall include any temporary fencing, gates and locks to protect contractor's equipment and materials.
- B. Haul Route Construction & Maintenance – Payment for Haul Route Construction & Maintenance shall include staking, clearing, stump removal, grading, foundation stabilization, stone placement and compaction, redressing of stone placement and compaction at locations shown on the Drawings for haul route construction. Haul Route Construction & Maintenance shall include removal of stone to borrow site and restoration of the haul route to a grassed condition, once the haul route is no longer needed.
- C. Clearing and Grubbing – Payment for Clearing and Grubbing shall include flagging clearing limits, cutting and removal of trees in locations shown on the Drawings. Care shall be utilized to not damage existing trees to remain outside of the clearing and grubbing limits shown on the Drawings. Clearing and Grubbing shall include the removal of the tree root ball and roots. Clearing and Grubbing shall include the removal of clearing and grubbing debris from the park.
- D. Topsoil Strip and Stockpile – Payment for Topsoil Strip and Stockpile shall include excavation of topsoil free of roots and other deleterious material from areas to be cleared and grubbed. Topsoil Strip and Stockpile shall include stockpile of topsoil in locations shown on the plans, erosion control protection of stockpile areas and restoration of stockpile areas after topsoil is respread.
- E. Erosion Control Installation & Maintenance – Payment for Erosion Control Installation & Maintenance shall include installation of erosion control measures as shown on the Drawings or as required by the local land disturbance permit issuing authority or the Georgia EPD. Erosion Control Installation and Maintenance includes erosion control daily inspections, water quality monitoring, daily logs, and reporting. Erosion Control Installation & Maintenance shall include the maintenance of erosion control measures until final stabilization is complete including replacement of failed erosion control measures. Erosion Control Installation & Maintenance includes the removal of erosion control features once final stabilization is achieved or until the erosion control feature is no longer required.
- F. Additional Type C Silt Fence – Payment for Additional Type C Silt Fence shall include removal of damaged silt fence, if any; trenching; and installation of Type C Silt Fence. Contractor shall satisfy all requirements for maintenance of existing silt fence prior to approval of payment of Additional Type C Silt Fence.
- G. Dewatering & Maintenance – Payment for Dewatering & Maintenance includes the dewatering of Glen Emerald Lake and maintenance of lake levels in a dewatered state during reconstruction

of the dam and appurtenance structures are complete. Dewatering & Maintenance includes dewatering of excavations in accordance with the specifications and maintenance of excavations in a dewatered state until permanent improvements have been installed and approved. Dewatering and Maintenance shall include erosion control measures dictated by the nature of the contractor's means and methods of dewatering.

- H. Surface Water Control & Maintenance – Payment for Surface Water Control & Maintenance shall include diversion, collection, transporting and safely discharging surface waters around the construction site in order to protect permanent features of the dam. Surface Water Control & Maintenance shall include erosion control measures dictated by the nature of the contractor's means and methods of surface water control. Surface Water Control & Maintenance shall include maintenance of surface water controls until no longer needed to protect permanent construction.
- I. Undercut & Dam Embankment Excavation – Payment for Undercut & Dam Embankment Excavation shall include excavation of material that is determined unsuitable by the Geotechnical Engineer, haul of material to the on-site borrow areas, spreading of unsuitable material, drying of unsuitable material if required, and final grading of borrow sites. If Dam Embankment material is deemed by the Geotechnical Engineer to be suitable for use in new dam embankment then payment for Undercut & Dam Embankment Excavation shall include placement, soil moisture adjustment, compaction in the new dam embankment and settlement monitoring.
- J. Dam Fill – On-Site Borrow – Payment for Dam Fill – On-Site Borrow shall include removal of roots and other deleterious material from the borrow sites, excavation of borrow material to the limits approved by the Geotechnical Engineer, haul of material, placement, soil moisture adjustment, compaction, settlement monitoring, final grading of dam embankment and borrow sites and redressing graded areas that become damaged.
- K. Dam Fill – Off-Site Borrow – Payment for Dam Fill – Off-Site Borrow shall include test samples for Geotechnical Engineering analysis, acquisition of borrow material, excavation of borrow material approved by the Geotechnical Engineer, haul of material, placement, soil moisture adjustment, compaction, settlement monitoring, final grading of dam embankment and redressing graded areas that become damaged. All On-Site borrow material shall have been exhausted prior to payment for Dam Fill – Off-Site Borrow.
- L. Toe Drain – Payment for Toe Drain shall include the excavation of toe drain to limits shown on the Drawings, acquisition, placement and compaction of filter fabric, C-33 sand, #89 stone, #57 stone, acquisition and laying perforated PVC pipe, and removal and replacement of contaminated drain aggregate.
- M. Foundation Drain – Payment for Foundation Drain shall include surface preparation, acquisition, placement and compaction of C-33 sand, acquisition and laying perforated PVC pipe, and removal and replacement of contaminated drain aggregate.
- N. Chimney Drain – Payment for Chimney Drain shall include surface preparation, acquisition, placement and compaction of C-33 sand, installation of filter collar, and removal and replacement of contaminated drain aggregate.
- O. Additional C-33 Drain Aggregate – Payment for Additional C-33 Drain Aggregate shall include extra depth excavation of toe drain and/or additional width, length or height of foundation drain or chimney drain the limits of which have been approved by the Geotechnical Engineer.
- P. Cleanouts – Payment for Cleanouts shall include excavation, installation of pipe, pipe fittings, pipe caps, backfill and compaction, concrete collars, concrete markers and final stabilization.
- Q. Drain Outlet Pipe and Headwall – Payment for Drain Outlet Pipe and Headwall shall include excavation, procurement and installation of PVC and DIP pipes from the toe drain to the outlet headwall, backfill and compaction, concrete headwall, animal guard, riprap and concrete marker.
- R. Existing Spillway Demolition – Payment for Existing Spillway Demolition shall include excavation, demolition of pedestrian bridge, demolition of steel support beams, demolition of stone masonry spillway removal of stone bedding if present, removal of all demolished materials for the park property, disposal of all demolished material.
- S. Existing Spillway Over Excavation & Recomposition – Payment for Existing Spillway Over Excavation & Recomposition shall include excavation, disposal of unsuitable material, backfill, soil

- moisture adjustment, compaction, final grading and redressing graded areas that become damaged.
- T. New Spillway Over Excavation & Recomposition – Payment for New Spillway Over Excavation & Recomposition shall include excavation, disposal of unsuitable material, backfill, soil moisture adjustment, compaction, final grading and redressing graded areas that become damaged.
- U. New Spillway Underdrain System – Payment for New Spillway Underdrain System shall include excavation, surface preparation; mixing, placement and compaction of the fine filter; placement and compaction of the coarse filter; installation of perforated PVC pipe and fittings; installation of non-perforated PVC pipe and fittings; pipe outlet wall penetrations and backfill and compaction.
- V. New Concrete Spillway – Payment for New Concrete Spillway shall include excavation, surface preparation, vapor barrier, erection of formwork, installation of steel reinforcement, installation of pipe penetrations, installation of joint dowels, installation of fence post embedments, installation of watertops as shown on Drawings, placement and consolidation of concrete, removal of formwork, concrete curing, concrete pointing and finishing, backfill and compaction of spillway walls.
- W. Siphon System – Payment for Siphon System shall include excavation; surface preparation; pipe, bends and fittings placement; concrete thrust blocks; concrete encasement; aluminum intake screen, fill stand, valve box and marker; gate valve, valve box and marker; spillway wall penetration; and backfill and compaction.
- X. 18" Storm Drainage System – Payment for 18" Storm Drainage System shall include excavation, surface preparation, concrete pipe, pipe laying, filter fabric, concrete bedding, inlets, headwalls, rip-rap placement, concrete valley gutter, pipe backfill and compaction.
- Y. Wave Protection Mating – Payment for Wave Protection Mating shall include surface preparation, installation of wave protection mating, staking and repair of damaged mating.
- Z. Permanent Grassing – Payment for Permanent Grassing shall include spreading topsoil on all areas to receive permanent grass, removal of deleterious material, surface preparation, seeding, fertilization, watering, replacement of grass that is damaged or is not fully established up to one year after final completion of the project.
- AA. Tree Replacement – Payment for Tree Replacement shall include tree root ball excavation, fertilization, soil preparation, planting, staking, watering and replacement of all trees that are not stabilized in one year after final completion of the project.
- BB. Observation Wells – Payment for Observation Wells shall include multiple drill rig mobilizations, grading access for drill rig, drilling observation wells, installation of screen of length shown on Drawings with bottom cap, installation of solid wall pipe, installation of sand filter pack, grouting observation well, installation of steel sleeve and concrete pad and marker, well cap and locking mechanism, backfill and compaction around top of observation well, and re-establishment of dam slope.
- CC. 30" Heavy Rip-Rap – Payment for 30" Heavy Rip-Rap shall include surface preparation, filter fabric installation, filter stone installation, rip-rap placement and chinking.
- DD. 18" Rip-Rap – Payment for 18" Rip-Rap shall include surface preparation, filter fabric installation, filter stone installation, rip-rap placement and chinking.
- EE. 4' Chain Link Fence – Payment for 4' Chain Link Fence shall include drilling post anchor holes in spillway walls, grouting fence post, installation of top and bottom rail, installation of fence material, stretcher bars, post caps, and end anchorage.
- FF. Pedestrian Bridge Precast Concrete Hollowcore Slabs – Payment for Pedestrian Bridge Precast Concrete Hollowcore Slabs shall include spillway wall cutout for precast concrete hollowcore slabs, bearing pads, installation of precast concrete hollowcore slabs as shown on Drawings and installation of concrete sidewalk extension.
- GG. Pedestrian Bridge Handrail – Payment for Pedestrian Bridge Handrail shall include mounting galvanized steel handrail post, welding galvanized steel handrails and post, painting handrails and post and installation of steel bollards.

END OF SECTION 00432

SECTION 02010 – SUBSURFACE CONDITIONS

PART I – GENERAL

1. DESCRIPTION

- A. Soil boring logs are shown in the Geotechnical report entitled “Report of Subsurface Exploration and Geotechnical Engineering Evaluation, Rehabilitation of Glen Emerald Dam, DeKalb County, Georgia, PGC Project No. 109036 prepared by Piedmont Geotechnical Consultants, Inc. dated October 28, 2009. Results of exploration of two on-site borrow sites is shown in the Geotechnical Report entitled “Borrow Site Evaluation, Rehabilitation of Glen Emerald Dam, DeKalb County, Georgia, PGC Project No. 109036.01, dated June 13, 2011. This information may be obtained upon request at the Owner’s offices.
- B. This investigation information is offered as an aid in bidding only and is not a part of the Contract Documents. The boring logs are available for the Contractor’s information, but are not a warranty of subsurface conditions. The Owner, Engineer and Geotechnical Engineer assume no responsibility for any variation between materials encountered during construction and those indicated on the boring logs, nor for any variation between the location of the water table encountered and that indicated on the boring logs at the date borings were taken.
- C. Additional Investigation: The Contractor shall visit the site and become acquainted with site conditions. Prior to bidding, prospective Contractors may make their own site and subsurface investigations to satisfy themselves with site and subsurface conditions only if the Owner and Geotechnical Engineer has reviewed and approved the proposed investigation. The Contractor shall be responsible for obtaining rights of ingress and egress to private property for site and subsurface investigation and shall assume all responsibility for any damage to property caused as a result of the Contractor’s investigation.
- D. Location of Borings: Contractors shall be responsible for making their own determination of the location of the soil borings on this Project.

END OF SECTION 02010



SECTION 02020 – DEWATERING

PART I – GENERAL

1. SCOPE

- A. This section shall apply to all excavation.
- B. Construct all permanent work in areas free from water. Lower lake levels and design, construct and maintain all dikes, levees, cofferdams, dewatering wells, siphons, diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.
- C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

2. SUBMITTALS

The Contractor shall submit his proposed dewatering & observation well plan at least 3 weeks in advance of initiation of dewatering. The Contractor's dewatering plan will be reviewed to identify potential for disturbance of damage to existing embankment materials and will in no way be construed as acceptance of the Contractor's means and methods of dewatering. Contractor shall correct any exceptions to the proposed dewatering plan prior to initiation of dewatering.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

1. CARE OF WATER

- A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.
- B. Furnish, install, maintain and operate necessary pumping, siphons and other equipment for removal of water from Glen Emerald Lake and the various parts of the work and for maintaining the foundation and excavations free from water as required for construction of each part of the work.
- C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.
- D. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.
- E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.
- F. Do not overload or obstruct existing drainage facilities.

- G. After they have served their purpose, remove all temporary dewatering work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed as specified in Section 02200 Earthwork of these specifications.
- H. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breaching of dikes, levees and cofferdams may be required.
- I. Contractor is to co-ordinate with the DeKalb County Parks, Recreation and Open Space Department ---  
- concerning schedule of lowering of water levels in Glen Emerald Lake.

**2. DEWATERING**

- A. By the use of lowering lake levels, well points, pumps, sumps, drains, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.
- B. Excavations shall be continuously dewatered to maintain a ground water level no higher than 3 feet below the lowest point in the excavation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade. Dewatering should function continuously until the excavation is completely backfilled at least 3 feet above existing grade(s).
- C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the Owner.
- D. Temporary observation wells are required to monitor the ground water level to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of the excavations as directed by the Geotechnical Engineer.

END OF SECTION 02020

**SECTION 02100 – SITE PREPARATION**

**PART I – GENERAL**

**1. SCOPE**

- A. This section describes materials and equipment to be utilized and requirements for their use in preparing the work site for construction. The Contractor shall furnish all materials, equipment and labor necessary to complete the work.
- B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

**2. PROTECTION OF EXISTING FEATURES**

- A. Flag and erect barriers to protect 3 existing piezometers along the crest of the dam during dewatering operations. One month after dewatering of lake has been completed existing piezometers can be abandoned. Contractor may reuse existing piezometer covers if not damaged.

**3. CLEARING AND GRUBBING**

- A. Within the limits shown on the Drawings, the site will be cleared and grubbed to prepare for construction.
- B. Clearing
  - 1) All vegetative growth such as trees, shrubs, brush, logs, upturned stumps and roots of down trees and other similar items shall be removed and disposed of properly by the Contractor as specified below. Cultivated growth shall be removed and trees felled as necessary within the construction work limits and as indicated on the Contract Documents.
  - 2) Where the tree limb structure interferes with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the appropriate utility.
  - 3) All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored and replaced.

**C. Grubbing**

All stumps, roots, foundations, pipe to be removed and planking embedded in the ground shall be removed and disposed of properly by the Contractor as directed by the Geotechnical Engineer. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

**4. PRELIMINARY GRADING**

Before beginning construction, the Contractor shall grade the entire work site to conform, in general, to the existing contours shown on the Drawings. A portion of the downstream slope of the existing dam shall be removed and downstream slope graded smooth as directed by the Geotechnical Engineer prior to placement of chimney drain materials. Some backfill where large stumps/roots have been removed or where sloughing of previously failed material may be required.

5. TESTING AND INSPECTION SERVICES

- A. Soil testing will be performed by an independent testing laboratory selected and paid for by the Owner. Glen Emerald Dam is a Category I High Hazard Dam and will have essentially full time monitoring and/or testing.
- B. The soils testing laboratory is responsible for the following:
  - 1) Compaction tests in accordance with ASTM D 698.
  - 2) Field density tests for each two feet of lift; one test for each 5,000 square feet of fill.
  - 3) Inspecting and testing stripped site, undercut areas, subgrades and proposed borrow site fill materials.
- C. The Contractor's duties relative to testing include:
  - 1) Notifying the laboratory of conditions requiring testing.
  - 2) Coordinating with the laboratory for field testing.
  - 3) Providing representative, borrow site fill soil samples to laboratory for test purposes. Provide 50 pound samples of each fill soil.
  - 4) Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveals non-conformance with specified requirements.
- D. Inspection
  - 1) Dewatering, earthwork operations, undercutting operations, suitability of excavated materials for fill and backfill, and placing and compaction of fill and backfill is subject to inspection. The Geotechnical Engineer will observe earthwork operations.
  - 2) Foundations and shallow spread footing foundations are required to be inspected by a Geotechnical Engineer to verify suitable bearing and construction.
  - 3) Glen Emerald Dam is a Category I Dam as defined by the Georgia Safe Dam Program. No work is to be performed on the dam without a representative of the Engineer or Geotechnical Engineer being on-site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

1. PREPARATION

Maintain bench marks, monuments and other reference points. Re-establish, at no cost to the Owner, any such reference points if disturbed or destroyed.

2. CLEARING

- A. Clear areas required for access to site and execution of the work.
- B. Remove trees and shrubs within the area to be cleared.
- C. Clear undergrowth and deadwood, without disturbing subsoil.

3. DISPOSAL OF REFUSE

The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or

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body of water, or in any street or alley. No debris shall be deposited upon any private property except by written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

END OF SECTION 02100

SECTION 02125 – EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1. SCOPE

A. General

- 1) The work specified in this Section consists of providing and maintaining temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation work.
- 2) Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas which will ensure that erosion during construction will be maintained within acceptable limits. Acceptable limits are as scheduled by the Georgia Erosion and Sedimentation Control Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations, and laws of local and municipal authorities having jurisdiction.
- 3) All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.
- 4) Land disturbance activity shall not commence until a DeKalb County Land Disturbance Permit is issued.
- 5) The Contractor shall also comply with all requirements for an NPDES General Construction Permit, including the submittal of notices, plan presentation, and fee payment.

B. Basic Principles

- 1) Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.
- 2) Minimize the disturbed area and the duration of exposure to erosive conditions.
- 3) Stabilize disturbed areas immediately.
- 4) Safely convey run-off from the site to an outlet such that erosion will not be increased off site.
- 5) Retain sediment on site that was generated on site.
- 6) Minimize encroachment upon watercourses.

C. Implementation

- 1) The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The Contractor's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings, which shall be the Contractor's responsibility to determine and install said measures. The Contractor's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings, which shall be the Contractor's responsibility to determine and install said measures.
- 2) The Contractor shall notify the Engineer of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the Contractor's methods of operation. No additional payment shall be made for erosion and sedimentation control measures made necessary by the Contractor's methods of operation.
- 3) The Contractor shall be solely responsible for control of erosion within the Project site and prevention of sedimentation of any adjacent waterways.
- 4) The Contractor shall install controls which will ensure that stormwater and drainage from the disturbed area of the Project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 as amended.

- D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:
- 1) Preventing soil erosion at the source.
  - 2) Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
  - 3) Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.
  - 4) Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

## 2. QUALITY ASSURANCE

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

## PART 2 – PRODUCTS

### 1. TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES

- A. Silt Fence: Silt fence shall meet the requirements of Section 171 – Temporary Silt Fence of the Department of Transportation, State of Georgia, Standard Specification, 2006 edition. Silt fence fabric must be on the Georgia DOT Qualified Product List.
- B. Hay bales shall be clean, seedfree cereal hay type.
- C. Netting shall be ½-inch, galvanized steel, chicken wire mesh.
- D. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01H, Size Number 3 (2006).
- E. Concrete block shall be hollow, non-load bearing type.
- F. Plywood shall be ¾-inch thick exterior type.

### 2. RIP-RAP

- A. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO (American Association of State Highway and Transportation Officials) T-96 (2006).
- 1) Type 1 Rip Rap: The largest pieces shall have a maximum volume of two cubic feet. At least 35 percent of the mass shall be comprised of pieces which weigh 125 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 1 (2006).
  - 2) Type 3 Rip Rap: The largest pieces shall have a maximum approximate volume of one cubic foot. At least 35 percent of the mass shall be comprised of pieces which weigh 15 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise

a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 3 (2006).

- 3) Heavy Rip Rap: The largest pieces shall have a maximum volume of 6 cubic feet. At least 30 percent of the mass shall be comprised of pieces which weigh 770 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve.

**3. FILTER FABRIC**

- A. Filter fabric under rip-rap shall be non-woven and shall conform to the Georgia Department of Transportation Standard Specifications, Section 881.06 for non-woven fabrics (2006).

**4. CONCRETE**

- A. Concrete for erosion control measures shall have a compressive strength of not less than 4,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. (2006) Reinforcing steels shall conform to the requirements of ASTM A 615, Grade 60 (2006).

**5. WAVE PROTECTION MATTING**

- A. Wave protection matting shall be North American Green VMAS C350 or equal.

**PART 3 – EXECUTION**

**1. GENERAL**

Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Georgia Erosion and Sedimentation Act of 1975 as amended in 1989, local enforcing agency guidelines and these Specifications.

**2. TEMPORARY EROSION AND SEDIMENT CONTROL**

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. If the amount of sediment overwhelms the creek, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the creek banks. When excavation activities disturb the previously stated preventative measures, or if they are not maintained, or whenever the construction activities cross the creeks, the check dams shall be installed downstream and within 200 feet of the affected area.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings. Such temporary vegetative cover shall be provided by the Contractor in compliance with the Manual for Erosion and Sedimentation Control in Georgia, specifically in the selection of species, planting dates and application rates for seedings, fertilizer and mulching, with the exception that kudzu shall not be permitted.



- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3. PERMANENT EROSION CONTROL

A. Permanent erosion control shall include:

- 1) Restoring the work site to its proposed contours, unless shown otherwise on the Drawings or directed by the Engineer.
- 2) Permanent vegetative cover shall be performed in accordance with Section 02933.

B. Permanent erosion control measures shall be implemented as soon as practical after the completion of land disturbance for each segment of the Project.

4. GRASSING

Temporary Stabilization: Temporary stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site. Temporary stabilization shall be provided to any area, which will not receive permanent stabilization within the next 14 calendar days. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

5. RIP RAP

A. Unless shown otherwise on the Drawings, rip rap shall be placed at all points where spillway outlets or storm sewer discharges are proposed, where banks of streams or drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.

B. Preparation of Foundations: The ground surface upon which the filter fabric and rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the rip rap placement area. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly.

C. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running parallel to the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of 24-inches of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any

contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Owner.

- D. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of crushed stone overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural slope of the streambank and stream bottom. Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or the Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.

**6. WAVE PROTECTION MATTING**

- A. Surface Preparation: The surface to receive the wave protection matting shall be graded to a smooth consistent slope and horizontal alignment across the full length of the dam. All sticks, roots and other deleterious material shall be removed from the surface to receive the wave protection matting.
- B. Placement: The wave protection matting shall be rolled out along the horizontal alignment and staked in accordance with the manufacturer's recommendations. The wave protection matting shall be overlapped a minimum of 24 inches at all splices and staked in accordance with the manufacturer's recommendations.

END OF SECTION 02125

SECTION 02200 – EARTHWORK

PART 1 – GENERAL

1. SCOPE

- A. This Section includes earthwork and related operations associated with construction and/or shaping of the existing dam, floodplain undercutting, embankment placement, and principal spillway structure backfill. These operations include, but are not limited to, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures, backfilling all trenches and pits, compacting, all sheeting, shoring and bracing, preparation of subgrades, finish grading, and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the work.
- B. The Contractor shall provide all services, labor, materials and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing complete Work as shown on the Drawings or specified in these Contract Documents.

2 GENERAL

- A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise and include approximate elevations below water surfaces based upon limited soundings. The Contractor shall become satisfied as to the exact quantities of excavation and fill required.
- C. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- D. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Client. All damage caused by erosion, lack of adequate dewatering, use of equipment that is improper for earthwork operation, or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material with no additional cost to the Owner.
- E. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing surface drains or temporary drains. Free access must be provided to all fire hydrants, watergates and meters.
- F. No classification of excavated materials will be made. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof.
- G. Two borrow areas and a haul route has been identified on the Drawings for the Contractor's use and convenience. The haul route provides access to Bouldercrest Road. The limits of the borrow sites and haul road shall be flagged in the field by the Contractor and approved by the Engineer prior to commencement of clearing operations. The borrow areas are not anticipated to provide all the suitable earth materials necessary to complete earthwork operations.
- H. Tests for compaction and density shall be conducted by an independent testing laboratory selected by the Owner. Costs of compaction tests performed by an independent testing laboratory shall be paid for

directly by the Owner and not as a part of this Contract. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for acceptance of borrow materials and conducting compaction and density tests. The cost of all retests made necessary by the failure of materials to conform to the requirements of these Contract Documents shall be paid by the Contractor.

- I. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P. Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations.
- J. It is understood and agreed to by the Contractor that he has made a thorough investigation of the surface and subsurface conditions of the site including any special construction problems which might arise as a result of nearby lake and floodplains, particularly in areas where construction activities may encounter water-bearing subgrades, sands and gravels or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment and materials necessary or convenient to the Contractor for completing the work within the time specified in these Contract Documents.

## **PART 2 – PRODUCTS**

### **1. MATERIALS AND CONSTRUCTION**

#### **A. Earthwork Materials**

##### **1) Fill Material, General**

- a. Approval Required: All fill material shall be subject to the approval of the Geotechnical Engineer.
- b. Notification: For approval of imported fill material, notify the Geotechnical Engineer at least four weeks in advance of intention to import material, designate the proposed borrow area and permit the Geotechnical Engineer to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2) On-Site Fill Material: All On-Site Fill material shall be soil exclusive of organic matter, frozen lumps or other deleterious substances. On-Site Fill material shall contain no rocks or lumps over 3-inches maximum in dimension.

3) Select Fill Material: Select Fill material for construction of the dam and shall be material consisting of soil classified as ML, CL or SC with some limited amount of MH and CH. SC materials shall have at least 25% passing the #200 sieve and a plasticity index of at least 6. Select fill material shall have a minimum dry weight of at least 90 pounds per cubic foot at 95 percent compaction (ASTM 698). Placement of select fill material shall be as directed by the Geotechnical Engineer.

4) Common Fill Material: Common Fill Material includes all select material and soil classified as SM or SC with less than 25% passing the #200 sieve.

5) Imported Fill Materials: All Imported Fill material shall meet the requirements of On-Site Fill material or Select Fill material

6) Top Soil: Dark organic weed free loam, free of muck.

- B. Sheet piling, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheet piling, bracing and timbering required to properly support excavations in open cut and to prevent all movement of the soil, rock or structures outside the excavation.

1) General

- a. Cofferdams and bracing design, including computations, shall be prepared before commencing construction operations. Drawings and design computations shall be signed and sealed by a professional engineer registered in the State of Georgia. The drawings and design computations shall not be submitted to the Engineer.
- b. Sheeting, bracing and timbering shall be so placed as to allow the work to be constructed to the lines and grades shown on the Drawings and as ordered by the Engineer.
- c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe, the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety.
- d. All sheeting in contact with the concrete or masonry shall be cut off as directed by the Engineer and left in place.

2) Timber: Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

3) Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and/or live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Steel piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.

4) Remove bracing and sheeting in units when backfill reaches the point necessary to protect the structures and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed. Cut off sheeting left in place at least two feet below the finish surface.

C. Other Materials: All other materials not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the approval of the Engineer.

**PART 3 – EXECUTION**

**1. GENERAL**

A. Safety: Comply with local regulations and with the provisions of the “Manual of Accident prevention in Construction: of the Associated General Contractors of America, Inc., Occupational Safety and Health Act and all other applicable safety regulations.

**B. Topsoil**

- 1) Remove all topsoil to a depth at which subsoil is encountered, from all areas under proposed embankments and from all areas which are to be cut to lower grades or filled including borrow areas.
- 2) With the Engineer’s approval, topsoil to be used for finish grading may be stored on the site.
- 3) Other topsoil may be used for fill in non-critical areas with approval of the Engineer.
- 4) Properly dispose of all excess topsoil off site.

C. Bracing and Sheeting

- 1) Furnish, put in place, and maintain all sheeting, bracing and shoring as may be required to properly support the sides of an excavation and to prevent all movement of earth which could in any way injure the work, adjacent property or workers.
- 2) Properly support all excavations where necessary to conform to all pertinent rules and regulations and these Specifications, even though, such locations are not indicated on the Drawings.
- 3) Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work, adjacent property or workers.
- 4) Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved by the Engineer.

D. Obstructions

- 1) Remove and dispose of all trees, stumps, roots, boulders, sidewalks, driveways, pavement, pipes and the like, as required for the performance of the work in the presence of the Geotechnical Engineer.
- 2) Once the Glen Emerald Lake has been dewatered, remove the existing stone masonry spillway and associated aggregate subgrade as shown in the Drawings.
- 3) Damaged or displaced structures or appurtenances shall be repaired or replaced at no additional cost to the Owner.

E. Unsuitable Material Excavation

- 1) In case soft or excessively wet material which, in the opinion of the Geotechnical Engineer, is not suitable, is encountered below the existing toe of dam elevation of the earth embankment, below the prescribed partial removal of the existing embankment, beyond the prescribed excavation beside and/or below the existing stone masonry spillway or underneath a structure, the Geotechnical Engineer may order the removal of this material and its replacement with suitable material in order to make a suitable foundation for the construction of the structure.
- 2) All extra excavation made at the order of the Geotechnical Engineer will be paid for on the basis of the actual volume of the excavation as measured by the Geotechnical Engineer. No measurement for payment shall be made until all dewatering as specified in Section 02020 Dewatering has been successfully accomplished.
- 3) Excavation of unsuitable material may be necessary to be performed in strips or small areas in order to minimize exposure time and groundwater infiltration and backfilled during same shift. Contractor shall co-ordinate with the Geotechnical Engineer to select the appropriate excavation equipment to prevent damage to suitable materials to remain in place.

2. EXCAVATION

A. Method

- 1) All excavation shall be by open cut from the surface except as indicated on the Drawings.
- 2) All excavations for pipe appurtenances and structures shall be made in such manner and to such depth and width as will give ample room for structures and for bracing, sheeting and supporting the sides of the excavation, for pumping and draining groundwater which may be encountered, and for the removal from the excavation of all materials excavated.

- 3) Take special care so that the subgrade, rock or partially weathered rock below the bottom of any structure to be built is left undisturbed.
- 4) All final excavations shall be made with equipment using smooth blade buckets to minimize damage to the subgrades.

**B. Grades**

- 1) Excavate to grades indicated on the Drawings.
- 2) Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation or as recommended by the Engineer.
- 3) No excavations shall be made without authorization from the Geotechnical Engineer.

**C. Disposal of Excavated Material**

- 1) Remove and properly dispose of all excavated material determined by the Geotechnical Engineer to be unsuitable, or not needed, to complete filling, backfilling and grading.
- 2) The Contractor may place unsuitable soil materials within the two borrow sites as long as they are spread, uniformly graded to drain and create a stable surface as noted on the Drawings and approved by the Engineer.
- 3) Dispose of excess excavated material off site at locations secured by the Contractor and in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property except by written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

**3. EXCAVATION FOR STRUCTURES**

**A. Earth Excavation**

- 1) Earth excavation shall include all substances to be excavated including rock. Earth excavation for structures shall be to limits not less than two feet outside wall lines, to allow for formwork and inspection, and further as necessary to permit the trades to install their work. All materials loosened or disturbed by excavation or seepage shall be removed from surfaces to receive new fill material, subsurface drainage system or concrete.
- 2) No separate payment will be made for earth excavation. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.
- 3) Blasting is not allowed for removal of rock or other materials.

**B. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock or compacted materials to insure proper bearing.**

**1) Unsuitable Foundation Material**

- a. Any material in the opinion of the Geotechnical Engineer which is unsuitable at the prescribed foundation elevation shall be removed to a suitable foundation as directed by the Geotechnical Engineer.
- b. No determination of unsuitability will be made until all requirements for dewatering as specified in Section 02020 Dewatering are satisfactorily met.

**2) Foundation in Rock: Foundations for a structure shall be on similar materials. Should excavation for a foundation be partially in rock, the Contractor shall undercut that portion of the rock 12-inches and bring the excavation to grade with concrete.**

**3) Unauthorized Excavation**

- a) Care shall be taken that excavation does not extend below bottom levels of footings or slabs on earth or rock. Should the excavation, through carelessness or neglect, be carried below such levels, the Contractor shall fill in the resulting excess excavation with materials approved by, and as directed by the Engineer.
- b) Additional costs of corrective work, made necessary by unauthorized excavation of earth or rock, shall be borne by the Contractor.

C. Unsuitable Bearing

- 1) If suitable bearings for foundations are not encountered at the elevations indicated on the Drawings, immediately notify the Geotechnical Engineer.
- 2) Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.

4. FILL

A. Controlled Fill

- 1) The fill for embankments shall be controlled fill.
- 2) After the existing ground or excavated area has been proofrolled and examined by the Geotechnical Engineer, all holes and other irregularities shall be filled and compacted before the main fill is placed. No fill shall be placed until the Geotechnical Engineer has approved subgrades to receive fill.
- 3) Each lift of fill shall be placed in even layers not exceeding 8-inches in depth and to the fullest horizontal extent possible and shall be thoroughly compacted as herein specified.
- 4) If an analysis of the soil being placed shows a marked difference from one location to another, the fill being placed shall not be made up of a mixture of these materials.
- 5) Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.
- 6) Fill lifts shall not be left in a smooth condition, such as may occur by use of a pneumatic roller or dump trucks. If a smooth condition should occur it will be necessary to scarify the exposed surface before placing subsequent lifts.
- 7) No fill shall be placed following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
- 8) Where fill is to be placed against slopes greater than 4(horizontal) to 1(vertical), contractor shall bench into slopes not covered by the subsurface drainage system.
- 9) If exposed subgrade becomes overly dry or overly wet it will be necessary to blade off or scarify and recompact the subgrade as directed by the Geotechnical Engineer.
- 10) Contractor shall vary where materials are being excavated at the borrow sources as well as where they are being placed as directed by the Geotechnical Engineer.

B. Proofrolling

- 1) Where practical, areas where embankments, spillways and structures are to be constructed on cut areas, compacted fill, and other areas where indicated on the Drawings, shall be proofrolled to detect soft spots prior to the placement of fill material and after placement of fill.
- 2) Proofrolling shall consist of moving a 20-30 ton loaded tandem axle dump truck or other pneumatic tire roller over the subgrade before the subgrade is shaped. Proofrolling shall be witnessed by the Geotechnical Engineer.
- 3) Pneumatic-tired rollers shall have not fewer than four pneumatic tired wheels which shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 90 psi. The roller wheels shall be located abreast in a rigid steel frame. Each wheel shall be loaded with an individual weight box so that each wheel will



bear an equal load when traversing uneven ground. The weight boxes shall be suitable for ballast loading such that the load per wheel shall be 25,000 pounds. The spacing of the wheels shall insure that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The roller shall be operated no faster than 10 miles per hour.

- 4) Subgrade shall be proofrolled with two passes of the truck or roller in each of two perpendicular directions. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with two passes of the roller in each of two perpendicular directions. If after having been filled and proofrolled, the subgrade still contains depressions, the area shall be undercut to the full depth of the soft material or five feet whichever is less, backfilled, recompact, and rolled to achieve a subgrade acceptable to the Geotechnical Engineer.
- 5) Conduits, pipes, culverts and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than five feet to, conduits, pipes, culverts and underdrains unless the tops of those products are deeper than three feet.

**C. Placement**

- 1) Prior to placement of any material in embankments, the area within embankment limits shall be cleared and stripped of stumps, roots and topsoil and all unsuitable materials removed. The area shall then be scarified to a depth of at least 6-inches.
- 2) Fill materials shall be placed in continuous approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practical and having a net compacted thickness of not over 8-inches.
- 3) Fill materials shall be placed at optimum moisture content, but no greater than 3 percent above optimum. Optimum moisture shall be maintained by sprinkling the layers as placed or by allowing materials to dry before placement.

**D. Compaction**

- 1) Fill materials shall be compacted to dry densities as determined by the Standard Proctor Compaction Test performed in accordance with ASTM D 698.
- 2) Fill materials supporting embankments, structures, backfill around structures and walls shall be compacted to 95 percent of the maximum dry density. The top 24-inches of fill material supporting structures shall be compacted to 98 percent of the maximum dry density. Fill placed for general site grading shall be compacted to at least 95 percent of the maximum dry density.
- 3) Compaction of embankments shall be by sheepfoot rollers with staggered, uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one row of knobs shall be 250 psi. Placement and compaction of materials shall extend beyond the final contours sufficiently to insure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer shaping the face of the embankment.
- 4) Compaction of backfill around structures shall be accomplished by heavy power tamping equipment. Heavy vibratory rollers or compactors should not be operated any closer than 5 feet from earth retaining structures.
- 5) If tests indicate that density of fill is less than that specified, the area shall be recompact or undercut, filled, and compacted until specified density is achieved.

- E. Final Grading:** Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend into conformation with existing ground surfaces. All surfaces shall be left smooth and free to drain.

F. Excess Material

- 1) Any excess earth excavation and unsuitable materials shall be removed from the site. If approved by the Engineer, select excess earth excavation and unsuitable materials can be placed in the on-site borrow areas as directed by the Engineer. No excess earth and unsuitable materials shall be wasted downstream of the dam. Surfaces and slopes of waste fills shall be left smooth and free to drain.
- 2) No separate payment will be made for grading waste fills. The cost of all such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

G. Moisture

- 1) All fill shall be compacted at or above the soil's optimum moisture content, but not to exceed 3% above optimum moisture content.
- 2) If fill material is too wet, provide and operate approved mechanical means to assist the drying of the fill until suitable for compaction.
- 3) If fill material is too dry, provide and operate approved mechanical means to add and uniformly mix moisture into the fill layers.

5. BACKFILLING

A. Backfill carefully to restore the ground surface to its original condition. Dispose of surplus material.

B. Compact backfill underlying spillways, embankments and structures to 95 percent of the maximum dry density.

C. Backfill for Pipe

- 1) Initial: Place initial backfill material carefully around the pipe above bedding in uniform 6-inch layers to a depth of at least 18-inches above the pipe bell. Compact each layer thoroughly with suitable hand tools. Do not disturb or damage the pipe. Backfill on both sides of the pipe simultaneously to prevent unbalanced side pressures. Initial backfill material is select or common earth material which is clean and free of rock, organics, and other unsuitable material as shown on the plans. If materials excavated from the trench are not suitable for use as initial backfill material, obtain suitable materials elsewhere.
- 2) Final: After initial backfill material has been placed and compacted, backfill with general excavated material. Place backfill material in uniform layers and thoroughly compact with heavy power tamping tools of the "Whacker" type.
- 3) Settlement: If trenches settle, re-fill and grade the surface to conform to the adjacent surfaces.
- 4) Additional Material
  - a) Where final grades above the pre-existing grades are required to maintain minimum cover, additional fill material will be shown on the Drawings.
  - b) Utilize excess material excavated from the trench if the material is suitable. No additional payment will be made for additional material.
  - c) If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide suitable additional fill material.

D. Backfilling Around Structures

1) General

- a) Remove debris from excavations before backfilling.

- b) Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
  - c) Do not backfill against walls until all permanent construction is in place to furnish lateral support on both top and bottom of wall.
  - d) Backfilling against walls is to take place after all the concrete in the affected members has attained the specified strengths.
- 2) Materials: Backfill material placed against built structures shall be select fill material. No broken concrete, bricks or similar materials will be permitted as backfill.

**6. GRADING**

- A. General: Perform all rough and finish grading required to attain the elevations indicated on the Drawings. Perform finish grading to an accuracy of  $\pm 0.10$  foot.
- B. Treatment After Completion of Grading
  - 1) After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.
  - 2) Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

**7. SETTLEMENT**

- A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the Work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Owner.

**8. CLEANING**

Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer.

END OF SECTION 02200

SECTION 02410 – FOUNDATION, TOE, CHIMNEY AND SPILLWAY DRAINS

PART 1 – GENERAL

1. SCOPE

- A. The work of this Section shall consist of installation of foundation drains and toe drains at the toe of the existing dam, a chimney drain on the back face of the existing dam and spillway underdrains under the new concrete spillway.
- B. The Contractor shall provide all services, labor, materials, and equipment required for all work and related operations necessary for the Contractor to complete work as shown on the Drawings and/or specified.

2. EXISTING ELEVATIONS AND LOCATIONS

The elevations and locations shown on the Drawings as existing are taken from the best existing data, and are intended to give reasonable accurate information regarding existing elevations and locations. The final depth and location of each foundation drain, toe drain, chimney drain and spillway underdrain will be determined by the Geotechnical Engineer on the basis of site conditions exposed at the approved foundation level and final configuration of the downstream slope of the existing dam.

3. SUBMITTALS

At least 14 days prior to installation of the foundation drain, toe drain, chimney drain and spillway underdrain, submit the installation procedure, method of excavation, a 50 pound representative sample of gravel, sand, or crushed stone; and manufacture's literature for filter fabric, perforated PVC pipe, and solid PVC pipe.

4. STORAGE AND PROTECTION

Store PVC pipe materials off ground and protected from sunlight.

PART 2 – PRODUCTS

1. MATERIALS

- A. Fine Filter: To meet the minimum standards for ASTM C-33 sand.
- B. Coarse Filter: To meet the Georgia Department of Transportation gradation for washed No. 57 and No. 89 stone.
- C. Perforated PVC Pipe: 6-inch diameter Schedule 40 PVC, perforated plastic pipe, complete with fittings and couplings as required, meeting ASTM D 1785. Perforations shall be in 4 rows at no greater than 6-inch spacings. The bottom two rows of holes shall be spaced greater than or equal to 60 degrees apart. The top two rows of holes shall be spaced less than or equal to 166 degrees apart. The perforations shall be 1/4-inch diameter.
- D. Solid PVC Pipe
  - 1) Pipe and fittings, 4 to 15-Inches in Diameter: Pipe and fittings shall meet the following requirements:

- a) Pipe and fittings shall be manufactured in accordance with ASTM D 2672. The minimum wall thickness shall be that for Schedule 40.
  - 2) Fittings: Fittings for pipe 8-inches and less in diameter shall be one-piece with no solvent welded joints. Fittings for pipe 10-inches and larger in diameter may be fabricated using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.
  - 3) Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. The joint system shall be subject to the approval of the Engineer and shall be identical for pipe and fittings.
- E. Ductile Iron Pipe
- 1) Ductile iron pipe shall be utilized where shown on the Drawings.
  - 2) Ductile iron pipe shall be manufactured in accordance with AWWA (American Water Works Association) C151 (2006). All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipes shall be Special Thickness Class 51.
  - 3) Fittings and Accessories
    - a). Fittings shall be ductile iron and shall conform to AWWA C110 (2006)/ANSI (American National Standards Institute) A21.10 (2006) or AWWA C153 (2006)/ANSI A21.53 (2006) with a minimum rated working pressure of 250 psi.
  - 4) Joints for Ductile Iron Pipe and Fittings
    - a). General
      - i. Joints for ductile iron pipe and fittings shall be mechanical joint or push-on joint as shown on the Drawings or specified herein.
      - ii. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints.
      - iii. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
      - iv. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI (American National Standards Institute) B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
    - b). Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111 (2006)/ANSI A21.11 (2006). Details of the joint design shall be in accordance with the manufacturer's standard practices such as ACIPCO (American Cast Iron Pipe Company) "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints (2006).

F. Sand: Sand shall be natural and meet the requirements of ASTM C33 and conform to the following gradation:

Sieve Size	Percent Passing
3/8"	100
#4	95 – 100
#8	80 – 100
#16	50 – 85
#30	25 – 60
#50	10 – 30
#100	2 - 10

G. Animal Guards: Animal guards shall be provided on all exposed outlet pipes as manufactured by Agri-Drain.

H. Filter Fabric: Filter fabric shall be 8oz / SY, needle punched, non-woven filtration/drainage fabric meeting the requirements of Thrace-Linq Industries 225EX, Carthage Mills FX-80HS, Mirafi 180N or Amoco 4553.

### PART 3 – EXECUTION

#### 1. INSTALLATION

A. Toe Drain: The natural sand filter shall be constructed on clean, dry subgrade to the limits shown on the Drawings or as directed by the Geotechnical Engineer. The contractor shall use a flat bladed excavator bucket to excavate the toe drain. The Geotechnical Engineer shall evaluate and approve the subgrade prior to placement of the sand. The foundation drain shall consist of ASTM C-33 sand. Adequate quantities of sand will be stockpiled on site to allow placement as excavation is in progress to prevent sloughing of trench. If the toe drain trench exceeds 5 feet, based upon final undercut grades, the drain should be constructed in 5 feet (maximum) lifts. Sand lifts should not exceed 2 feet and be compacted with a small vibratory sled. Excavation depths should not exceed 5 feet. Filter fabric for the toe drain shall be embed a minimum of 24 inches into the sand by draping the filter fabric on both sides of the trench in an open bottom configuration.

The filter fabric and gravel filter shall be constructed above the sand on clean, dry sand layer to the limits shown on the Drawings or as directed by the Geotechnical Engineer. The Geotechnical Engineer shall evaluate and approve the sand layer prior to placement of the filter fabric or gravel filter. Filter fabric for toe drain shall be placed in intimate contact with a relatively undisturbed soil interface to prevent clogging. No fabric shall be placed in a wet or muddy excavation. Filter fabric shall be overlapped a minimum of 24 inches.

No. 89 stone of the thickness shown on the Drawings shall be placed in one lift, or as directed by the Geotechnical Engineer, directly on the sand below. The crushed stone for the toe drain shall be placed in approximately 4-6 inch layer prior to placement of perforated PVC pipe. The remainder of the crushed stone or gravel shall be placed so as to not disturb perforated PVC pipe.

Perforated PVC pipe shall be placed at locations shown on the Drawings with the perforations turned down. Solid wall PVC pipe shall be placed to within 10 feet of headwalls. The last 10 feet

should be ductile iron pipe. Solid wall PVC pipe shall be laid at a grade sufficient to ensure positive drainage away from the drain.

- B. Foundation Drain: The natural sand filter shall be constructed on clean, dry subgrade to the limits shown on the Drawings or as directed by the Geotechnical Engineer. The Geotechnical Engineer shall evaluate and approve the subgrade prior to placement of the sand. The foundation drain shall consist of ASTM C-33 sand. Adequate quantities of sand will be stockpiled on site to allow placement as embankment fill operations are in progress, to support the downstream edge of the foundation drain. Filter fabric for the foundation drain shall be placed on clean dry subgrade at locations shown on the Drawings prior to sand and crushed stone placement. A 4 to 6 inch layer of crushed stone shall be placed prior to the placement of 6 inch perforated PVC pipe. The remainder of the crushed stone shall be placed so as to not disturb perforated PVC pipe. Perforated PVC pipe shall be placed at locations shown on the Drawings with the perforations turned down. Solid wall PVC pipe shall be placed to within 10 feet of headwalls. The last 10 feet of solid wall pipe at headwalls shall be ductile iron pipe.
- C. Chimney Drain: The natural sand filter shall be constructed on clean, dry subgrade to the limits shown on the Drawings or as directed by the Geotechnical Engineer. The Geotechnical Engineer shall evaluate and approve the subgrade prior to placement of the sand. The chimney drain shall consist of natural ASTM C-33 sand. Adequate quantities of sand will be stockpiled on site to allow placement as embankment fill operations are in progress. The chimney drain can be placed in lifts not to exceed 2 feet in conjunction with placement of the downstream fill material. The chimney drain thickness shall be measured normal to the embankment slope. Each lift should be compacted using a vibratory sled tamp.
- D. Spillway Underdrains: The spillway underdrains shall be constructed on clean, dry subgrade to the limits shown on the Drawings, or as directed by the Geotechnical Engineer. The Geotechnical Engineer shall evaluate and approve the subgrade prior to placement of the underdrains. The spillway underdrains shall consist of a 50 – 50 blend by volume of natural ASTM C-33 sand and #89 stone placed on the prepared subgrade. The 50- 50 blend of natural ASTM C-33 sand and #89 stone shall be mixed thoroughly prior to placement on the subgrade. Once the 50- 50 blend of natural ASTM C-33 sand and #89 stone has been reviewed and approved by the Geotechnical Engineer, a layer of #57 stone shall be placed to finish grade of the spillway. Perforated PVC pipe shall be placed at locations shown on the Drawings with the perforations turned down. Care shall be taken when placing #57 stone around the perforated pipe to not disturb the perforated PVC pipe. Solid wall PVC pipe shall be placed to within 10 feet of walls. The last 10 feet should be ductile iron pipe. Solid wall PVC pipe shall be laid at a grade sufficient to ensure positive drainage away from the drain.

## 2. FINAL ACCEPTANCE

The Contractor shall be responsible for foundation drain, toe drains, chimney drains and spillway underdrains until Final Acceptance. Care shall be exercised to avoid clogging the drain during the progress of the work, and should any drain become clogged or obstructed from any cause before Final Acceptance, it shall be cleaned out or removed and replaced in a manner approved by the Geotechnical Engineer at no additional cost to the Owner. The Contractor shall replace, at no additional cost to the Owner, any portion of a drain which, in the opinion of the Geotechnical Engineer, has become displaced or damaged due to carelessness or negligence.

END OF SECTION 02410

**SECTION 02725 – SIPHON SYSTEM****PART 1 - GENERAL****1. SCOPE**

The work covered in this Section shall include the furnishing and laying of PVC siphon pipe system with fittings as called for on the Drawings and specified, including trench excavation and backfill.

**2. QUALITY ASSURANCE**

- A. Each length of pipe, each fitting and special fitting shall be inspected by an independent commercial testing laboratory prior to delivery. Each joint of pipe and each special shall be stenciled or otherwise clearly and legibly marked with the laboratory's mark of acceptance.
- B. Each pipe shall be clearly marked as required by the governing ASTM standard specifications (2006) to show its class or gauge, date of manufacture, and the name or trademark of the manufacturer.
- C. Any pipe or specials which have been broken, cracked, or otherwise damaged before or after delivery or which have failed to meet the required tests shall be removed from the site and shall not be used in new work.

**PART 2 - PRODUCTS****1. PIPE**

- A. Pipe and special fittings shall be furnished in sizes, types and classes at the locations shown on the Drawings, and/or specified herein.
- B. All pipe and special fittings shall be of all new materials which have not been previously used.

**2. POLYVINYL CHLORIDE (PVC) SIPHON PIPE**

- A. Pipe and Fittings, 4 to 15-Inches in Diameter: Pipe and fittings shall meet one of the following requirements:
  - 1). Pipe and fittings shall be manufactured in accordance with ASTM D 3034 (2006). The minimum wall thickness shall be that which will provide an SDR of 21. The pipe shall also have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412 (2006).
  - 2). Pipe and fittings shall be manufactured in accordance with ASTM F 789 (2006). The minimum wall thickness shall conform to T-3 as defined in ASTM F 789 (2006). The pipe shall also have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412 (2006).
- B. Fittings: Fittings for pipe 8-inches and less in diameter shall be one-piece with no solvent welded joints. Fittings for pipe 10-inches and larger in diameter may be fabricated using solvent welding.



No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

- C. Joints: Joints between pipe and fittings shall be solvent cement welded. Joints for pipe shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3212 (2006); gaskets shall meet the requirements of ASTM F 477 (2006). The joint systems shall be subject to the approval of the Engineer and shall be identical for pipe and fittings.
- D. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

### 3. DUCTILE IRON PIPE

- A. Ductile iron pipe shall be utilized where shown on the Drawings.
- B. Ductile iron pipe shall be manufactured in accordance with AWWA (American Water Works Association) C151 (2006). All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipes shall be Special Thickness Class 51.
- C. Fittings and Accessories
  - 1). Fittings shall be ductile iron and shall conform to AWWA C110 (2006)/ANSI (American National Standards Institute) A21.10 (2006) or AWWA C153 (2006)/ANSI A21.53 (2006) with a minimum rated working pressure of 250 psi.
- D. Joints for Ductile Iron Pipe and Fittings
  - 1). General
    - a. Joints for ductile iron pipe and fittings shall be mechanical joint or push-on joint as shown on the Drawings or specified herein.
    - b. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints.
    - c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
    - d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI (American National Standards Institute) B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
  - 2). Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111 (2006) / ANSI A21.11 (2006). Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO (American Cast Iron Pipe Company) "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints (2006).

### 4. GATE VALVE

- A. AWWA, Cast-Iron Gate Valves:

- 1) Available Manufacturers: Subject to compliance with DeKalb County Water Standards, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3) Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American AVK Co.; Valves & Fittings Div.
  - b. American Cast Iron Pipe Co.; American Flow Control Div.
  - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
  - d. Crane Co.; Crane Valve Group; Stockham Div.
  - e. East Jordan Iron Works, Inc.
  - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
  - g. McWane, Inc.; Kennedy Valve Div.
  - h. McWane, Inc.; M & H Valve Company Div.
  - i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
  - j. Mueller Co.; Water Products Div.
  - k. NIBCO INC.
  - l. U.S. Pipe and Foundry Company.
- 4) Nonrising-Stem, Metal-Seated Gate Valves:
  - a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gaterings, bronze stem, and stem nut.
    - 1) Standard: AWWA C500.
    - 2) Minimum Pressure Rating: 200 psig, 400 psig test.
    - 3) End Connections: Mechanical joint.
    - 4) Interior Coating: Complying with AWWA C550.
    - 5) IBBM-NRS-MJ with accessories.
    - 6) 2 inch square operating nut, close right "O" ring packing.

## 5. VALVE BOX

- A. Valve Boxes: Comply with DeKalb County Water Standards for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 1/4 inches in diameter. Extension is not to be less than 24 inches, nor greater than 38 inches, minimum weight of 74 lbs.
  - 1) Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
  - 2) Valve Marker: Reinforced concrete with marking plate.
  - 3) Valve Box Pad: Prefabricated concrete.

## 6. ALUMINUM INTAKE SCREEN

- A. Aluminum Intake Screen shall be constructed of a wire mesh material of a minimum thickness of 0.125 inches.

- B. Screen shall have a 12 inch adapter manufactured specifically for attachment to the 12 PVC siphon pipe.

7. CONCRETE

- A. Concrete blocking, encasement and headwalls shall have a compressive strength of not less than 4,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. (2006) Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60(2006).
- B. Provide a concrete mix design for job mixed concrete for the Engineer's approval.

8. BEDDING

- A. Bedding for PVC siphon pipe shall be Class "C" as described below to fit the depth of trench, type and size of pipe, width of trench and bearing value of subgrade.
- B. Class "C" Bedding shall consist of suitable backfill material as approved by the Geotechnical Engineer. The backfill material shall be placed in 6-inch lifts and compacted to 95 percent of the maximum dry density. Placement of this material shall be done carefully. Material shall be thoroughly compacted by tamping.
- C. If Contractor increases width of trench for the Contractor's convenience or due to collapse of trench walls, a higher class of bedding may be required. The increased cost of the same shall be borne by the Contractor. If the bearing value of the subgrade is determined by the Geotechnical Engineer to be inadequate for a particular class of bedding, the Contractor shall substitute a higher class of bedding as directed by the Geotechnical Engineer.

PART 3 - EXECUTION

1. EXCAVATION

Excavation shall be performed in accordance with the requirements of Sections 02200 of these Specifications.

2. LAYING AND JOINTING PIPE AND ACCESSORIES

- A. Lay all pipe and fittings to accurately conform to the lines and grades as shown on the Drawings.
- B. Pipe Installation
  - 1). Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe and fittings shall be lowered carefully into the trench. Under no circumstances shall sewer materials be dropped or dumped into the trench.
  - 2). All pipe, fittings, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be removed and replaced.
  - 3). All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.

- 4) Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
- 5) As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
- 6) Lay pipe with the bells facing uphill.
- 7) Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.

**C. Alignment and Gradient**

- 1). Lay pipe straight in alignment and gradient as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
- 2). Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

**D. Expediting of Work:** Excavate, lay the pipe, construct concrete blocking or casing and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, or restrained joint.

**E. Joint Assembly**

- 1). Push-on joints shall be assembled in accordance with the manufacturer's recommendations.
- 2). Each joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

**F. Cutting Pipe**

- 1). Cut PVC pipe using a suitable saw.
- 2). Remove all burrs and smooth the end before jointing.
- 3). The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, accessories and closure pieces in the correct location.

**G. Gate Valve and Box**

- 1) Gate Valve shall be attached to PVC Pipe with mechanical fittings in accordance with the manufacturer's recommendations.
- 2) Gate Valve shall be adequately supported within the valve box.
- 3) The top of the Valve Box shall be positioned to be at finish grade.

**3. CONCRETE BLOCK, ENCASEMENT AND HEADWALLS**

A. Concrete forms shall be placed to the line and grades shown of the Drawings. Forms shall be supported and secured to prevent movement during concrete placement.

B. Pipe shall be anchored to prevent flotation during concrete placement.

4. FILLING AROUND AND OVER SIPHON PIPE

A. After the pipe is laid to line and grade, the backfill material shall be compacted by means of a vibrator or mechanical tampers. Tamping by hand will not be permitted. The remaining portion of the trench shall be filled in 6-inch lifts with suitable select/common backfill material. Each lift shall be compacted with mechanical tampers.

B. The bedding for the pipe must be laid in a dry trench, and any water encountered in ditches, springs, etc. shall be considered a necessary part of construction and shall be handled by pumping, ditching or any other method.

5. INSPECTION AND TESTING

A. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the pipes by means of rods, swabs, or other instruments.

B. Exfiltration Tests: Choose one of the following test methods:

1). Hydrostatic Test

a. Test pipe with a minimum of 10 feet hydrostatic pressure, measured at the highest point of the pipe.

b. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation.

c. During the test period, which shall extend over a period of two hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed 100 GPD/IN-MILE/DIA.

2). Low-Pressure Air Test

a. Prior to air testing, the contractor shall obtain permission from the Georgia Safe Dams Program to utilize air test. The section of siphon pipe shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the siphon pipe shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi or greater drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the

line. Minimum test time for various pipe sizes, in accordance with ASTM C 828 (2006) is as follows:

Nominal Pipe Size	T (Time Min/100) Feet
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1

- b. Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotometer as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of  $\pm$  two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.
- c. The Contractor shall keep records of all tests made. Copy of such records will be given to the Engineer or the Owner. Such records shall show date, line number, operator, and test results.
- d. The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the siphon line.

END OF SECTION

**SECTION 02774 – STORM DRAINAGE SYSTEM**

**PART 1 - GENERAL**

**1. SCOPE**

The storm drainage system includes, but is not limited to, construction of storm sewers, drainage structures, drainage appurtenances, ditching, backfilling, shoring and dewatering of trenches for storm sewers as required for safe and workmanlike construction.

**2. QUALITY ASSURANCE**

- A. Storm drain pipe may be inspected at the job site by the Contractor prior to incorporation into new works.
- B. The Contractor shall notify the Engineer for inspection of pipe and drainage structure installation prior to backfilling trenches.

**3. JOB CONDITIONS**

- A. Coordination and Scheduling of the Work: Construction of new drainage systems shall proceed as early in the construction program as possible. Maintain adequate drainage of the Project area at all times. Prevent flooding of adjacent roads and private properties.
- B. Temporary Drainage: Wherever possible, new sewers and inlets to serve the various drainage areas shall be constructed and placed in service. Where this is not possible, temporary drainage facilities shall be provided as required. These may include temporary ditches, slope drains, temporary connections into completed storm drains, or such other means as the circumstances may require.

**PART 2 - PRODUCTS**

**1. BEDDING MATERIAL**

- A. Class B concrete bedding as shown on the Drawings.
- B. Select earth material where shown on Drawings and as approved by the Geotechnical Engineer.

**2. STORM DRAIN PIPE MATERIALS**

- A. Storm drain pipe is to be of the size and material as shown on the Drawings.
- B. Reinforced concrete pipe conforming to ASTM C 76 (2006). All pipe shall be Class III unless shown otherwise on the Drawings. Minimum wall thickness design shall correspond to Wall C. Joints shall be bell and spigot joints and shall be O-ring rubber gasket joints conforming ASTM C 443 (2006)

3. APPURTENANCE MATERIAL

- A. Brick
  - 1). Clay or Shale Brick: Comply with ASTM C 32 (2006) for sewer brick and manhole brick, grade as selected.
  - 2). Concrete Masonry Units: Comply with ASTM C 139 (2006).
- B. Mortar: Comply with ASTM C 270 (2006), Type M, for pipe joints and manhole and inlet brickwork.
- C. Concrete for storm drainage construction shall be in accordance with the requirements of Section 03300 of these Specifications. Strength shall be 4,000 psi at age 28 days.
- D. Reinforcement: Comply with ASTM A 615 (2006).
- E. Castings: Comply with ASTM A 48 (2006), grey cast iron.
- F. If the Contractor desires to substitute precast drainage structures for structure detailed on the Drawings, the Contractor shall submit design drawings to the Engineer for consideration. If precast structures are acceptable by the Engineer, shop drawings for construction will be required and shall conform to these Specifications.

PART 3 - EXECUTION

1. GENERAL

- A. All pipe will be laid in an open trench of dimensions as given below. No projecting conditions will be allowed.
- B. Lengths of storm drain pipe shown on the Drawings are approximate distances center to center of structures. Slopes are approximate. The Contractor shall install pipe based on actual field measurements after locating drainage structures in accordance with Drawing requirements.
- C. Particular care shall be exercised in establishing the relationship of storm drain pipe, drainage structure bases and final drainage top conditions. Drainage structure tops are required to be located in specific position and orientation. Subsurface construction is to be located to allow drainage structure construction as detailed on the Drawings without modification. In case of misalignment of drainage structure tops and bases, the Contractor will be required to correct the construction as directed by the Engineer.

2. EXCAVATION

- A. Excavation shall be by open cut. The top portion of trenches should be excavated as required by the Drawings. The lower portion of the trench to a height of one foot above the top of the pipe shall not exceed the dimensions shown on the Drawings.
- B. The bottom of trenches shall be carefully shaped to conform to and support the lower one-fourth of the periphery of the pipe barrel. Where rock is encountered, it shall be removed to a depth of 1 foot below the pipe and replaced with an approved soil material.



- C. Where wet or otherwise unsuitable material is encountered at or below the invert elevation during excavation, it shall be removed to a point 12-inches below the pipe invert and replaced with selected fill.

3. **BEDDING**

Pipe shall be supported on suitable concrete or brick supports to allow the placement of concrete cradle underneath and beside the pipe. Pipe shall be adequately anchored to prevent floatation.

4. **PIPE INSTALLATION**

Pipe joints shall be laid with the spigot end downstream and joints shall be snug such that the rubber gasket fits in the adjoining pipe groove. All pipe joints and manhole structure joints below elevation 889 feet shall be double wrapped with a minimum of 2 feet wide strip of approved filter fabric prior to casting concrete or placement of backfill. Fabric shall be firmly attached to the pipes and manhole structures using methods approved by the Engineer.

4. **BACKFILLING**

Backfilling shall be done with select material, in accordance with Section 02200 Earthwork. Backfill shall be carefully placed and tamped around and over the pipe to avoid displacement of the pipe or damage to the joints. All backfill shall be placed in 6-inch lifts and shall meet material and compaction requirements of Section 02200 of these Specifications.

5. **APPURTENANCES**

- A. All drainage structures are to be constructed as shown on the Drawings and in accordance with generally accepted construction practice. Refer to Drawings for location and size.
- B. The Contractor shall furnish and install drainage structures as shown in detail on the Drawings.
- C. Structure bottoms shall have shaped inverts.
- D. All mortar joints shall be filled full. Joints shall be struck flush inside and out.
- E. All pipe, where cut at the face of the structure wall, shall be cut and ground smooth with the face of the wall.
- F. All joints around pipe and structure walls at the face of the wall shall be packed full with mortar.
- G. The bottom of drainage structures shall be clean of all debris and walls shall be wiped clean of mortar as the work progresses.
- H. Catch basin tops shall be cast-in-place concrete and constructed to line and grade and shall slope continuous with gutter.
- I. All structures over four feet deep shall have cast iron steps installed 15-inches on center in a vertical direction. Cast iron steps and manhole rings and covers shall meet ASTM A 48 Specification.

5. **CLEANING**

Stormsewers and structures shall be left clean and free from mud or debris of any kind. When looked through, each line between structures shall show a full circle of light. Otherwise, the Contractor shall be required to remove and replace the defective portion of the work at Contractor's own expense.

END OF SECTION

SECTION 02831 – CHAIN LINK FENCE

PART 1 - GENERAL

1. SCOPE

- A. The Contractor shall furnish all labor, materials, equipment and miscellaneous items as necessary for the installation of a complete chain link fence system. Fencing shall be installed in the location as shown on the Drawings in complete conformity with the manufacturer's written recommendations and as specified herein.
- B. Security fencing for the Contractor is at Contractor's option and is not included as part of the work specified.

2. SUBMITTALS

Product data shall be submitted for review.

3. DELIVERY AND HANDLING

- A. Deliver materials with the manufacturer's tags and labels intact.
- B. Handle and store materials in such a manner that will avoid damage.

4. QUALITY ASSURANCE

- A. Standards of manufacturer shall comply with the standards of the Chain Link Manufacturers Institute and these Specifications.
- B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.

PART 2 - PRODUCTS

1. GENERAL

Overall height for new fencing shall be four feet. Posts shall be set at no more than 10 foot centers, a full one foot deep.

2. MATERIALS AND CONSTRUCTION

- A. Fence Mesh: 9 gauge wire, woven to 2-inch squares, galvanized after weaving, four foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.
- B. Line Post: 2-1/2-inch O.D. Galvanized Pipe (3.65 #/ft.).
- C. Corner Post: 3-inch O.D. Galvanized Pipe (5.79 #/ft.).
- D. Top Rail: 1-5/8-inch O.D. Galvanized Pipe (2.27 #/ft.) with extra long pressed steel sleeves.

Part 3 Execution

3. INSTALLATION

- A. Fence installation shall not be started before the final grading is completed, with finish grade elevations established, unless otherwise permitted.
- B. Drill holes of diameters and spacings shown, for post installation in concrete walls.
  - 1). If not shown on the Drawings, drill holes to the minimum diameters as recommended by fence manufacturer.
  - 2). Unless otherwise indicated, drill hole depths approximately 3-inches lower than the post bottom, with bottom of posts set not less than 12-inches below the subgrade when in concrete walls.
- C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes.
  - 1). Center and align posts in holes 3-inches above bottom.
  - 2). Grout-in posts set into sleeved holes, concrete constructions or rock excavations with non-shrink Portland cement grout or other acceptable grouting material.
- D. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gauge galvanized wire or by securing the wire to the fabric.
- G. Fabric: Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.
- H. Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.
- I. Stretcher Bars: Thread through or clamp to fabric 4-inches on center and secure to posts with metal bands spaced 15-inches on center.
- J. Tie Wires: Use U-shaped wire appropriate for the diameter of pipe. Attach pipe and fabric firmly with tie wire ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
- K. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

4. CLEANING

**SECTION 02831 – CHAIN LINK FENCE**

**Glen Emerald Dam Rehabilitation**

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Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from chain link fence system installation.

END OF SECTION

SECTION 02933 – SEEDING

PART 1 - GENERAL

1. SCOPE

- A. The work covered by this Section consists of furnishing all labor, equipment and material required to place topsoil, seed, commercial fertilizer, agricultural limestone and mulch material, including seedbed preparation, harrowing, compacting and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures or trails; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.
- B. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations when grading is complete, but permanent grassing season is not appropriate.

PART 2 - PRODUCTS

1. ACCEPTABLE MANUFACTURERS

- A. All materials shall conform to the requirements and standards of this Section.
- B. Wood-cellulose fiber mulch shall be manufactured by Weyerhaeuser Company or Conway Corporation.

2. TOPSOIL

- A. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 4-inches of topsoil over all graded earthen areas and over any other areas to be seeded. No additional compensation will be allowed for spreading of topsoil.
- B. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.
- C. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam or a combination thereof. The pH shall range from 5.5 to 7.0. Topsoil shall contain not less than five percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to 65 degrees C.

3. SEED

- A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
- B. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage.
- C. Seed shall bear the growers analysis testing to 98 percent for purity and 90 percent for germination.
- D. Species, rate of seeding and other requirements shall be as follows:

Species	Broadcast Rate	Planting Dates
Common Bermuda-Hulled	10 lbs/acre	March – June
Common Bermuda - Unhulled with Temporary Cover	10 lbs/acre	October-February
Tall Fescue	50 lbs/acre	August-October

4. FERTILIZER AND LIMING MATERIALS

- A. Fertilizer and liming materials shall comply with applicable state, local and federal laws concerned with their production and use.
- B. Commercial fertilizer shall be a ready mixed material equivalent to the grade or grades specified in the Seeding Schedule shown on the Drawings. Container bags shall have the name and address of the manufacturer, the brand name, net weight and chemical composition.
- C. Agricultural limestone shall be a pulverized dolamitic limestone having a calcium carbonate content of not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material will pass a No. 10 mesh screen and 50 percent will pass a No. 40 mesh screen.
- D. Type of grass species, application, type of fertilizer and rate of fertilizer shall be as follows:

Species	Year	N - P – K	Broadcast Rate
Common Bermuda-Hulled	First	6-12-12	1500 lbs/acre
Common Bermuda – Unhulled with Temporary Cover	First	6-12-12	1500 lbs/acre
Tall Fescue	First	6-12-12	1500 lbs/acre

5. MULCH MATERIAL

- A. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
- B. Mulch shall be composed of wood cellulose fiber, straw or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.
- C. Straw mulch shall be partially decomposed stalks of wheat, rye, oats or other approved grain crops.

- D. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum or other approved standing field crops.

6. MULCH BINDER

- A. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life.
- B. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977 (2006). Cutback asphalt binder shall be Grade RC 70 or RC 250 (2006).

7. INOCULANTS FOR LEGUMES

All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

8. WATER

Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

PART 3 - EXECUTION

1. SECURING AND PLACING TOPSOIL

- A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods.
- B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.
- D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil.
- E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed.
- F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

2. SEEDBED PREPARATION

- A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line from unsightly variation, bumps, ridges and depressions and all detrimental material, roots and stones larger than 3-inches in any dimension shall be removed from the soil.



- B. Not earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 4-inches with a weighted disc, tiller, pulvimixer or other equipment, until the surface is smooth.
- C. If the prepared surface becomes eroded as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.
- D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition.

3. **FERTILIZATION AND LIMING**

- A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown on the Drawings.
- B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1-inch.
- C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.
- D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates shown in the Seeding Schedule shown on the Drawings. The specified rate of application of limestone may be reduced if pH tests indicate this to be desirable. It is the responsibility of the Contractor to obtain such tests and submit the results to the Engineer for adjustment in rates.
- E. It is the responsibility of the Contractor to make one application of a maintenance fertilizer according to the recommendations listed in the Seeding Schedule shown on the Drawings.

4. **SEEDING**

- A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the dates shown on the Drawings unless otherwise approved by the Engineer. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.
- B. Seed shall be uniformly sown by any approved mechanical method suitable for the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.
- C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8-inch by a cultipacker or suitable roller.
- D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible

nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

5. MULCHING

- A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied evenly so as to permit sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture. Approximately 45 percent of the ground shall be visible through the mulch blanket.
- B. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:
  - 1. Wood Cellulose Fiber: 1,400 pounds/acre.
  - 2. Straw: 4,000 pounds/acre.
  - 3. Stalks: 4,000 pounds/acre.
  - 4. These rates may be adjusted at the discretion of the Engineer at no additional cost to the Owner, depending on the texture and condition of the mulch material and the characteristics of the seeded area.
- C. Mulch on slopes greater than 3 to 1 ratio shall be held in place by the use of an approved mulch binder. Binder shall be thoroughly mixed and applied with the mulch. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of five gallons per 1,000 square feet as required to hold the mulch in place.
- D. The Contractor shall cover structures, poles, fences and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
- E. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates.

6. WATERING

- A. The Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain an adequate water content in the soil.
- B. Watering shall be accomplished by hoses, tank truck or sprinklers in such a way to prevent erosion, excessive runoff and over-watered spots.

7. MAINTENANCE

- A. Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris and excess material and the premises shall be left in a neat and orderly condition. Erosion control measures shall remain in place until a suitable stand of grass is established.
- B. The Contractor shall maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any regrading, refertilizing, reliming, reseeding or remulching shall be done at Contractor's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gulleys,

washouts or other causes shall be repaired by filling with topsoil; compacting and repeating the seeding work at Contractor's expense. Contractor shall warrant seeded areas for a period of 1 year after final acceptance.

END OF SECTION

## SECTION 03100 – CONCRETE REINFORCEMENT

## PART 1 - GENERAL

## 1. SCOPE

Furnish and install the concrete reinforcement as shown and indicated on the Drawings and specified in this Section, complete in place.

## 2. SUBMITTALS

## A. Shop Drawings

- 1). All shop drawings shall be of the same size. Reproductions of the Drawings for use as shop drawings is not permitted. Shop drawings shall include placing drawings, bending details, and bar lists with bar marks. All details and notes appearing on the Drawings, giving information for the placing of reinforcing steel, shall be shown on the shop drawings. Shop drawings will not be reviewed without such information.
- 2). Wall reinforcing shall be shown in elevation.
- 3). Show location and size of all penetrations greater than 6-inches in diameter or across the opening with the corresponding added reinforcing around the penetrations.
- 4). Submittals shall be complete for each structure. Partial submittals are not permitted and will be returned unmarked. Each submittal shall clearly indicate the structure and Drawing numbers that the work is for. The identifying numbers of the shop drawings for each structure shall be in numerical order.
- 5). Location and arrangement of accessories shall be clearly indicated.
- 6). All shop drawings shall be checked by the fabricator and Contractor before being submitted to the Engineer.

## B. Mill tests of reinforcing steel shall be submitted prior to use for each 15 tons or less shipped to the site. Tests shall be conducted in conformance with ASTM A 615 (2006), and methods prescribed therein.

- 1). Cost of mill tests shall be borne by Contractor.
- 2). Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the Engineer.
- 3). Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the Engineer may require the Contractor to furnish, at no additional cost to the Owner, test results from an independent testing laboratory acceptable to the Engineer on mill samples or delivered steel reinforcement.

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**PART 2 - PRODUCTS****1. REINFORCING BARS**

- A. Bar reinforcement shall be deformed-type bars conforming to ASTM A 615 (2006). Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60, yield strength 60,000 psi minimum.
- B. Reinforcing steel shall be shop fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 (2006) and ACI 318 (2006).
- C. Bars shall be bent cold. Bars shall be pre-fabricated to detail and delivered on the job plainly tagged and ready to set.

**2. ACCESSORIES**

- A. All chairs and bolsters shall have plastic-covered or galvanized steel legs.
- B. For slabs on grade, all reinforcing shall be supported on chairs and/or bolsters as required to properly position the bars. The chairs and/or bolsters shall be supported on precast concrete pads bearing on the subgrade. The concrete pads shall be at least 6 x 6-inches and be no more than 1-1/2-inches thick. Pads shall be cast from Class "A" concrete or from mortar made up of one part cement and two parts sand, with tie wires embedded.

**PART 3 - EXECUTION****1. STORAGE OF MATERIALS**

Reinforcing steel delivered to the site, not immediately placed in forms, shall be protected from mud and excessive rust-producing conditions by storing in a well-drained area and supported off the ground. All reinforcing shall be properly tagged with their bar marks and location in the structure clearly noted.

**2. TOLERANCES**

- A. Allowable tolerances for fabricating steel reinforcement shall be as follows:

Item	Maximum Tolerance, Inches	
	+1	-1
Sheared Length of Bars	+1	-1
Outside Dimensions of Stirrups, Ties and Spirals	+1/2	-1/2

- B. Allowable tolerances for placing steel reinforcement shall be as follows:

Item	Maximum Tolerance, Inches	
Concrete Cover from Outside of Bar to Finished Surface	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Beams	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Plane of Reinforcement in Slabs and Walls	+1	-1
Spacing of Stirrups, Ties and Spirals Along Longitudinal Axis of Member	+1/2	-1/4
Height of Bottom Bars in Slabs and Beams	+1/4	-1/4
Height of Top Bars in Slabs and Beams	+1/4	-1/4
Depth 8" and Less	+1/2	-1/2
Depth 9" - 24"	+1	-1
Depths 25" & Greater		

3. FIELD FABRICATION

Field fabrication of reinforcing steel will not be permitted without the approval of the Engineer.

4. PLACEMENT AND ANCHORAGE

- A. Space metal chairs, bolsters, spacers and hangers in accordance with ACI 315 (2006).
- B. Reinforcement, at the time concrete is placed, shall be free from rust scale or other coatings that will destroy or reduce bond. Bars with kinks or bends not shown on the plans shall not be used.
- C. Reinforcement shall be accurately placed in accordance with the Drawings and shall be adequately secured in position with not less than 16 gauge annealed wire or suitable clips at intersections. Reinforcement shall be held securely at the required distance from the forms. Nails shall not be driven into outside forms to support reinforcement.

5. CONCRETE COVER

- A. Unless otherwise shown on the Drawings, the following concrete cover shall be provided for reinforcement:

Bottom and Sides of Footing	3"
Walls	2"
Framed Slabs, Bottom	3/4"
Framed Slabs, Top	1"
Beams (Stirrups), Bottom and Sides	1-1/2"
Beams (Stirrups), Top	2"

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Slabs on Grade - Liquid Containment Structures, Bottom and Sides	3"
Slabs on Grade - Liquid Containment Structures, Top	See Drawings

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- B. Reinforcement shall be protected by concrete cover as shown and noted on the Drawings.

6. SPLICING

- A. Splicing of reinforcement shall be as shown and indicated on the Drawings. Splices not shown on the Drawings shall be Class "B" splice, in accordance with ACI 318 (2006). Any changes to the location and type of splices desired by the Contractor must be specifically requested and must meet with the acceptance of the Engineer before they can be used.
- B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.
- C. Mechanical splices may be used instead of lap splices provided that their location and type meets with the acceptance of the Engineer.

7. INSPECTION

Inspect all the work in accordance with Section 03300 of these Specifications.

END OF SECTION

## SECTION 03150 – CONCRETE FORMWORK

## PART 1 - GENERAL

## 1. SCOPE

Furnish and install the concrete formwork as required by the concrete outlines shown and indicated on the Drawings and specified in this Section, complete.

## 2. FORM DESIGN

Provide the design of all forms for this work. Formwork shall comply with ANSI A10.9 (2006) and OSHA Construction Standards, Part 1926, Subpart Q, Concrete, Concrete Forms, and Shoring (2006). In addition, the form designs shall meet the requirements of ACI (American Concrete Institute) 347 (2006).

## 3. SUBMITTALS

- A. Do not provide submittals for the structural design of forms.
- B. Form Tie Assemblies: Manufacturer's product data sheets fully describing the form tie assemblies.
- C. Form Releasing Agent: Manufacturer's product data sheets fully describing the form coating.
- D. Plywood Panels: Certification that the plywood panels for use on this work meets the specified standard.

## 4. STORAGE AND PROTECTION

All form materials and accessories shall be stored above ground on framework or blocking, shall be protected from precipitation and shall have adequate air circulation and ventilation.

## PART 2 - PRODUCTS

## 1. FORM MATERIAL

- A. Smooth Form Finish: Forms for this finish shall be applied to surfaces specified in Section 03300 of these Specifications. Some of these surfaces will receive a brushed surface coating as specified in Section 03300 of these Specifications.

- 1). Form facing material shall produce a smooth, dense, uniform texture on the concrete. Form facing shall be one of the following:

- a. Plywood, meeting the requirements of U.S. Department of Commerce Product Standard (PS) (2006). PS 1 - Construction and Industrial Plywood, B-B Concrete Form Panels. The arrangement of the facing material shall be orderly with the number of seams kept to a practical minimum.
- b. Patented forms may be used, subject to acceptance by the Engineer, provided they produce a smooth, even surface. This acceptance is for the finish these forms will leave



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on the contact surfaces and will not relieve the Contractor of the responsibility for the design and structural soundness of the forms. Patented forms shall be lined with the specified plywood. Plywood panels shall not be used more than three times unless further use is acceptable to the Engineer.

- B. Rough Form Finish: Forms for this finish shall be applied to the surfaces specified in Section 03300 of these Specifications. Forms for this finish may be the same as specified for the Smooth Form Finish or may be constructed of used plywood panels, unlined steel forms or straight dressed lumber.

## 2. ACCESSORIES

- A. Formties for use in all liquid containment structure walls shall be one of the following:
- 1). Formclamp assemblies with smooth tie rods with a waterstop at their centers; or "she bolt" tie assemblies with a waterstop at their centers.
  - 2). Both of the assemblies shall permit tightening of the forms and be of such type that leaves no tie metal, or any other tie material, within 1-1/2-inch of the surface after use. The assemblies shall provide cone-shaped depressions at the surface of the concrete at least 1-inch in diameter to allow filling and patching with the specified grout.
- B. Formties for use in all other walls shall be one of the assemblies specified in Article 2.02, paragraph A., except that waterstops are not required.
- C. Formreleasing agents shall be a non-staining formcoating compound.

## PART 3 - EXECUTION

### 1. FORM CONSTRUCTION

- A. Formwork shall be in accordance with ACI 347 (2006) and as follows:
- 1). Forms shall conform to shape, lines and dimensions of members indicated and shall be sufficiently rigid and tight to prevent leakage of mortar. Forms shall be properly braced or tied together so as to maintain position and shape. Construct forms so that they can be removed readily without hammering or prying against the concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and lines.
  - 2). Joints shall be butted tight. Arrangements of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Forms shall be chamfered 1-inch for external corners of concrete, including top of walls, which will be exposed to view in the finished work.
  - 3). Provide adequate formwork in its entirety. Forms shall safely support loads they will sustain and shall maintain their dimensional and surface correctness to produce members required by the Drawings. Formties shall be spaced close enough to avoid bulges and variations in the required cross-sectional dimensions shown on the Drawings for the members being cast.
  - 4). Box out for chases, recesses or other openings required in the completed work.
  - 5). Install all the items (sleeves, inserts, hangers, anchors, etc.) to be supported by the formwork as required by the work.

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- 6). Install pipe sleeves, wall pipes and wall sleeves, as shown or specified, for all piping penetrating walls and slabs. The use of block-outs in walls is prohibited.
  - 7). The use of reinforcing steel, partially embedded in concrete, as toe pins or form spacers is prohibited.

## 2. TOLERANCES FOR FORMED SURFACES

### A. Variation from Plumb

- 1). In the Lines and Surfaces of Walls:
  - a. In any 10 Feet of Height: 1/4-inch (walls 1/2-inch).
  - b. Maximum for the Entire Height: 1-inch.
- 2). For Construction and Expansion Joint Grooves and Other Conspicuous Lines:
  - a. In any 20 Foot Height: 1/4-inch.
  - b. Maximum for the Entire Height: 1/2-inch.

### B. Variation from the Level or from the Grades Shown on the Drawings:

- 1). In Slab Soffits and Tops of Slabs, Measured Before Removal of Supporting Shores:
  - a. In any 10 Foot Length: 1/4-inch.
  - b. In any Bay or in any 20 Foot Length: 3/8-inch.
  - c. Maximum for the Entire Length: 3/4-inch.

### C. Variation of the Linear Structure Lines from Established Position in Plan and Related Position of Walls:

- 1). In any 20 Foot Length: 1/2-inch.
- 2). Maximum for the Entire Length: 1-inch.

### D. Variation in the Sizes and Location of Sleeves, Floor Openings and Wall Openings: $\pm 1/4$ -inch.

### E. Variation in Cross-Sectional Dimensions in the Thickness of Slabs and Walls: -1/4-inch, +1/2-inch.

### F. Variation in Sizes of Pipe Sleeves, Wall Pipes and Wall Sleeves: None.

### G. Variation in Location of Pipe Sleeves, Wall Pipes and Wall Sleeves: $\pm 1/8$ -inch.

### H. Footings

- 1). Variations in Dimensions in Plan: -1/2-inch, +2-inches.

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- 2). Misplacement or Eccentricity: Two percent of the footing width in the direction of misplacement but not more than: 2-inches.
  - 3). Thickness: Decrease in specified thickness - none; increase in specified thickness 25 percent unless otherwise approved by the Engineer.
  - 4). Tolerances above apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels or embedded items.

### 3. APPLICATION FOR FORM COATING

Before the placing of reinforcing, faces of all forms to be in contact with the concrete shall receive a thorough coating of the liquid form-releasing agent specified, applied in compliance with the manufacturer's instructions.

### 4. INSPECTION

Inspect all the work in accordance with Section 03300 of these Specifications.

### 5. REMOVAL OF FORMS

- A. Forms shall be removed in such a manner as to insure complete integrity and safety of the structure. Formwork shall be designed so that it can be removed without removal of sufficient original shores to adequately support the work until such time that the concrete strength reaches its specified 28 day strength. The forms and shoring shall remain in place for the following minimum periods of time after the casting of the concrete is completed. In the case of slab soffits, forms shall remain in place for no less than the time required for the concrete to gain 75 percent of its specified 28 day strength; and in the case of all other concrete, no less than the time for the concrete to gain 40 percent of its specified 28 day strength.

	Form Removal, Days	Shoring, Days
Slabs (Soffits)	7	14
Walls	3	0

- B. In no case shall the beam and slab soffits be unsupported during the process of the form removal and reshoring.
- C. Removal of forms shall be coordinated with the selected specified method of curing concrete.
- D. Wood forms shall be completely removed from all the work to avoid termite infestation.

END OF SECTION

## SECTION 03250 – CONCRETE ACCESSORIES

## PART 1 - GENERAL

## 1. SCOPE

The work under this Section includes, but is not necessarily limited to, furnishing and installing all concrete accessories as indicated on the Drawings, herein specified, and as necessary for the progress and complete performance of this work.

## 2. SUBMITTALS

The waterstop manufacturer shall submit documented test results demonstrating that the waterstop will not permit water leakage when subjected to pressure and joint movement.

## PART 2 - PRODUCTS

## 1. ACCEPTABLE MANUFACTURERS

- A. Waterstops for construction joints shall be Wirestop Waterstop Type No. FR-6380 as manufactured by Paul Murphey Plastics Company, Rossville, Michigan, or Vinylx Waterstop Type R6-38TR as manufactured by Vinylx Corporation, Knoxville, Tennessee or equal.
- B. Waterstops for expansion joints shall be Greenstreak Style 757 or equal.

## 2. MATERIALS AND CONSTRUCTION

- A. Waterstops: Waterstops shall be of the highest grade polyvinyl chloride meeting U.S. Army Corp of Engineers Specification CRD-C572-74 (2006) and shall incorporate looped galvanized steel wire along both edges to mechanically bond to the concrete.
- B. Expansion Joint Filler
  - 1). Asphalt impregnated fiberboard, ASTM D 1751 (2006), for interior work.
  - 2). Self-expanding corkboard, ASTM D 1752 (2006), for exterior work.

## 3. OTHER MATERIALS

All other materials not specifically described, but required for a complete and proper installation of concrete accessories, shall be as selected by the Contractor subject to the approval of the Engineer.

## PART 3 - EXECUTION

## 1. INSTALLATION

- A. General: Install concrete accessories as indicated on the Drawings, specified in various other Sections and as necessary for the proper and complete performance of this work.

B. Waterstops

- 1). Waterstops shall be installed in all construction joints in walls and slabs which are to hold water and also where shown on the Drawings. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's recommendations.
- 2). Waterstops for all joints shall be continuous around all corners and intersections. Provide factory formed corners and intersections where angle intersections occur. Only straight splices shall be made in the field. Splices shall be made by heat welding in accordance with the manufacturer's recommendations and shall be subject to the approval of the Engineer.
- 3). No holes will be permitted in waterstops.
- 4). Waterstops shall be securely fastened to formwork or reinforcing steel every 12-inches or less on both edges as required to concrete placement.

END OF SECTION

## SECTION 03300- CAST-IN-PLACE CONCRETE

## PART 1- GENERAL

## 1. SCOPE

Furnish and install the cast-in-place concrete as shown and indicated on the Drawings and as specified in this Section, complete.

## 2. SUBMITTALS

- A. Mix designs for all groups and classes of concrete.
- B. Strength and slump tests results.
- C. Certificates of compliance for each of the following:
  - 1). Cement
  - 2). Aggregates
  - 3). Fly ash
  - 4). All admixtures

## PART 2 - PRODUCTS

## 1. CEMENT

Cement shall be standard Portland Cement, of American manufacture, conforming to ASTM C 150, Type I. Only one brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used in this work. Each bag shall weigh approximately 94 pounds and contain one cubic foot.

## 2. CONCRETE AGGREGATES

- A. Fine aggregate shall be sand having clean, hard, durable, uncoated grains and free from deleterious substances and shall conform to ASTM C 33 (2006).
- B. Coarse aggregate shall be crushed stone having clean, hard, durable, uncoated particles conforming to ASTM C 33 (2006). Size No. 57 coarse aggregate shall be used in all concrete members whose minimum size dimension is less than 8-inches.

## 3. WATER

Water used in mixing concrete shall be clean and free from deleterious amounts of acids, alkalis or organic materials.

## 4. EXPANSION JOINT FILLER

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See Section 03250 of these Specifications for expansion joint filler.

5. WATERSTOPS

See Section 03250 of these Specifications for waterstops.

6. VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting, minimum 6 mil thickness, conforming to ASTM C 171 (2006).

7. ADMIXTURES

- A. Water reducing admixture shall conform to ASTM C 494, Type A (2006).
- B. Water reducing, retarding admixture shall conform to ASTM C 494, Type D (2006).
- C. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C 494, Type C (2006).
- D. Air entraining admixture shall conform to ASTM C 260 (2006).
- E. Fly ash shall conform to ASTM C 618, Type F (2006).
- F. Calcium Chloride: Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

8. CURING AND SEALING COMPOUNTS

- A. Curing compound shall be acrylic based, conforming to ASTM C 309 (2006).
- B. Sealing compound shall be Masterseal 340 as manufactured by Master Builders, Sikaguard 70 as manufactured by Sika Corporation, or Super Rez Seal as manufactured by Euclid Chemical Company or equal.

PART 3 - EXECUTION

1. CONCRETE QUALITY

- A. Mix design shall be proportioned in accordance with ACI 211.1 (2006) making maximum use of the coarse aggregate. The proportioning shall be based on the requirements of a well-graded high density plastic workable mix within the slump range and strengths required. The mix shall contain no less than 1,850 pounds of coarse aggregate per cubic yard of concrete, shall be based on conventional conveying and shall not be altered for use in pumping. Pumping equipment, if used, shall be of sufficient size and design to pump the mix designed for conventional concrete pumping. The following classes of concrete are required:

Class of Concrete	Compressive Strength @ 28 Days	Slump Range	Maximum W/C Ratio
A	4,000	3" - 5"	0.45
A'	4,000	1" – 3"	0.45
B	1,500	3" - 5"	none specified

- 1). Air Content: All concrete shall have an air content of 4.0 to 7.0 percent.

- 2). Admixture Usage: All concrete placed at air temperatures above 50 degrees F shall contain a water reducing admixture or water reducing-retarding admixture. All concrete placed at air temperatures below 50 degrees F shall contain the specified non-corrosive non-chloride accelerator.
- 3). Class B concrete shall be used for over excavation fill and mud slabs. Class A concrete shall be used for other concrete work. Class A' concrete shall be used for applications on 3:1 or greater slopes.
- 4). The use of fly ash is not required but is permitted. If used, the combined weight of cement and fly ash shall contain no less than 20 percent nor more than 25 percent of fly ash. The combined weight of cement and fly ash shall be used as the weight of cement in the determining of the water-cement (w/c) ratio.

## 2. MIX DESIGNS

- A. Submit samples, in adequate quantities for each mix design and verification, of all concrete materials to be used on the project to the designated testing laboratory. Do not use any concrete in this work without acceptance and verification of design mix by the testing laboratory and the approval of the Engineer.
- B. If trial batches are used, the testing laboratory shall make strength tests from trial batches in the laboratory using materials and mix designs proposed for use by the Contractor. The testing laboratory shall prepare trial batches in accordance with ACI 211.1 (2006).
- C. If field experience method is selected, the proposed mix design shall be accompanied by complete standard deviation analysis and at least 30 consecutive strength test that represent the proposed mix.
- D. The proposed mix design and supporting data shall be submitted, in triplicate, to the testing laboratory for their review and comments at least 21 days prior to the expected start of concreting operations. The testing laboratory will forward two copies of the submittal to the Engineer with their comments. The Engineer will review the submittal and return one copy to the Contractor with the Engineer's comments.
- E. Compression test specimens made to verify the mixes shall be made in accordance with ASTM C 192 (2006). All compression test specimens shall be tested in accordance with ASTM C 39 (2006).

## 3. PLANT MIXING

- A. Proportioning Concrete
  - 1). Proportions shall be in compliance with approved design mix for each class of concrete.
  - 2). The mixing plant shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete.
  - 3). Concrete materials shall be measured by weight except that admixtures shall be measured by volume.
- B. Batching



- 1). Provide all necessary equipment to accurately determine and control actual amount of materials entering into the concrete mix. Individual ingredients shall be weighted separately for each batch.

Accumulative weighing will be allowed if equipment is in acceptable working order as determined by the testing laboratory and approved by the Engineer. Accuracy of all weighing devices shall be such that successive quantities can be measured to within one percent of the desired amount.

- 2). Completely discharge contents of the mixer before each new batch is loaded. Use of retempered concrete is not permitted.
- 3). Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C 94 (2006) and the following:
  - a. A separate water metering device (not truck tank) shall be used for measuring water added to the original batch.
  - b. Use of wash water as a portion of the mixing water is not permitted. Wash water added to empty drums after discharging shall be dumped before a new batch is received.
  - c. Centrally mixed concrete shall be mixed for the length of time specified herein, not "shrink-mixed".
  - d. Mixing drums shall be watertight.
  - e. Concrete shall be discharged within one hour from the time concrete was mixed, if centrally mixed, or from time the original water was added, if transit-mixed.
  - f. Furnish delivery ticket with each load of concrete delivered under these Specifications. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, water per cubic yard, its slump, quantities of all admixtures, the date and time of departure from the batching plant, and the time of placement.

#### 4. CONVEYING EQUIPMENT

- A. If concrete is to be transported in carts or buggies, the carts or buggies shall be equipped with pneumatic tires.
- B. Equipment for chuting or other methods of conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at delivery without segregation of concrete.

#### 5. CONVEYING

- A. Concrete shall be conveyed from mixer to place of final placement by methods which will prevent separation or loss of the material.
- B. Runway supports shall not bear upon reinforcing steel or fresh concrete.

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- C. All conveying equipment shall be thoroughly cleaned before each run of concrete is begun.

6. DELIVERY AND PROTECTION OF MATERIALS

Deliver ready-mixed concrete in compliance with requirements of ASTM C 94 (2006).

7. SEVERE-WEATHER CONDITIONS

- A. Hot Weather Concreting: Protect in accordance with ACI 305R (2006) except as modified herein.

- 1). Provide adequate methods of lowering temperature of concrete ingredients so that the temperature of concrete when placed does not exceed 90 degrees F.
- 2). Concrete shall not be placed when the air temperature is expected to exceed 100 degrees F within 12 hours after casting.
- 3). When the air temperature is 75 degrees F and above, forms and reinforcing shall be thoroughly wetted with water so that the concrete will be placed against wet and cooled surfaces. All excess water shall be removed before casting the concrete.
- 4). Protection and Curing - Slabs (On Grade and Formed)
  - a. Protect slabs from damage due to dry winds and high temperatures.
  - b. Protect slabs from direct sun at temperatures of 85 degrees F and above.
  - c. Moist curing of all slabs shall start as soon as the surface of the fresh concrete is hard enough to permit curing without damage to the surface of the concrete.
- 5). Protection and Curing - Formed Surfaces: As soon as the concrete has set, wet the forms and keep the forms wet during the curing period. Provide for keeping the top of the walls, and other top surfaces, moist during the curing period.

- B. Cold-Weather Concreting: Protect in accordance with ACI 306R (2006) except as modified herein.

- 1). Provide adequate equipment for heating concrete materials and protecting concrete from damage during freezing or near-freezing weather. No frozen materials, or materials containing ice, shall be used.
- 2). All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come into contact shall be free from frost.
- 3). Whenever the temperature of the surrounding air is below 40 degrees F and falling, all concrete placed in the forms shall have a temperature of between 70 and 80 degrees F, and adequate means shall be provided for maintaining a temperature of not less than 70 degrees F for three days, or 50 degrees F for five days, or for as much more time as is necessary to insure proper curing of the concrete. If high early strength concrete is used, the requirement for maintenance of 50 degrees F may be reduced to three days.
- 4). Use only the specified non-chloride accelerator. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

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- 5). Housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heat is discontinued.

8. CONSTRUCTION JOINTS AND EXPANSION JOINTS

- A. Formed Construction Joints in Containment Structures and Where Otherwise Shown: Prior to placing concrete next to the joint, the joint surface shall be thoroughly cleaned and dampened with water. Remove all free water so that the surface of the joint shows signs of drying before placing the adjacent concrete.
- B. Construction joints in Beams, Girders and Slabs where waterstops are not specified or shown to be installed: These joints shall be located at points of minimum shear and their locations shall be approved by the Engineer before they are bulkheaded. These joints shall be roughened and thoroughly cleaned of all foreign matter and laitance and dampened with water. Remove all free water and slush with a coat of neat cement grout before placing the adjacent concrete. Place the adjacent concrete before the next cement grout takes its initial set.
- C. Construction Joints in Beams, Girders and Slabs where waterstops are specified or shown to be installed: These joints shall be treated as specified in paragraph A. above.
- D. Expansion Joints: Expansion joints shall be installed where shown on the Drawings.

9. WATERSTOPS

Waterstops shall be provided where specified and as indicated and noted on Drawings and shall be made continuous throughout their length.

10. INSPECTION OF WORK BEFORE PLACING CONCRETE

- A. Inspect the area to receive concrete for any deficiencies which would prevent proper placing of concrete. Do not proceed with placing concrete until such deficiencies are corrected.
- B. Do not place in the concrete any item that is not required to be in the concrete by the Drawings and Specifications. Insert all the items shown on the Drawings or specified properly positioned and secured. Openings other than those which are facilitated by sleeves shall be properly formed and positioned.
- C. Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.
- D. Do not place concrete on earth until the fill or excavation has been prepared as set forth under applicable sections of the Specifications for that work.
- E. Give the Engineer at least 48 hours notice before any concrete is to be placed. Concrete shall not be placed until the Engineer has received a completed Concrete Preplacement Sign-Off Card signed by the superintendent. The Concrete Preplacement Sign-Off Card certifies that the formwork, reinforcing and all inserts required for piping and any other inserts or miscellaneous specialties required for the work are supported in their proper position; that the formed enclosure is clean, and the surfaces to receive concrete are prepared as specified. A sample of the Concrete Pre-Placement Sign-Off Card is attached to this Section.

11. PLACING

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- A. Place concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not place concrete on work that has partially hardened or been contaminated by foreign material, and do not use retempered concrete. In no case shall concrete be placed when the elapsed time after addition of water and cement to batch exceeds one hour.
  - B. Concrete shall be placed in a manner to avoid the displacement of reinforcing, and coating or spattering the reinforcing steel. The placing of concrete within form work shall be regulated so that the pressure within form work does not exceed the design pressure. In placing concrete each layer shall be placed following the preceding layer to prevent lines of separation or "cold joints" in the work. After the concrete reaches its initial set, jarring the formwork or placing strain or vibration on the ends of projecting reinforcing bars shall be avoided.
  - C. Concrete shall not be dropped more than four feet. All concrete placed over PVC waterstops shall drop no more than 6-inches until there is at least one foot of concrete above the PVC waterstop, at which point the drop distances may be increased to those noted above.
  - D. Once concrete placing has started, it shall be carried on as a continuous operation until placing of the concrete between construction joints is completed.
  - E. Concrete shall be placed in layers not over 12-inches deep and each layer shall be compacted with the aid of mechanical internal-vibrating equipment supplemented by hand spading. Vibrators shall in no case be used to transport concrete. Use of form vibrators are not permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one spare working vibrator shall be on the job site as a back-up. Duration of vibrator use shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrator shall not be lowered into courses that have begun to set. Apply vibrator at uniformly spaced points not further apart than the visible effectiveness of the machine. Type and use of vibrators shall be in accordance with ACI 301 (2006).
  - F. Provide filter fabric under all slabs on soil, sand or stone. Use largest sheets practicable to reduce number of joints. Lap joints a minimum of 24-inches. Remove torn and punctured sheets and replace with new sheets prior to placing concrete. Placing of concrete shall be done in a manner that will not damage the vapor barrier material. The sub-base material shall be as shown and/or noted on the Drawings.

## 12. PROTECTION

Protect freshly placed concrete from damage or injury due to water, falling objects, persons or anything that may mar or injure finish surface on concrete. Only light use of slabs will be permitted for the first 14 days after placing of the concrete.

## 13. CURING

- A. Curing shall conform to ACI 308 (2006) except as modified herein.
- B. All Slabs on Grade: After placement and finishing, concrete shall be maintained in a moist condition for at least seven successive days during which the temperature of the concrete is 50 degrees F or above. For temperatures of 50 degrees F and below, curing period shall be 14 successive days. Concrete shall be kept moist by any one, or combination, of the following methods:
  - 1). Ponding or Immersion: Continually immerse the concrete in water throughout the curing

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- period. Water shall not be more than 20 degrees F less than the temperature of the concrete.
- 2). Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.
  - 3). Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6-inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
  - 4). Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Inspect surface of concrete daily for wetness. The surface shall be kept continuously wet during the curing period.
- C. All Other Concrete: After placement, concrete shall be maintained in a moist condition for the same periods as specified above for slabs on grade.
- 1). Concrete in Formed Surfaces - Slabs, Beams and Walls: Keep forms and exposed surfaces wet with water during the curing period. If forms are removed before the end of the curing period, apply a curing compound within one hour after form removal.
  - 2). Concrete in Formed Surfaces - Containment Vessel Walls: Keep forms wet with water during the curing period. If forms are removed before the end of the curing period, continue the moist curing in accordance with Paragraph A. of this article of these Specifications.
14. PATCHING
- A. As determined by the Engineer, any concrete which is out of alignment or level has a defective surface or has defects which reduce its structural adequacy, shall be considered as not conforming with the Drawings and Specifications and shall be rejected.
  - B. Do not take any remedial action on concrete with any defect without the permission of the Engineer.
  - C. Unless the Engineer grants permission to patch the rejected concrete, remove the rejected concrete and replace it with concrete that conforms to the Drawings and Specifications. The location of cut lines and the extent of removal will be determined by the Engineer.
  - D. If the Engineer grants permission to patch the rejected concrete, it shall be done in accordance with the following:
    - 1). Permission to patch rejected concrete will not be a waiver of the Engineer's right to require complete removal of the rejected concrete if the patching does not, in the Engineer's judgement, restore the concrete to the requirements of the Specifications and Drawings.
    - 2). Patching shall be accomplished after the curing is completed.

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- 3). Defective areas shall be chipped away to a depth of not less than 1-inch, in all cases to sound concrete, with edges perpendicular to the surface. Feather edges will not be permitted. Remove all loose material and thoroughly clean the chipped surfaces with a high pressure air hose delivering air at 100 psi. The area to be patched and an area at least 6-inches wide surrounding it shall be dampened. A bonding grout shall be prepared using a mix of approximately one part cement to one part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surfaces as noted below in paragraph 5.
  - 4). The patching mixture shall be made of the same materials and of approximately the same portions as used for the original concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp, loose volume. White Portland cement shall be substituted for a part of the gray Portland cement to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
  - 5). After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be kept damp for seven days. Finishing tools that produce a finish matching the surrounding shall be used.
- E. Tie holes left by withdrawal of rods or the holes left by removal of ends of wall ties shall be filled solid with mortar after first being wetted. For holes passing through the wall, a plunger-type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing through the walls shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth. Mortar shall consist of one part cement, two and one-half parts sand and no more water than necessary for handling and packing.

## 15. FINISHES OR FORMED SURFACES

- A. Upon completion of patching, surfaces of concrete shall be Smooth Form Finished. Smooth Form Finish is required for all concrete surfaces exposed to view in the completed work and all liquid containment structure walls whether exposed to view or not in the completed work. Accomplish the required patching and the following touch-up:
- 1). Remove all burrs.
  - 2). Remove all form marks.
  - 3). Smooth out lines of indentations.
- B. Rough Form Finish shall be produced by filling all tie holes and honeycomb and in other respects leaving the surface as formed. All concrete surfaces which will be covered by earth and which will not be visible in the completed structure (except as noted above for liquid

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containment structure walls which shall have a Smooth Form Finish), may receive a Rough Form Finish.

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16. STEEL TROWELED FINISH

- A. Steel troweled finish shall be applied to the surface of all building and liquid containment structure floor slabs and interior equipment pads.
- B. Concrete shall be placed, consolidated, struck-off and leveled to the proper elevation. After the surface has stiffened sufficiently to permit the operation and the water sheen has disappeared, the surface shall be wood floated, by hand or power floated, at least twice, to a uniform sandy texture. Floors shall be leveled such that depressions between high spots do not exceed 1/4-inch under a 10 foot straightedge except where drains occur, in which case the floors shall be pitched to the drains as indicated on the Drawings.
- C. After the concrete has received a wood float finish, it shall be troweled at least twice to a smooth dense finish. The drying of the surface moisture before floating or troweling shall not be hastened by the dusting on of dry sand or cement. The first troweling shall be done by a power trowel and shall produce a smooth surface relatively free of defects. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks or other imperfections; shall be uniform in texture and appearance, and shall be in true plane within the tolerance specified. Any deviation from this condition which remains after the troweling is completed shall be corrected by grinding.

17. BROOM FINISH

- A. Broom finish shall be applied to:
  - 1). All exterior sidewalks, walkways and platforms.
  - 2). All steps and landings, both interior or exterior.
  - 3). Spillway and SAF basin floor.
- B. The surface shall be given a floated finish as specified above, then finished with a flexible bristle broom or burlap belt drawn across the surface. Surface must be hardened sufficiently to retain the scoring or ridges. Scores or ridges shall be transverse to traffic or at right angles to the slope of the slab.

18. TESTING LABORATORY

- A. The testing laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed and tested. Duties shall include, but not necessarily be limited to the following:
  - 1). Make, store, transport, cure and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C 39 (2006). Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen, concrete slump test results and air content of concrete from which the specimen was

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made. One copy each of all tests shall be sent to the Contractor and two copies each to the Engineer.

- 2). Each strength test requires four standard test cylinders.
  - 3). Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5,000 square feet of surface area for slabs or walls.
  - 4). Each class of concrete shall be tested with at least five strength tests.
  - 5). From each set of four cylinders, two shall be tested at 28 days and shall comprise a strength test under the definition of these Specifications. One cylinder shall be broken at seven days and will be used as an aid in determining the early strength of the concrete and the 28 day strength, and one cylinder retained in reserve for later testing if required.
  - 6). Test for unit weight of concrete when the first load of each class of concrete is delivered and thereafter at the discretion of the testing laboratory.
- B. Periodically inspect the batching plant and file a report with the Engineer stating whether the supplier's equipment and methods meet the requirements of these Specifications.
- C. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity and starting and finishing time of placement for all concrete work. Copy distribution shall be as specified above for test reports.

#### 19. EVALUATION OF COMPRESSION TESTS

- A. Evaluation of compression test results shall be as follows: For each class of concrete, compression-strength tests for laboratory-cured cylinders shall be considered satisfactory if the averages of the results of all sets of three consecutive compression-strength tests equal or exceed the 28 day design compression-strength specified; and, no individual cylinder strength test falls below the required compression strength by more than 500 psi. Strength tests of specimens cured under field conditions may be required by the Engineer to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality-control laboratory at the same time and from the same samples as the laboratory-cured specimens.
- B. Faulty Concrete: Failure to comply with any of the specified conditions shall constitute faulty concrete. Unless otherwise directed by the Engineer, faulty concrete shall be removed and replaced with concrete as specified, at no expense to the Owner.
- C. Additional Test: If permitted by the Engineer, additional tests shall be subject to the approval of the Engineer and at no expense to the Owner. Load tests, if permitted by the Engineer, shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the Engineer.
- D. Neither the results of laboratory verification tests nor any provision in the Contract Documents shall relieve the Contractor of the obligation to furnish concrete of the class and strength specified.



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END OF SECTION

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CONCRETE PREPLACEMENT SIGN-OFF CARD

Project:\_\_\_\_\_

Inspection Date:\_\_\_\_\_ Concrete Placement Date:\_\_\_\_\_

Expected Time of Concrete Placement:\_\_\_\_\_

Estimated Quantity:\_\_\_\_\_

Mix Design Strength:\_\_\_\_\_

Location of Structure:\_\_\_\_\_

Member (walls, beams, etc.):\_\_\_\_\_

Weather Conditions:\_\_\_\_\_

Method of Pour: Chute \_\_\_\_\_ Bucket \_\_\_\_\_ Pump \_\_\_\_\_

Conveyor \_\_\_\_\_ Other \_\_\_\_\_

WORK	STATUS		SIGNATURE	DATE
	Ready	N/A		
Formwork				
Reinforcing				
Mechanical				
Electrical				
Instrumentation				
Plumbing				
Process				
Metal Embeds				
Miscellaneous Specialties				
Clean-Up/OK to Place				

The Contractor certifies that the above work to be cast is prepared in accordance with the Contract Documents.

By: Contractor (Superintendent) \_\_\_\_\_

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

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## SECTION 03620 – EXISTING PIPE GROUTING

### PART 1 - GENERAL

#### 1. SCOPE

The work under this Section includes, but is not necessarily limited to, furnishing all labor, materials, tools, equipment and incidentals and performing all operations in connection with grouting the existing low level pipe. The pipe shall be completely filled with cement grout.

#### 2. SUBMITTALS

- A. Before beginning any work on the pipe grouting, the details of the proposed grouting method shall be submitted to Engineer for approval.
- B. Information on the proposed grout mix shall also be submitted. This submittal shall include information on strength, shrink-swell potential, water-cement ratio, and materials used. Information on materials of a proprietary nature shall not be required.

#### 3. EXPERIENCE

Grouting must be performed by a specialty contractor experienced in similar grouting operations.

### PART 2 - PRODUCTS

#### 1. CEMENT GROUT

The grout mix shall be a cement or a sand/cement grout containing additives and/or bentonite to produce a nonshrink mix.

### PART 3 - EXECUTION

#### 1. PIPE PREPARATION AND GROUTING

- A. Pipe to be grouted shall be thoroughly cleaned of sediments and other debris prior to grouting.
- B. Pipe to be grouted shall be video inspected prior to installation of bulkheads and grouting tubes.
- C. The pipe and all voids around the existing pipe shall be completely filled with nonshrink cement grout.
- D. The pressure grouting operation shall require a secure bulkhead at the downstream end of the pipe to confine the grout.
- E. A vent tube or tubes from the bulkhead to the upstream end of the pipe shall be installed to allow the escape of displaced air and water and provide a return flow of grout at completion of the grouting procedure.
- F. Maximum grouting pressure shall be in accordance with the existing pipe material.

END OF SECTION

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SECTION 15900

INSTRUMENTATION

PART 1 - GENERAL

1 SCOPE

- A. The work shall include installation of Observation Wells complete and operational. These instruments shall be capable of permanent monitoring of the development of the phreatic surface. The number and locations of these instruments shall be as shown on the Drawings and as recommended by the Geotechnical Engineer. The final number and location of wells may be adjusted by the Geotechnical Engineer based on the actual foundation conditions encountered at the time of construction.

2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

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

1. ASTM D1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

B. Department of the Army Corps of Engineers (USACE):

1. USACE Engineer Manual EM1110-2-1908, Instrumentation of Earth and Rock-fill Dams (Groundwater and Pore Pressure Observations)

3 QUALITY ASSURANCE

A. Product Data

1. Provide manufacture's data on the proposed pipe products, pipe accessories, and fittings including leak-resistant well covers.

B. Installation Plan

1. A plan illustrating the location of Observation Wells is provided in the design documents.
2. The final location of monitoring devices shall be approved by the Geotechnical Engineer prior to installation of any instrumentation equipment.

C. Pipe Materials

1. Shop drawings and descriptive literature showing pipe dimensions, joints, joint materials, pipe stiffness, and other details for the Observation Wells.
2. Certification with each delivery that pipe complies with this specification.

- D. Aggregates: Submit, in airtight containers, 100 lb sample of each type of aggregate to testing laboratory.
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- E. Bentonite: Submit, in airtight containers, 50 lb sample to testing laboratory.
  - F. Materials Source: Submit name of imported aggregate and bentonite material suppliers. Provide materials of each type from same source throughout the Work unless permission given by the Geotechnical Engineer to change source.

4 SUBMITTALS AT PROJECT CLOSEOUT

- A. Surveyed location of all instrumentation devices and elevations.
- B. Observation Well drill logs, installation records.

PART 2 - PRODUCTS

1 OBSERVATION WELLS

- A. All pipe shall conform to ASTM D 1785 polyvinyl chloride (PVC) pipe, Schedule 40. Fittings shall be Schedule 40 screwed end.
- B. Well pipe shall have a 2-inch nominal inside diameter and shall be blank and slotted pipe with the slotted PVC as indicated in the project Drawings. The blank and slotted PVC sections shall be in 5 and 10 foot lengths with flush thread type couplings.
- C. The slotted section shall have circumferential slots cut in two rows on 180 degree centers. The slots shall be 0.010 inch in width and of sufficient number to provide a minimum of 0.75 square inch of opening per linear foot of pipe.
- D. Sand for the filter pack shall be #20 Morrie Industrial Sand and shall not extend more than 4 feet above the screened interval and no closer to the finished ground surface than specified in the project Drawings.
- E. Bentonite for seals shall be in either 3/8-inch pellet, chip or other approved form. Cement/bentonite grout shall be prepared at a mix ratio of 94 pounds cement : 3 pounds bentonite : 9 gallons of water.
- F. A concrete base as shown on the Drawings shall be constructed in the ground surface at the top of each hole providing positive surface drainage away from the well.
- G. A steel sleeve with leak-resistant flush manhole type cover shall be permanently set in the concrete base to protect the well pipe.
- H. Well pipes shall be equipped with a slide on water tight cap.

2 WATER LEVEL INDICATOR

- A. Battery operated manual level indicator shall measure water level by electrical continuity.
  - B. Water level indicator shall be a new Heron Instruments, Grokon, Solinst or other approved equal device capable of measuring in 1/10 inch increments. The indicator shall be attached to a cable of sufficient length that is marked at every one-tenth foot (minimum), and has a printed footage label at every ten feet (minimum).
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- C. Contractor shall furnish one water level indicators which shall become the property of the Owner at Project Completion.

### PART 3 - EXECUTION

#### 1 OBSERVATION WELL INSTALLATION

- A. The depths and locations of the wells shall be as specified on the Drawings and approved by the Geotechnical Engineer prior to installation.
- B. Borings shall be drilled in accordance with reference specifications and details. A drill log shall be prepared for each drill hole. The log shall include the location of special features, such as abnormal gain or loss of drill water, drill action, penetration rate, drilling RPM, hydraulic pressure, and other pertinent items. Observation well should be installed only while under the observation of the Geotechnical Engineer.
- C. The borehole shall be stabilized with casing, clean drilling water or clean water with a degradable drilling fluid additive. When the hole has reached the prescribed depth and cuttings have been removed from the hole, the slotted screen pipe shall be lowered into the hole, centered using centering spiders, and backfilled with filter material as shown on the Drawings. If the hole has been stabilized using casing, the backfill shall be placed using 1-foot increments as the casing is removed. Sand backfill in wet drill holes shall be placed through a tremie.
- D. An installation record shall be provided to the Geotechnical Engineer containing a copy of the field boring log and documenting all pertinent dimensions, conditions, observations made during installation and installation performance test results.
- E. Installation shall be reviewed by the Geotechnical Engineer. If the Geotechnical Engineer determines that the well is not functioning properly, the well will be pulled, the hole will be backfilled, and a working well shall be installed at a new location specified by the Geotechnical Engineer.
- F. Once installed, a complete survey shall be performed to establish the location and top elevation of the Observation Wells.

END OF SECTION

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