THOMAS & HUTTON

CONTRACT DOCUMENTS

AND

TECHNICAL SPECIFICATIONS

FOR

EFFINGHAM COUNTY BOOSTER PUMP STATION

PREPARED FOR:

EFFINGHAM COUNTY BOARD OF COMMISSIONERS

BID SET - NOT FOR CONSTRUCTION

J– 28378.0000

FEBRUARY, 2021

thomasandhutton.com

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SECTION 02110

SITE CLEARING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Removal of surface debris.

B. Removal of trees, shrubs, and other plant life.

C. Topsoil excavation.

1.2 RELATED SECTIONS

A. Section 02200 – Excavation, Filling, and Grading.

1.3 MEASUREMENT AND PAYMENT

A. Site Clearing: Clearing, grubbing and other items to be removed will be included in the lump sum price in the proposal for "Site Clearing and Preparation". Includes clearing site, removing stumps, loading and removing waste materials from site.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for environmental requirements, disposal of debris.

B. Coordinate clearing Work with utility companies.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide tree protection materials as detailed on the construction drawings.

PART 3 – EXECUTION

3.1 PREPARATION

A. Verify existing plant life designated to remain is tagged or identified.

B. Identify a waste area for placing removed materials.

3.2 PROTECTION

A. All trees on site will be saved except those marked specifically by the Owner's representative for removal during construction. No trees, including those marked for removal on site or any other tree, may be removed prior to the preconstruction conference. All trees not to be removed will be protected from injury to their roots and to their top to a distance three feet beyond the drip–line and no grading, trenching, pruning, or storage of materials may go in this area except as provided by an Owner's representative stakeout. Contractor will pay a penalty for any tree removed from the site that has not been marked specifically for removal. Contractor also will pay for any tree that dies due to damage during construction. This applies to all trees on site whether or not they are shown on the plans.

B. Contractor shall not be held accountable for damages to trees resulting from placement of fill or removal of soils where such action is required by the contract documents. Any tree, the trunk of which is within 10 feet of any footing or trench, shall be exempt from these penalties except Contractor shall exercise all reasonable precautions to preserve even these trees. Contractor agrees to pay fines as established below in the event he or any of his subcontractors causes loss or removal of trees designated to be saved under provisions of this contract.

The fines are as follows:

Caliper	Fine
1" – 2"	$ 150.00
2" – 3"	200.00
3" – 4"	250.00
4" – 5"	400.00
5" – 6"	500.00
6" – 7"	600.00
7" – 8"	750.00
8" – 11"	1,500.00
12" – 20"	2,000.00
21" & larger	$ 2,500.00

C. Trees shall be graded by Owner's representative as to variety, condition, and site importance, with above figures acting as a maximum fine. Lowest assessment amount shall be no less than one–half of the above fine figures.

D. Protect bench marks, survey control points, and existing structures from damage or displacement.

E. Protect all remaining utilities.

F. Clearing operations shall be conducted to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and to provide for the safety of employees and others.

3.3 CLEARING

A. Clear areas required for access to site and execution of work. Clearing shall consist of felling and cutting trees into sections, and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within area to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be [burned or] removed completely from the site, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within cleared areas shall be trimmed of dead branches 1–1/2 inch or more in diameter. Limbs and branches to be trimmed shall be neatly cut close to the trunk of the tree or main branches. Cuts more than 1–1/2 inches in diameter shall be painted with an accepted treewound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations, by the erection of timber barriers or by such other means as circumstances require. Such barriers must be placed and be checked by the OWNER before construction observations can proceed (See 3.2). Clearing shall also include removal and disposal of structures obtruding, encroaching upon, or otherwise obstructing the work.

3.4 REMOVAL

A. Where indicated or directed, trees and stumps shall be removed from areas outside those areas designated for clearing and grubbing. Work shall include felling of such trees and removal of their stumps and roots. Trees shall be disposed of as hereinafter specified.

B. Remove debris, rock, and other extracted plant life from site.

3.5 DISPOSAL

A. Disposal of trees, branches, snags, brush, stumps, etc., resulting from clearing and grubbing shall be the Contractor's responsibility and shall be disposed of by burning, removal from site, or a combination of both. All costs in connection with disposing of materials will be at the Contractor's expense. Material disposed of by burning shall be burned in a manner avoiding all hazards, such as damage to existing structures, construction in progress, trees, and vegetation. Contractor shall be responsible for compliance with all local and State laws and regulations relative to the building of fires. Disposal by burning shall be kept under constant attendance until fires have burned out or extinguished. All liability of any nature resulting from disposal of cleared and grubbed material shall become the Contractor's responsibility. Disposal of all materials cleared and grubbed will be in accordance with rules and regulations of the State of Georgia. No material will be burned unless directed to do so by the OWNER. Contractor shall obtain a permit to burn on site from local fire department, before beginning the work.

3.6 GRUBBING

A. Grubbing shall consist of removal and disposal of stumps, roots larger than one inch in diameter, and matted roots from designated grubbing areas. This material, together with logs and other organic or metallic debris not suitable for building of pavement subgrade or building pads, shall be excavated and removed to a depth of not less than 18 inches below original surface level of the ground in embankment areas and not less than 2 feet below finished earth surface in excavated areas. Depressions

made by grubbing shall be filled with suitable material and compacted to make the surface conform to original adjacent ground.

END OF SECTION

INDEX TO

SECTION 02111 – SITE PREPARATION

SECTION 02111

SITE PREPARATION

Paragraph

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protection or removal of trees and other vegetation.
2. Topsoil stripping.
3. Clearing and grubbing.
4. Erosion control.

1.2 RELATED REQUIREMENTS

A. Construction Drawings

1.3 MEASUREMENT AND PAYMENT

A. Site Preparation: Will be included in the lump sum price in the proposal for "Site Clearing and Preparation". Includes removing obstructions, vegetation, strip topsoil, filling depressions, etc.

1.4 PROTECTIONS

A. Provide protection necessary to prevent damage to existing improvements, trees, or vegetation indicated on the Contract Documents to remain.

B. Protect improvements on adjoining properties and on Owner's property.

C. Restore damaged improvements to original condition as acceptable to parties having jurisdiction.

D. Conduct operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction and from Owner. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform Traffic Control Devices" and the state highway department requirements.

F. Provide necessary erosion control measures to prevent siltation of existing pavement or storm drainage facilities to remain.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 CLEARING AND REMOVAL OF TREES AND OTHER VEGETATION

A. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction within the limits of work. Removal includes digging out stumps and roots. Do not remove items elsewhere on site or premises unless specifically indicated.

B. Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping. Topsoil shall consist of sandy clay surficial soil found in depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other objectionable material.

C. Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Dispose of unsuitable or excess topsoil same as specified for waste material, unless otherwise specified by Owner.

D. Completely remove stumps, roots, and other debris below proposed subgrade elevation. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is required. Place fill material in horizontal layers not exceeding 8-inches loose depth, and thoroughly compacted per fill requirements of this section.

E. Remove existing above grade and below grade improvements and abandoned underground piping or conduit necessary to permit construction and other work.

END OF SECTION

SECTION 02200
EXCAVATION, FILLING AND GRADING

1. SCOPE:

Under this heading shall be included the following:

a) Excavation required for structures.
b) Sub-cut excavation as required or designated.
c) Excavation as required for roadways.
d) Shoring, sheeting and bracing as required.
e) Wasting and disposal of excess or unsuitable materials.
f) Furnishing and placing borrow material.
g) Furnishing and placing granular foundation material.
h) Compaction of all materials.
i) Dewatering or unwatering as necessary to complete the excavations to the required depths and as necessary to maintain the excavation sufficiently dry so that all work can be accomplished.
j) Site grading as required, including excavation and backfill.
k) Preparation of subgrades.
l) All other work specified herein.

2. GENERAL:

The Contractor shall accept the site in its existing condition, and shall assume the risk of encountering whatever materials as may occur.

3. SOILS:

The Contractor shall make his own determination of the soil structure and site conditions as it may affect the work. If soils information is provided by the Owner it is for guidance only and shall not serve as relief for the Contractor in complying with the previous statement.

4. DEWATERING AND PROTECTION AGAINST WATER:

The Contractor shall remove water from the site and shall lower the ground water level as necessary to complete the excavations to the required depths and as required to maintain the excavations sufficiently dry so that all required work can be accomplished. The Contractor shall do such well construction, well pointing, sheeting, ditching, diking and pumping and shall construct necessary drains, channels, sumps and cofferdams to keep his excavations and new structures clear of ground water, storm water or sewage and to keep his construction areas dry during the progress of the work and until the finished work is accepted by the Owner, except as otherwise specified.

The Contractor shall be responsible for the effect of dewatering operations on adjacent property and for the effect on water supplies located in the vicinity of the project.

Adequate measures and protection shall be provided by the Contractor to protect his work from damage from uplift due to ground water, storm water, or flood water. Any damages which may result shall be the Contractor's responsibility.

The Contractor shall accept all responsibility for damage to the work of this Contract because of floods and water pressures and other water damages and shall accept all risks of floods and other events which may occur.

All water discharged by pumping operations shall be discharged so as not to interfere with work under this Contract or with existing structures and operations. Route of dewatering pipe shall be subject to the Engineer's review. Discharge facilities and water quality shall comply with applicable regulations of State and Federal agencies.

Dewatering operations shall be uninterrupted and continuous during the course of the work so as not to endanger any construction in place or to present a hazard to workmen in and around the site. The Contractor shall take all measures necessary including, but not limited to, standby equipment and constant attendance to ensure that the dewatering system remains operational and effective throughout the period of time that it is required.

5. MATERIALS:

a) Earth Fill.

Earth fill, including pavement subgrades, shall consist of all suitable materials from required excavations. Suitable materials for earth fill shall generally be composed of sands, clay-sand mixtures and silt-sand mixtures. Clay-sand and silt-sand mixtures shall be approved by the soil technician prior to being incorporated in fills. Clays, silts, and organic soils will be considered as unsuitable materials.

b) Excavated Materials.

All suitable materials from excavations shall be used in the permanent construction required under these Specifications. Suitable materials shall be excavated separately from materials to be wasted and the suitable materials shall be segregated by loads during the excavation operations and shall be placed in temporary stockpiles and later placed in the designated locations. Excavated materials, which, after drainage, are suitable for the embankment but which, when excavated are too wet for immediate compaction in the embankment, shall be placed temporarily in stockpiles until the moisture content is reduced sufficiently to permit them to be placed in the earth fills.

c) Excess Materials.

All excess material from required excavations shall be removed from the site unless written authorization is given by the Owner to stockpile the material on the site.

6. EXCAVATION:

Excavation shall include the loosening, loading, removing, transporting, stockpiling and disposing of all materials, wet or dry, necessary to be removed to construct all structures included in this Contract to the lines and grades, and at the locations, shown on the Contract Drawings.

Excavation for structures shall conform to the depth and dimensions necessary for the proper installation of all structures detailed on the Contract Drawings. Unless shown on the Drawings excavation shall not be carried below the elevations shown on the Drawings. Where bottoms of excavations are slightly unstable and the Drawings do not require a stabilized granular backfill and the Owner=s representative does not direct additional excavation and replacement, the Contractor may provide a gravel course, but such work will be considered as for the Contractor's convenience and will not be considered as extra work.

Where any unauthorized excavation is made below the elevation indicated on the Contract Drawings, the excavation shall be restored to the proper elevation with compacted, well graded granular backfill. Such backfill shall be compacted as specified in the Article entitled "Compaction".

Excavations shall be made to the required depths, grades, alignment, and trench widths required for the installation of the pipe. Temporary sheeting and bracing shall be used as required to confine the trench size and width.

Excavation shall be made for roadways and other site work to the required depths, grades and alignment.

Excavations, where conditions require, shall be properly shored, sheeted and braced by the Contractor to maintain excavation in a condition to permit the safe and efficient installation of all items of Contract work. Upon completion of the various Contract items, all temporary forms, shores and bracing shall be removed. While being withdrawn, all voids left by the sheeting and bracing shall be carefully filled with sand and compacted.

7. UNSUITABLE MATERIAL:

Where material encountered is unsuitable for subgrade construction of roads, buildings and walks, such material shall be excavated to the required depth of compaction (generally two feet below pavement base course or finished floor elevation), disposed of off the site and property of the Owner and replaced with suitable material. Unsuitable materials are those classified as MH, CH, OH, OL, and Peat in accordance with the Unified Soil Classification System. Excess water in material will not be a basis for establishing unsuitable material regardless of gradation. The Owner=s representative shall be notified immediately upon encountering of unsuitable material.

8. BORROW:

It is anticipated that some suitable material for required fill and backfill can be obtained from required excavation. Additional suitable materials shall be secured by the Contractor from off-site sources acceptable to the Owner.

9. BACKFILLING:

All excavation shall be backfilled to the lines and grades shown on the Contract Drawings. Backfill adjacent to structures shall not be placed until forms, form lumber and all debris from construction has been entirely removed from around the work. No backfilling shall be done in unsuitable weather or over ground that is frozen or too wet.

Backfill shall not be placed against structures until the concrete has cured at least 7 days. Backfill, in general, shall be placed in horizontal layers not in excess of 12 inches in thickness, except in the cases of embankment construction around structures and under roadway and piping locations, where backfill shall be placed in 6 inch layers, with each layer thoroughly compacted as specified hereinafter, prior to the addition of the succeeding layer.

Fill immediately adjacent to walls shall be hand tamped and special care shall be taken to prevent any wedging action or eccentric loading against the walls.

Fill material shall be suitable material taken from the excavation. All sticks, debris, organic matter, frozen material, stones or cobbles over 6 inches in maximum dimension, and other deleterious material shall be removed from the backfill material prior to its use.

10. COMPACTION:

a) General.

Compaction of earth fill and all pavement subgrades shall be performed to the percentages of maximum standard or modified dry densities and to the depths as shown on the drawing or as follows:

1. Subgrades Under Paved Areas, Sidewalks and Structures.

   100 Percent Standard (ASTM Test D698) 24 inches

2. Unpaved Areas To Be Grassed Or Sodded.

   Match existing undisturbed soil compaction.

b) Moisture Content.

All compaction shall be performed at material moisture contents within 3 percentage points, plus or minus of optimum. Compaction and proof rolling equipment shall be as outlined in Section 02500 or as may be required for the type of fill being compacted.

11. TESTING:

a) General.

The Contractor will select a qualified independent testing laboratory for the purpose of identifying soils, checking densities, and classifying soils materials during construction. Payment for the testing will be by Contractor with the cost included in other items of the work.

The Contractor shall include the cost of one compaction test per 500 cubic yards of fill material, 300 linear feet of curb, 200 linear feet of subgrade along pavement centerline and 1,500 square yards of base and one "proctor" test for each type of fill material to determine if the proper compaction has been attained.

b) Moisture-Density Tests.

Testing shall be in accordance with ASTM Methods D698 or such other test as approved by the Engineer. A test shall be performed on each type of material used in the work regardless of source. Tests will be accompanied by particle-size analyses of the soils tested (ASTM Methods D421 and D422). Changes in color, gradation, plasticity or source of fill material will require the performance of additional tests. Copies of all test results shall be furnished to the Owner=s representative.

c) Field Density Tests.

Tests shall be made in accordance with ASTM Method D1556 or such other test as may be approved by the Owner. If any compaction test reveals that fill or backfill is not compacted as specified, the Contractor shall scarify and re-compact as required to achieve the specified density. Additional compaction tests shall be made to verify proper compaction.

d) Submittals.

The soils technicians will submit formal reports of all compaction tests and retests to the Contractor and the Owner as soon as possible upon completion of the required tests.

This report information is to include but not be limited to the following:

1. Date of the test and date submitted.
2. Location of test.
3. Wet weight, moisture content and dry weight of field sample.
4. Description of soil.
5. Maximum dry density and moisture content of the lab sample which best matches the field sample in color, texture, grain size and maximum dry density.
6 Ratio of field dry density to maximum lab dry density expressed as a percentage.
7. Comments concerning the field density passing or failing the specified compaction.
8. Comments about re-compaction if required.

e) Compaction Results.

The soils technician is to advise the Owner=s representative and Contractor immediately of any compaction tests failing to meet the specified minimum requirements. No additional lift is to be placed on a lift with any portion failing.

12. GRADING:

Upon completion of other construction operations, the entire site, within the limits shown on the Drawings, shall be brought to the finished grades shown. All surfaces shall be sloped to the grades indicated and which will provide proper drainage. All surfaces shall be raked smooth and shall be free of all vegetable matter, debris and stones larger than 2-1/2 inches. Allow for thickness of required topsoil.

END OF SECTION 02200

SECTION 02210
EROSION AND SEDIMENT CONTROL

1. GENERAL:

a. RELATED LAND DISTURBING DOCUMENTS:

1. Land Disturbing Activity Permit (LDA) is required for each project over 1.1 acres and is part of the Work associated with the project. The Contractor is required to comply with the best management practices for the control of erosion and sediment from the work site.

2. NPDES Phase 2 General Permit Nos. GAR 100001, GAR 100002, GAR 100003 for the discharge of storm water associated with construction activity for projects one (1) acre and larger is required and is a part of the work associated with this project. Both the Owner and the Contractor are primary permittees (any entity that has submitted a Notice of Intent) of the Erosion, Sedimentation and Pollution Control Plan (ES&PCP). The Owner provides the ES&PCP to the Contractor. A copy of this permit will be provided to the Contractor and the Contractor shall comply with its provisions until the work is completed and accepted by the Owner.

The Contractor cannot start work until seven (7) days after the Owner has filed the Notice of Intent (NOI).

The ES&PCP and Comprehensive Monitoring Plan (CMP) will indicate when, where and how often the site inspection and water testing should be conducted. Inspections will be made by Effingham County.

3. NPDES Phase 2 Stormwater Discharge Permit Fees as required by Rules & Regulations for Water Quality Control Chapter 391-3-6, revised October 2003 is part of the permit requirement. These fees shall be paid prior to the commencement of any land disturbing activity.

b. DESCRIPTION OF WORK:

Under this section shall be included all measures both temporary and permanent to control erosion and sedimentation, and protect all surface waters and property both on and off site. This shall include all labor, materials and equipment necessary to meet the requirements of this Section. The Contractor shall not begin work until he is in full compliance with the LDA Permit that has been approved for the work associated with this project. Failure to install and maintain erosion control and sedimentation on the site shall constitute a violation of this permit for each day on which such failure occurs.

c. EROSION AND SEDIMENTATION ACT - DEFINED:

It is the intent of this Specification that the Project and the Contractor comply with all applicable requirements of the State of Georgia Erosion and Sedimentation Control Act of 1975 as amended and any County or Municipal Soil Erosion Ordinance.

The Manual for Erosion and Sediment Control in Georgia further defines practices and requirements. All erosion and sedimentation control measures must be designed for a 25-year, 24-hour rain event. The Contractor is responsible for maintaining all sediment and erosion control measures on the project site during construction. The Contractor is responsible for any damage caused due to failure to implement these requirements. A Soil Erosion and Sedimentation Control Permit has been obtained by the Owner so that periodic inspections may be made by Effingham County. The Contractor is to cooperate with the person performing these inspections.

d. COORDINATION WITH CONTRACT DRAWINGS:

A Soil Erosion and Sedimentation Control Plan will be provided to the Contractor and is to be implemented as a part of the procedures necessary to implement requirements of the Act and Ordinance.

2 PRODUCTS:

Not applicable to this specification section.

3. EXECUTION:

a. IMPLEMENTATION:

Implementation of the requirements of the Act is based on the following principles:

1. The disturbed area and the duration of exposure to erosion elements should be minimized.

2. Stabilize disturbed areas immediately.

3. Retain or accumulate runoff.

4. Retain sediment.

5. Do not encroach upon watercourses.

4. SYMBOLS:

The Soil Erosion and Sedimentation Control Plan contains standard symbols for the different types of measures for implementing the Act. These symbols are defined for conditions, design criteria and construction specifications in Chapter 6 of the Manual and on the Drawings.

5. SPECIFIC REQUIREMENTS:

a. All erosion and control measures must be installed prior to initiation of construction activity.

b. A temporary construction egress pad shall be installed and maintained at any point where construction vehicles enter a paved road, street or parking area. The pad shall be used to prevent mud from leaving the construction area. The pad shall be constructed as shown in the Manual for Erosion and Sediment Control.

c. All disturbed areas shall be grassed by sodding or seeding, fertilizing, mulching and watering to obtain a ground cover which prevents soil erosion.

d. All measures installed for sediment control shall be checked at the beginning and end of each day when construction is occurring to ascertain that the measures are in place and functioning properly.

e. Erosion control measures shall be inspected by the Contractor after each rainfall event and at least daily during prolonged periods of continuous rainfall. Contractor shall make repairs and adjustments as necessary to maintain the effectiveness of all sediment and erosion control measures.

f. The contractor shall remove all silt fencing after permanent grassing is established and accepted by the Owner.

END OF SECTION 02210

GENERAL NPDES
PERMIT NO. GAR100002

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

Authorization To Discharge Under The National Pollutant Discharge Elimination System Storm Water Discharges Associated With Construction Activity For Infrastructure Construction Projects

In compliance with the provisions of the Georgia Water Quality Control Act (Georgia Laws 1964, p.416, as amended), hereinafter called the "State Act," the Federal Clean Water Act, as amended (33 U.S.C. 1251 et seq.), hereinafter called the "Clean Water Act," and the Rules and Regulations promulgated pursuant to each of these Acts, new and existing stormwater point sources within the State of Georgia that are required to have a permit, upon submittal of a Notice of Intent, are authorized to discharge stormwater associated with construction activity to the waters of the State of Georgia in accordance with the limitations, monitoring requirements and other conditions set forth in Parts I through VI hereof.

This permit shall become effective on August 1, 2018.

This permit and the authorization to discharge shall expire at midnight, July 31, 2023.

Signed this 16th day of May 2018.

Richard E. Dunn, Director
Environmental Protection Division

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Part I. COVERAGE UNDER THIS PERMIT

A. Permit Area.

This permit regulates point source discharges of stormwater to the waters of the State of Georgia from construction activities, as defined in this permit.

B. Definitions. All terms used in this permit shall be interpreted in accordance with the definitions as set forth in the Georgia Water Quality Control Act (Act) and the Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6 (Rules), unless otherwise defined in this permit:

1. "Best Management Practices" (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted to prevent or reduce the pollution of waters of Georgia. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

2. "Buffer" means the area of land immediately adjacent to the banks of State waters in its natural state of vegetation, which facilitates the protection of water quality and aquatic habitat.

3. "Certified Personnel" means a person who has successfully completed the appropriate certification course approved by the Georgia Soil and Water Conservation Commission.

4. "Commencement of Construction" means the initial disturbance of soils associated with clearing, grading, or excavating activities or other construction activities.

5. "Construction Activity" means the disturbance of soils associated with clearing, grading, excavating, filling of land, or other similar activities which may result in soil erosion. Construction activity does not include agricultural and silvicultural practices, but does include agricultural buildings.

6. "CPESC" means Certified Professional in Erosion and Sediment Control with current certification by EnviroCert International, Inc.

7. "CWA" means Federal Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972).

8. "Design Professional" means a professional licensed by the State of Georgia in the field of: engineering, architecture, landscape architecture, forestry, geology, or land surveying; or a person that is a Certified Professional in Erosion and Sediment Control (CPESC) with a current

certification by EnviroCert International, Inc. Design Professionals shall practice in a manner that complies with applicable Georgia law governing professional licensure.

9. "Director" means the Director of the Environmental Protection Division or an authorized representative.

10. "Division" means the Environmental Protection Division of the Department of Natural Resources.

11. "Erosion" means the process by which land surface is worn away by the action of wind, water, ice or gravity.

12. "Erosion, Sedimentation and Pollution Control Plan" or "Plan" means a plan for the control of soil erosion, sediment and pollution resulting from a construction activity.

13. "Filling" means the placement of any soil or solid material either organic or inorganic on a natural ground surface or an excavation.

14. "Final Stabilization" means that all soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures, 100% of the soil surface is uniformly covered in permanent vegetation with a density of 70% or greater, or landscaped according to the Plan (uniformly covered with landscaping materials in planned landscaped areas), or equivalent permanent stabilization measures as defined in the Manual (excluding a crop of annual vegetation and a seeding of target crop perennials appropriate for the region). For infrastructure construction projects on land used for agricultural or silvicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or silvicultural use.

15. "General Contractor" means the operator of the infrastructure construction or site.

16. "Impossible" means the monitoring location(s) are either physically or legally inaccessible, or access would cause danger to life or limb.

17. "Infeasible" means not technologically possible, or not economically practicable and achievable in light of best industry practices.

18. "Infrastructure Construction" or "Infrastructure Construction Project" means construction activities that are not part of a common development that include the construction, installation and maintenance of roadway and railway projects and conduits, pipes, pipelines, substations, cables, wires, trenches, vaults, manholes and similar or related structures for the conveyance of natural gas (or other types of gas), liquid petroleum products, electricity, telecommunications (telephone, data, television, etc.), water, stormwater or sewage.

19. “Infrastructure Company” or “Infrastructure Contractor” means, for the purposes of this Permit, an entity or sub-contractor that is responsible, either directly or indirectly, for infrastructure construction or an infrastructure construction project.

20. “Local Issuing Authority” means the governing authority of any county or municipality which is certified pursuant to Official Code of Georgia Section 12-7-8(a).

21. “Mass Grading” means the movement of earth by mechanical means to alter the gross topographic features (elevations, slopes, etc.) to prepare a site for final grading and the construction of facilities (buildings, roads, parking, etc.).

22. “Nephelometric Turbidity Unit (NTU)” means a numerical unit of measure based upon photometric analytical techniques for measuring the light scattered by fine particles of a substance in suspension.

23. “NOI” means Notice of Intent to be covered by this permit (see Part II).

24. “Normal Business Hours” means Monday thru Friday, 8:00 AM to 5:00 PM, excluding any non-working Saturday, non-working Sunday and non-working Federal holiday.

25. “NOT” means Notice of Termination (see Part VI).

26. “Operator” means the entity that has the primary day-to-day operational control of those activities at the construction site necessary to ensure compliance with Erosion, Sedimentation and Pollution Control Plan requirements and permit conditions.

27. “Other Water Bodies” means ponds, lakes, marshes and swamps which are waters of the State.

28. “Outfall” means the location where stormwater, in a discernible, confined and discrete conveyance, leaves a facility or construction site or, if there is a receiving water on site, becomes a point source discharging into that receiving water.

29. “Owner” means the legal title holder to the real property on which is located the facility or site where construction activity takes place. For purposes of this permit, this definition does not include the legal title holder to property on which the only construction activity planned and being conducted is by a infrastructure company or infrastructure contractor and the legal title holder has no significant control over design and implementation of the construction activity.

30. “Permittee” means any entity that has submitted a Notice of Intent and obtained permit coverage.

31. “Phase” or “Phased” means sub-parts, sections or segments of infrastructure construction sites where the sub-part, section or segment is constructed and stabilized prior to completing the entire construction site.

32. “Point Source” means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure or container from which pollutants are or may be discharged. This term also means sheet flow which is later conveyed via a point source to waters of the State. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

33. “Primary Permittee” means the Owner or the Operator or both of a tract of land for a construction site subject to this permit.

34. “Proper design” and “properly designed” means designed in accordance with the design requirements and specifications contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission (GSWCC) as of January 1 of the year in which the land-disturbing activity was permitted and amendments to the Manual as approved by the GSWCC up until the date of NOI submittal.

35. “Receiving Water(s)” means all perennial and intermittent waters of the State into which the runoff of stormwater from a construction activity will actually discharge, either directly or indirectly.

36. “Roadway Project(s)” means traveled ways including but not limited to roads, sidewalks, multi-use paths and trails, and airport runways and taxiways. This term also includes the accessory components to a roadway project that are necessary for the structural integrity of the roadway and the applicable safety requirements. These accessory components include but are not limited to slopes, shoulders, stormwater drainage ditches and structures, guardrails, lighting, signage, cameras and fences and exclude subsequent landscaping and beautification projects.

37. “Sediment” means solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its site of origin by, wind, water, ice, or gravity as a product of erosion.

38. “Sedimentation” means the action or process of forming or depositing sediment.

39. “Sheet flow” means runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.

40. “Site” or “Construction Site” means a facility of any type on which construction activities are occurring or are to occur which may result in the discharge of pollutants from a point source into the waters of the State.

41. “Stormwater” means stormwater runoff, snow melt runoff, and surface runoff and drainage.

42. “Structural Erosion and Sediment Control Practices” means measures for the stabilization of erosive or sediment producing areas by utilizing the mechanical properties of matter for the purpose of either changing the surface of the land or storing, regulating or disposing of runoff to prevent excessive sediment loss.

43. "Sub-contractor" means an entity employed or retained by the permittee to conduct any type of construction activity (as defined in this permit) at an infrastructure construction site. Sub-contractors must complete the appropriate certification course approved by the Georgia Soil and Water Conservation Commission in accordance with the provisions of O.C.G.A. 12-7-19. Sub-contractors are not permittees unless they meet the definition of either a primary, secondary or tertiary permittee.

44. "Surface Water Drainage Area" means the hydrologic area starting from the lowest downstream point where the stormwater from the construction activity enters the receiving water(s) and following the receiving water(s) upstream to the highest elevation of land that divides the direction of water flow. This boundary will connect back with the stormwater entrance point. Boundary lines follow the middle of the highest ground elevation or halfway between contour lines of equal elevation.

45. "Trout Streams" means waters of the State classified as either primary trout waters or secondary trout waters, as designated in the Rules and Regulations for Water Quality Control, Chapter 391-3-6.

46. "USGS Topographic Map" means a current quadrangle, 7½ minute series map prepared by the United States Department of the Interior, Geological Survey.

47. "Vegetative Erosion and Sediment Control Practices" means measures for the stabilization of erosive or sediment producing areas by covering the soil with: (1) permanent seeding, sprigging or planting, producing long-term vegetative cover; (2) temporary seeding, producing short-term vegetative cover; or (3) sodding, covering areas with a turf of perennial sod forming grass.

48. "Waters Supporting Warm Water Fisheries" means all waters of the State that sustain, or have the potential to sustain, aquatic life but excluding trout streams.

49. "Waters of Georgia" or "Waters of the State" means any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, wetlands, and all other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

C. Eligibility.

1. Construction Activities. This permit authorizes, subject to the conditions of this permit:

a. all discharges of stormwater associated with infrastructure construction projects that will result in contiguous land disturbances equal to or greater than one (1) acre occurring on or before, and continuing after, the effective date of this permit, (henceforth referred to as existing stormwater discharges from construction activities) except for discharges identified under Part I.C.3. Contiguous means areas of land disturbances that are in actual contact to create a connected, uninterrupted area of land disturbance. However, for the

purposes of this permit, contiguous areas of land disturbances include those areas of land disturbances solely separated by drilling and boring activities, waters of the State and adjacent State-mandated buffers, roadways and/or railways. In addition, contiguous areas of land disturbances include all areas of land disturbances at a sole roadway intersection and/or junction;

b. all discharges of stormwater associated with infrastructure construction projects that will result in contiguous land disturbances equal to or greater than one (1) acre occurring after the effective date of this permit, (henceforth referred to as stormwater discharges from construction activities), except for discharges identified under Part I.C.3. Contiguous means areas of land disturbances that are in actual contact to create a connected, uninterrupted area of land disturbance. However, for purposes of this permit, contiguous areas of land disturbances include those areas of land disturbances solely separated by drilling and boring activities, waters of the State and adjacent State-mandated buffers, roadways and/or railways. In addition, contiguous areas of land disturbances include all areas of land disturbances at a sole roadway intersection and/or junction;

c. coverage under this permit is not required for discharges of stormwater associated with infrastructure construction projects that consist solely of routine maintenance for the original purpose of the facility that is performed to maintain the original line and grade and the hydraulic capacity, as applicable. The construction activity shall, as a minimum, implement and maintain best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity is being conducted. In order to be eligible for this exemption the project must comply with the following conditions: (1) no mass grading shall occur on the project, (2) the project shall be stabilized by the end of each day with temporary or permanent stabilization measures, (3) the project shall have a duration of less than 120 calendar days, and (4) final stabilization must be implemented at the end of the maintenance project; and

d. coverage under this permit is not required for discharges of stormwater associated with infrastructure road construction projects that consist solely of routine maintenance for the original purpose of the facility that is performed to maintain the original line and grade and vehicular capacity, as applicable. The construction activity shall, as a minimum, implement and maintain best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity is being conducted. In order to be eligible for this exemption the project must comply with the following conditions: (1) no mass grading shall occur

on the project, (2) the project shall be stabilized by the end of each day with temporary or permanent stabilization measures, (3) the project shall have a duration of less than 120 calendar days, and (4) final stabilization must be implemented at the end of the maintenance project; and

e. coverage under this permit is not required for discharge of stormwater associated with railroad construction projects and emergency re-construction conducted pursuant to the Federal Railway Safety Act, the Interstate Commerce Commission Termination Act and which consist solely of routine maintenance for the original purpose of the facility that is performed to maintain the original line and grade and the hydraulic capacity, as applicable. The construction activity shall, as a minimum, implement and maintain best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation consistent with the requirements of the Federal Railway Safety Act and applicable requirements of the Clean Water Act.

f. coverage under this permit is not required for discharge of stormwater associated with infrastructure road construction projects that consist solely of the installation of cable barriers and guard rail for an existing facility within the existing rights-of-way. The construction activity shall, as a minimum, implement and maintain best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity is being conducted. In order to be eligible for this exemption the project must comply with the following conditions: (1) no mass grading shall occur on the project, (2) the project shall be stabilized by the end of each day with temporary or permanent stabilization measures, and (3) final stabilization must be implemented at the end of the project.

g. coverage under this permit is not required for discharge of stormwater associated with infrastructure construction projects that consist of the installation of buried utility lines and comply with the following conditions: (1) solely installed via vibratory plow, (2) the conduit does not exceed 4 inches in diameter, and (3) occurs within an existing stabilized right-of-way. The construction activity shall, as a minimum, implement and maintain best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity is being conducted. In order to be eligible for this exemption the project must comply with the following conditions: (1) no mass grading shall occur on the project, (2) no tree clearing, (3) no change in grade, (4) the project shall be stabilized by the end of each day with temporary or permanent stabilization measures, and (5) final stabilization must be implemented at the end of the project.

2. Mixed Stormwater Discharges. This permit may only authorize a stormwater discharge from a construction site or construction activities mixed with a stormwater discharge from an industrial source or activity other than construction where:

a. the industrial source or activity other than construction is located on the same site as the construction activity and is an integral part of the construction activity;

b. the stormwater discharges associated with industrial activity from the areas of the site where construction activities are occurring are in compliance with the terms of this permit; and

c. stormwater discharges associated with industrial activity from the areas of the site where industrial activity other than construction are occurring are covered by a different NPDES general permit or individual permit authorizing such discharges and the discharges are in compliance with a different NPDES permit.

3. Limitations on Coverage. The following stormwater discharges from construction sites are not authorized by this permit:

a. stormwater discharges associated with an industrial activity that originate from the site after construction activities have been completed and the site has undergone final stabilization;

b. discharges that are mixed with sources of non-stormwater other than discharges which are identified in Part III.A.2. of this permit and which are in compliance with Part IV.D.7. (non-stormwater discharges) of this permit;

c. stormwater discharges associated with industrial activity that are subject to an existing NPDES individual or general permit. Such discharges may be authorized under this permit after an existing permit expires provided the existing permit did not establish numeric limitations for such discharges; and

d. stormwater discharges from construction sites that the Director (EPD) has determined to be or may reasonably be expected to be contributing to a violation of a water quality standard.

4. Compliance with Water Quality Standards. No discharges authorized by this permit shall cause violations of Georgia's in-stream water quality standards as provided by the Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03.

D. Authorization.

1. Any person desiring coverage under this permit must submit a Notice of Intent (NOI) to the EPD and the NOI must be received by the EPD in accordance with the requirements of Part II,

using the electronic submittal service provided by the EPD, in order for stormwater discharges from construction sites to be authorized.

2. Unless notified by the Director to the contrary, a permittee who submits an NOI in accordance with the requirements of this permit is authorized to discharge stormwater from construction sites under the terms and conditions of this permit fourteen (14) days after the date that the NOI is submitted and confirmation of submittal is received. The Director may deny coverage under this permit and require submittal of an application for an individual NPDES permit or alternative general NPDES permit based on a review of the NOI or other information. Should the Director deny coverage under this permit, coverage under this permit is authorized until the date specified in the notice of denial by the Director.

3. Where a new permittee is to begin work on-site after an NOI for the facility/construction site has been submitted, that new permittee must submit a new NOI in accordance with Part II.

E. Continuing Obligations of Permittees. Unless and until responsibility for a site covered under this permit is properly terminated or ownership changes according to the terms of the permit, the current permittee remains responsible for compliance with all applicable terms of the permit and for any violations of said terms.

Part II. NOTICE OF INTENT REQUIREMENTS

A. Deadlines for Notification.

1. Except as provided in Part II.A.2., II.A.3. and II.A.5., Owners or Operators or both who intend to obtain coverage under this general permit for stormwater discharges from a construction site (where construction activities begin after issuance of this permit), shall submit a Notice of Intent (NOI) in accordance with the requirements of this Part at least fourteen (14) days prior to the commencement of construction activities.

2. For sites where construction activities, subject to this permit, are occurring on the effective date of this permit, the Owner or Operator or both shall submit a re-issuance NOI for an existing construction site in accordance with the requirements of this Part no later than ninety (90) days after the effective date of this permit. Failure to comply with this requirement shall constitute a violation of the Georgia Water Quality Control Act for each day until the Owner or Operator or both submit an initial NOI for a new construction site in accordance with Part II.A.1., comply with the special conditions in Part III., prepare and submit a new Erosion, Sedimentation and Pollution Control Plan in accordance with Part IV., and pay all applicable fees in accordance with Part II.D.

3. A discharger is not precluded from submitting an NOI in accordance with the requirements of this Part after the dates provided in Parts II.A.1. or II.A.2. of this permit. In such instances, EPD may bring an enforcement action for failure to submit an NOI in a timely manner or for any unauthorized discharges of stormwater associated with construction activity that have occurred on or after the dates specified in Part II.A.1. and II.A.2.

4. Where an Owner or an Operator or both changes after an NOI has been filed, the subsequent Owner or Operator or both must submit a modification NOI in accordance with this Part by the earlier to occur of (a) seven (7) days before beginning work at the facility/construction site; or (b) thirty (30) days from acquiring legal title to the facility/construction site. In the event a lender or other secured creditor acquires legal title to the facility/construction site, such party must submit a modification NOI in accordance with this Part by the earlier to occur of (a) seven (7) days before beginning work at the facility/construction site; or (b) thirty (30) days from acquiring legal title to the facility/construction site. Stabilization and BMP installation and/or maintenance measures of a disturbed site, by the subsequent Owner or Operator, may occur in advance of filing a new NOI, without violation of this permit. Failure to comply with this requirement shall constitute a violation of the Georgia Water Quality Control Act for each day until the Owner or Operator or both submit an initial NOI for a new construction site in accordance with Part II.A.1., comply with the special conditions in Part III., prepare and submit a new Erosion, Sedimentation and Pollution Control Plan in accordance with Part IV., and pay all applicable fees in accordance with Part II.D.

5. For sites where construction activities will result in land disturbance equal to or greater than one (1) acre that are required as a result of storm- or emergency-related repair work, the Owner or Operator or both shall notify the appropriate EPD District Office within three (3) days of commencement of said construction activities. The Owner or Operator or both shall submit the NOI to the appropriate EPD District Office as soon as possible after the storm- or emergency-related event but no later than fourteen (14) days after the commencement of construction activities and shall submit the Plan in accordance with Part IV.A.6.

B. Notice of Intent Contents.

1. Primary Permittee. A single Notice of Intent for the primary permittee (i.e., one NOI signed by the Owner or the Operator or both) shall be signed in accordance with Part V.G.1. of this permit and shall include the following information:

a. The project construction site name, GPS locations (decimal degrees) of the beginning and end of the infrastructure project, construction site location, city (if applicable) and county of the construction site for which the notification is submitted. The construction site location information must be sufficient to accurately locate the construction site;

b. The Owner's legal name, address, telephone number and email address; and if available, the Operator's legal name, address, telephone number and email address; and if applicable, the Duly Authorized Representative's legal name and/or position name, telephone number and email address;

c. The name, telephone number and email address of the individual to whom the permittee has assigned the responsibility for the daily operational control (i.e., construction superintendent, etc.) of the construction site;

d. The name of the initial receiving water(s) or if unnamed, the first named blue line stream indicated on the appropriate USGS Topographic map, and when the discharge is through a municipal separate storm sewer system (MS4), the name of the local government operating the municipal separate storm sewer system and the name of the receiving water(s) which receives the discharge from the MS4, and the permittee's determination of whether the receiving water(s) supports warm water fisheries or is a trout stream as indicated in the Rules and Regulations for Water Quality Control, Chapter 391-3-6.

e. The name of the receiving water(s) located within one (1) linear mile upstream of and within the same watershed as, any portion of an Impaired Stream Segment identified as "not supporting" its designated use(s) shown on Georgia's most current "305(b)/303(d) List Documents (Approved)" for the criteria violated/cause, "Bio F" (Impaired Fish Community) and/or "Bio M" (Impaired Macroinvertebrate Community), within Category 4a, 4b or 5, and the potential cause is either "NP" (nonpoint source) or "UR" (urban runoff);

f. An estimate of project start date and completion date, a schedule for the timing of the various construction activities, the number of acres of the site on which soil will be disturbed, and the surface water drainage area (if applicable). For projects that began on or before the effective date of this permit, the start date must be the actual start date of construction;

g. The following certification shall be signed in accordance with Part V.G.1. of this permit:

> "I certify that to the best of my knowledge and belief, that the Erosion, Sedimentation and Pollution Control Plan (Plan) was prepared by a design professional, as defined by this permit, that has completed the appropriate certification course approved by the Georgia Soil and Water Conservation Commission in accordance with the provisions of O.C.G.A. 12-7-19 and that I will adhere to the Plan and comply with all permit requirements."

h. The type of construction activity category (from those listed on the NOI) conducted at the site;

i. The location of the receiving water(s) or outfall(s) or a combination of receiving water(s) and outfall(s) to be sampled on a map or drawing of appropriate scale. When it is determined by the primary permittee that some or all of the outfall(s) will be sampled, the applicable nephelometric turbidity unit (NTU) selected from Appendix B (i.e., based upon the size of the construction site and the surface water drainage area) must be shown for each outfall to be sampled.

j. A single NOI with multiple phases or multiple NOIs for multiple phases may be submitted for construction sites with a total planned disturbance greater than 5.0 acres,

provided that each phase shall not be less than 1.0 acre. Phased NOIs shall include all documentation required by this permit for each phase, including fees; and

k. Any other information specified on the NOI in effect at the time of submittal.

C. Notice of Intent Submittal. NOIs are to be submitted to EPD using the electronic submittal service provided by EPD and a copy to the Local Issuing Authority in jurisdictions authorized to issue a Land Disturbance Activity permit for the permittee's construction site pursuant to O.C.G.A. 12-7-1, et seq. The permittee shall retain a copy of the proof of submittal at the construction site or the proof of submittal shall be readily available at a designated alternative location from commencement of construction until such time as a Notice of Termination (NOT) is submitted in accordance with Part VI.

D. Fees. Any applicable fees shall be submitted by the **Primary Permittee** in accordance with Rules and Regulations for Water Quality Control (Rules) promulgated by the Board of Natural Resources. By submitting an NOI for coverage under this permit the primary permittee agrees to pay any fees required, now or in the future, by such Rules authorized under O.C.G.A. Section 12-5-23(a)(5)(A), which allows the Board of Natural Resources to establish a fee system. Fees may be assessed on land disturbing activity proposed to occur on or after the effective date of this permit and shall be paid in accordance with such Rules.

E. Renotification. Upon issuance of a new or different general permit for some or all of the stormwater discharges covered by this permit, the permittee is required to notify the EPD of their intent to be covered by the new or different general permit. The permittee must submit a renewal Notice of Intent in accordance with the notification requirements of the new or different general permit.

PART III. SPECIAL CONDITIONS, MANAGEMENT PRACTICES, PERMIT VIOLATIONS AND OTHER LIMITATIONS

A. Prohibition on Non-Stormwater Discharges.

1. Except as provided in Part I.C.2. and III.A.2., all discharges covered by this permit shall be composed entirely of stormwater.

2. The following non-stormwater discharges may be authorized by this permit provided the non-stormwater component of the discharge is explicitly listed in the Erosion, Sedimentation and Pollution Control Plan and is in compliance with Part IV.D.7.; discharges from fire fighting activities; fire hydrant flushing; potable water sources including water line flushing; irrigation drainage; air conditioning condensate; springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials or pollutants.

3. This permit does not authorize the discharge of soaps or solvents used in vehicle and equipment washing.

4. This permit does not authorize the discharge of wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials.

B. Releases in Excess of Reportable Quantities.

1. The discharge of hazardous substances or oil in the stormwater discharge(s) from a site shall be prevented. This permit does not relieve the permittee of the reporting requirements of Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.), 40 CFR Part 117 and 40 CFR Part 302. Where a release containing a hazardous substance in an amount equal to or in excess of a reporting quantity established under either Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.), 40 CFR 117 or 40 CFR 302 occurs during a 24 hour period, the permittee is required to notify EPD at (404) 656-4863 or (800) 241-4113 and the National Response Center (NRC) at (800) 424-8802 in accordance with the requirements of Georgia's Oil or Hazardous Material Spills or Releases Act (O.C.G.A. §§12-14-2, et seq.), 40 CFR 117 and 40 CFR 302 as soon as he/she has knowledge of the discharge.

This permit does not authorize the discharge of hazardous substances or oil resulting from an on-site spill.

C. Discharges into, or within One Mile Upstream of and within the Same Watershed as, Any Portion of a Biota Impaired Stream Segment.

Any permittee who intends to obtain coverage under this permit for stormwater discharges associated with construction activity into an Impaired Stream Segment, or within one (1) linear mile upstream of and within the same watershed as, any portion of an Impaired Stream Segment identified as "not supporting" its designated use(s), as shown on Georgia's most current "305(b)/303(d) List Documents (Approved)" at the time of NOI submittal, must satisfy the requirements of Part III.C. of this permit if the Impaired Stream Segment has been listed for criteria violated/cause, "Bio F" (Impaired Fish Community) and/or "Bio M" (Impaired Macroinvertebrate Community), within Category 4a, 4b or 5, and the potential cause is either "NP" (nonpoint source) or "UR" (urban runoff). Those discharges that are located within one (1) linear mile of an Impaired Stream Segment, but are not located within the watershed of any portion of that stream segment, are excluded from this requirement. Georgia's "305(b)/303(d) List Documents (Approved)" can be viewed on the EPD website.

1. If a Total Maximum Daily Load (TMDL) Implementation Plan for sediment has been finalized at least six (6) months prior to the permittee's submittal of the NOI, the Erosion, Sedimentation and Pollution Control Plan (Plan) must address any site-specific conditions or requirements included in the TMDL Implementation Plan that are applicable to the permittee's discharge(s) to the Impaired Stream Segment within the timeframe specified in the TMDL Implementation Plan. If the TMDL Implementation Plan establishes a specific numeric wasteload allocation that applies to a permittee's discharge(s) to the Impaired Stream Segment, then the permittee must incorporate that allocation into the Erosion, Sedimentation and Pollution

Control Plan and implement all necessary measures to meet that allocation. A list of TMDL Implementation Plans can be viewed on the EPD website.

2. In order to ensure that the permittee's discharge(s) do not cause or contribute to a violation of State water quality standards, the Plan must include at least four (4) of the following best management practices (BMPs) for those areas of the site which discharge into or within one (1) linear mile upstream and within the same watershed as the Impaired Stream Segment:

a. During all construction activities as defined in this permit, double the width of the 25 foot undisturbed vegetated buffer along all State waters requiring a buffer and the 50 foot undisturbed vegetated buffer along all State waters classified as "trout streams" requiring a buffer. During construction activities, EPD will not grant variances to any such buffers that are increased in width pursuant to this section.

b. Increase all temporary sediment basins and retrofitted stormwater management basins to provide sediment storage of at least 3600 cubic feet (134 cubic yards) per acre drained.

c. Use baffles in all temporary sediment basins and retrofitted stormwater management basins to at least double the conventional flow path length to the outlet structure.

d. A large sign (minimum 4 feet x 8 feet) must be posted on site by the actual start date of construction. The sign must be visible from a public roadway. The sign must identify the following: (1) the construction site, (2) the permittee(s), (3) the contact person(s) along with their telephone number(s), and (4) the permittee-hosted website where the Plan can be viewed. The permittee-hosted website where the Plan can be viewed must be provided on the submitted NOI. The sign must remain on site and the Plan must be available on the provided website until a NOT has been submitted.

e. Use flocculants or coagulants and/or mulch to stabilize all areas left disturbed for more than seven (7) calendar days in accordance with Part III.D.1. of this permit.

f. Conduct turbidity sampling after every rain event of 0.5 inch or greater within any 24 hour period, recognizing the exceptions specified in Part IV.D.6.d. of this permit.

g. Comply with the applicable end-of-pipe turbidity effluent limit, without the "BMP defense" as provided for in O.C.G.A. 12-7-6(a)(1).

h. Reduce the total planned site disturbance to less than 50% impervious surfaces (excluding any State-mandated buffer areas from such calculations). All calculations must be included on the Plan.

i. Limit the amount of disturbed area at any one time to no greater than 25 acres or 50% of the total planned site, whichever is less. All calculations must be included on the Plan.

j. Use "Dirt II" techniques available on the EPD website, to model and manage all construction stormwater runoff (including sheet flow). All calculations must be included on the Plan.

k. Add appropriate organic soil amendments (e.g., compost) and conduct pre- and post-construction soil sampling to a depth of six (6) inches to document improved levels of soil carbon after final stabilization of the construction site.

l. Use mulch filter berms, in addition to a silt fence, on the site perimeter wherever construction stormwater (including sheet flow) may be discharged. Mulch filter berms cannot be placed in waterways or areas of concentrated flow.

m. Use appropriate erosion control slope stabilization instead of concrete in all construction stormwater ditches and storm drainages designed for a 25 year, 24 hour rainfall event.

n. Use flocculants or coagulants under a passive dosing method (e.g., flocculant blocks) within all construction stormwater ditches and storm drainages that feed into temporary sediment basins and retrofitted management basins.

o. Install sod for a minimum 20 foot width (in lieu of seeding) after final grade has been achieved, along the site perimeter wherever construction stormwater (including sheet flow) may be discharged.

p. Conduct soil tests to identify and to implement site-specific fertilizer needs.

q. Certified personnel shall conduct inspections at least once every seven (7) calendar days and within 24 hours of the end of the storm that is 0.5 inches rainfall or greater in accordance with Part IV.D.4.a.(3).(a)–(c) of this permit.

r. Apply the appropriate compost blankets (minimum depth 1.5 inches) to protect soil surfaces until vegetation is established during the final stabilization phase of the construction activity.

s. Use alternative BMPs whose performance has been documented to be superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission).

t. Limit the total planned site disturbance to less than 15% impervious surfaces (excluding any State-mandated buffer areas from such calculations). All calculations must be included on the Plan.

u. Conduct inspections during the intermediate grading and drainage BMP phase and during the final BMP phase of the project by the design professional who prepared the Plan in accordance with Part IV.A.5. of the permit.

v. Install Post Construction BMPs (e.g., runoff reduction BMPs) which remove 80% TSS as outlined in the Georgia Stormwater Management Manual known as the Blue Book or an equivalent or more stringent design manual.

D. Management Practices and Permit Violations.

1. Best management practices, as set forth in this permit, are required for all construction activities, and must be implemented in accordance with the design specifications contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted to prevent or reduce the pollution of waters of Georgia. Proper design, installation, and maintenance of best management practices shall constitute a complete defense to any action by the Director or to any other allegation of noncompliance with Part III.D.4. and Part III.D.5.

2. Except as required to install the initial sediment storage requirements and perimeter control BMPs as described in Part IV.D.3., the initial sediment storage requirements and perimeter control BMPs must be installed and implemented prior to conducting any other construction activities (e.g., clearing, grubbing and grading) within the construction site or when applicable, within phased sub-parts, sections or segments of the construction site. Failure to comply shall constitute a violation of this permit for each day on which construction activities occur. The design professional who prepared the Plan must inspect the initial sediment storage requirements and perimeter control BMPs in accordance with Part IV.A.5. within seven (7) days after installation.

3. Failure to properly design, install, or maintain best management practices shall constitute a violation of this permit for each day on which such failure occurs. BMP maintenance as a result of the permittee's routine inspections shall not be considered a violation for the purposes of this paragraph. If during the course of the permittee's routine inspection BMP failures are observed which have resulted in sediment deposition into waters of the State, the permittee shall correct the BMP failures and shall submit a summary of the violations to EPD in accordance with Part V.A.2. of this permit.

4. A discharge of stormwater runoff from disturbed areas where best management practices have not been properly designed, installed, and maintained shall constitute a separate violation for each day on which such discharge results in the turbidity of receiving water(s) being increased by more than ten (10) nephelometric turbidity units for waters classified as trout streams or more than twenty-five (25) nephelometric turbidity units for waters supporting warm water fisheries, regardless of a permittee's certification under Part II.B.1.i.

5. When the permittee has elected to sample outfall(s), the discharge of stormwater runoff from disturbed areas where best management practices have not been properly designed, installed, and maintained shall constitute a separate violation for each day on which such condition results in the turbidity of the discharge exceeding the value selected from Appendix B applicable to the

construction site. As set forth therein, the nephelometric turbidity unit (NTU) value shall be selected from Appendix B based upon the size of the construction site, the surface water drainage area and whether the receiving water(s) supports warm water fisheries or is a trout stream as indicated in the Rules and Regulations for Water Quality Control, Chapter 391-3-6.

6. Whenever a permittee finds that a BMP has failed or is deficient (beyond routine maintenance) and has resulted in sediment deposition into waters of the State, the permittee shall immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events. The permittee shall submit a summary of the violations to EPD in accordance with Part V.A.2. of this permit and shall correct such BMP as follows:

a. When the repair does not require a new or replacement BMP or significant repair, the BMP failure or deficiency must be repaired within two (2) business days from the time of discovery;

b. When the repair requires a new or replacement BMP or significant repair, the installation of the new or modified BMP must be completed and the BMP must be operational by no later than seven (7) days from the time of discovery. If it is infeasible to complete the installation or repair within seven (7) days, the permittee must document why it is infeasible to complete the installation or repair within the seven (7) day timeframe and document the schedule for installing or repairing the BMPs and making the BMPs operational as soon as feasible after the seven (7) day timeframe.

Part IV. EROSION, SEDIMENTATION AND POLLUTION CONTROL PLAN

A site-specific Erosion, Sedimentation and Pollution Control Plan (Plan) shall be designed, installed and maintained for the entire construction activity covered by this permit. The Erosion, Sedimentation and Pollution Control Plan must be prepared by a design professional as defined by this permit. All persons involved in Plan preparation shall have completed the appropriate certification course, pursuant to O.C.G.A. 12-7-19(b), approved by the Georgia Soil and Water Conservation Commission. The design professional preparing the Plan must include and sign the following certification in the Plan:

"I certify that the permittee's Erosion, Sedimentation and Pollution Control Plan provides for an appropriate and comprehensive system of best management practices required by the Georgia Water Quality Control Act and the document "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted, provides for the sampling of the receiving water(s) or the sampling of the stormwater outfalls and that the designed system of best management practices and sampling methods is expected to meet the requirements contained in the General NPDES Permit No. GAR100002."

The Plan shall include any additional certifications regarding the design professional's site visit in accordance with the Rules for Erosion and Sedimentation Control promulgated by the Board of Natural Resources;

> "I certify under penalty of law that this Plan was prepared after a site visit to the locations described herein by myself or my authorized agent, under my supervision."

The Plan shall include, as a minimum, best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted and O.C.G.A. 12-7-6, as well as the following:

(i). Except as provided in Part IV.(iii). below, no construction activities shall be conducted within a 25 foot buffer along the banks of all State waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except where the Director has determined to allow a variance that is at least as protective of natural resources and the environment in accordance with the provisions of O.C.G.A. 12-7-6, or where a drainage structure or a roadway drainage structure must be constructed, provided that adequate erosion control measures are incorporated in the project plans and specifications and are implemented, or along any ephemeral stream, or where bulkheads and seawalls must be constructed to prevent the erosion of the shoreline on Lake Oconee and Lake Sinclair. The buffer shall not apply to the following activities provided that adequate erosion control measures are incorporated into the project plans and specifications and are implemented:

(1) public drinking water system reservoirs;
(2) fences;
(3) stream crossings for water lines and sewer lines, provided that the stream crossings occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream and cause a width of disturbance of not more than 50 feet within the buffer, and native riparian vegetation is re-established in any bare or disturbed areas within the buffer;
(4) stream crossings for any utility lines of any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in Code Section 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission or distribution of power, provided that: (a) the stream crossings occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream and cause a width of disturbance of not more than 50 feet within the buffer, (b) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (c) the entity is not a secondary permittee for a project located within a common development or sale under this permit;
(5) stream crossings for aerial utility lines, provided that: (a) the new utility line right-of-way width does not exceed 200 linear feet, (b) utility lines are routed and constructed so as to

minimize the number of stream crossings and disturbances to the buffer, (c) only trees and tree debris are removed from within the buffer resulting in only minor soil erosion (i.e., disturbance to underlying vegetation is minimized), and (d) native riparian vegetation is re-established in any bare or disturbed areas within the buffer. The Plan shall include a description of the stream crossings with details of the buffer disturbance including area and length of buffer disturbance, estimated length of time of buffer disturbance, and justification;

(6) right-of-way posts, guy-wires, anchors, survey markers and the replacement or maintenance of existing utility structures within the current right-of-way undertaken or financed in whole or in part by the Department of Transportation, the Georgia Highway Authority or the State Road and Tollway Authority or undertaken by any county or municipality, provided that: (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit; and

(7) right-of-way posts, guy-wires, anchors, survey markers and the replacement or maintenance of existing utility structures within the current right-of-way undertaken by any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in Code Section 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission or distribution of power, provided that: (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit.

(ii). No construction activities shall be conducted within a 50 foot buffer, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, along the banks of any State waters classified as 'trout streams' except when approval is granted by the Director for alternate buffer requirements in accordance with the provisions of O.C.G.A. 12-7-6, or where a roadway drainage structure must be constructed; provided, however, that small springs and streams classified as ‘trout streams’ which discharge an average annual flow of 25 gallons per minute or less shall have a 25 foot buffer or they may be piped, at the discretion of the permittee, pursuant to the terms of a rule providing for a general variance promulgated by the Board of Natural Resources including notification of such to EPD and the Local Issuing Authority of the location and extent of the piping and prescribed methodology for minimizing the impact of such piping and for measuring the volume of water discharged by the stream. Any such pipe must stop short of the downstream permittee's property, and the permittee must comply with the buffer requirement for any adjacent trout streams. The buffer shall not apply to the following activities provided that adequate erosion control measures are incorporated into the project plans and specifications and are implemented:

(1) public drinking water system reservoirs;

(2) fences;
(3) stream crossings for water lines and sewer lines, provided that the stream crossings occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream and cause a width of disturbance of not more than 50 feet within the buffer, and native riparian vegetation is re-established in any bare or disturbed areas within the buffer;
(4) stream crossings for any utility lines of any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in Code Section 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission or distribution of power, provided that: (a) the stream crossings occur at an angle, as measured from the point of crossing, within 25 degrees of perpendicular to the stream and cause a width of disturbance of not more than 50 feet within the buffer, (b) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (c) the entity is not a secondary permittee for a project located within a common development or sale under this permit;
(5) stream crossings for aerial utility lines, provided that: (a) the new utility line right-of-way width does not exceed 200 linear feet, (b) utility lines are routed and constructed so as to minimize the number of stream crossings and disturbances to the buffer, (c) only trees and tree debris are removed from within the buffer resulting in only minor soil erosion (i.e., disturbance to underlying vegetation is minimized), and (d) native riparian vegetation is re-established in any bare or disturbed areas within the buffer. The Plan shall include a description of the stream crossings with details of the buffer disturbance including area and length of buffer disturbance, estimated length of time of buffer disturbance, and justification;
(6) right-of-way posts, guy-wires, anchors, survey markers and the replacement or maintenance of existing utility structures within the right-of-way undertaken or financed in whole or in part by the Department of Transportation, the Georgia Highway Authority or the State Road and Tollway Authority or undertaken by any county or municipality, provided that: (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit; and
(7) right-of-way posts, guy-wires, anchors, survey markers and the replacement or maintenance of existing utility structures within the current right-of-way undertaken by any electric membership corporation or municipal electrical system or any public utility under the regulatory jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in Code Section 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission or distribution of power, provided that: (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) native riparian vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit.

(iii). Except as provided in Part IV(iv) below, no construction activities shall be conducted within a 25 foot buffer along coastal marshlands, as measured horizontally from the coastal marshland-upland interface, as determined in accordance with Part 4 of Article 4 of Chapter 5 of Title 12, the Coastal Marshlands Protection Act of 1970, and the rules and regulations promulgated thereunder, except where the Director determines to allow a variance that is at least as protective of natural resources and the environment in accordance with the provisions of O.C.G.A. 12-7-6, or where otherwise allowed by the Director pursuant to Code Section 12-2-8, or where an alteration within the buffer area has been authorized pursuant to Code Section 12-5-286, or for maintenance of any currently serviceable structure, landscaping, or hardscaping, including bridges, roads, parking lots, golf courses, golf cart paths, retaining walls, bulkheads, and patios, provided that adequate erosion control measures are incorporated into the project plans and specifications and such measures are fully implemented, or where a drainage structure or roadway drainage structure is constructed or maintained, provided that adequate erosion control measures are incorporated into the project plans and specifications and such measures are fully implemented, or on the landward side of any currently serviceable shoreline stabilization structure, or for the maintenance of any manmade stormwater detention basin, golf course pond, or impoundment that is located entirely within the property of a single individual, partnership, or corporation, provided that adequate erosion control measures are incorporated into the project plans and specifications and such measures are fully implemented. The buffer shall not apply to the following activities provided that adequate erosion control measures are incorporated into the project plans and specifications and such measures are fully implemented:

(1) Public drinking water system reservoirs;
(2) Crossings for utility lines that cause a width of disturbance of not more than 50 feet within the buffer;
(3) Any land-disturbing activity conducted pursuant to and in compliance with a valid and effective land-disturbing permit issued subsequent to April 22, 2014, and prior to December 31, 2015;
(4) Any lot for which the preliminary plat has been approved prior to December 31, 2015 if roadways, bridges, or water and sewer lines have been extended to such lot prior to the effective date of this Act and if the requirement to maintain a 25 foot buffer would consume at least 18 percent of the high ground of the platted lot otherwise available for development;
(5) Fences;
(6) Crossings for aerial utility lines, provided that: (a) the new utility line right-of-way width does not exceed 200 linear feet, (b) utility lines are routed and constructed so as to minimize the number of crossings and disturbances to the buffer, (c) only trees and tree debris are removed from within the buffer resulting in only minor soil erosion (i.e., disturbance to underlying vegetation is minimized), and (d) vegetation is re-established in any bare or disturbed areas within the buffer. The Plan shall include a description of the crossings with details of the buffer disturbance including area and length of buffer disturbance, estimated length of time of buffer disturbance, and justification;
(7) Right-of-way posts, guy wires, anchors, survey markers and the replacement and maintenance of existing utility structures within the current right-of-way undertaken or

financed in whole or in part by the Department of Transportation, the Georgia Highway Authority or the State Road and Tollway Authority or undertaken by any county or municipality, provided that: (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit; and

(8) Right-of-way posts, guy wires, anchors, survey markers and the replacement and maintenance of existing utility structures within the current right-of-way by any electric membership corporation or municipal electrical system or any public utility under the regulator jurisdiction of the Public Service Commission, any utility under the regulatory jurisdiction of the Federal Energy Regulatory Commission, any cable television system as defined in Code Section 36-18-1, or any agency or instrumentality of the United States engaged in the generation, transmission or distribution of power, provided that (a) the area of land disturbance does not exceed 100 square feet per structure, (b) the area of buffer vegetation to be cut (not grubbed) does not exceed 1,000 square feet per structure, (c) vegetation is re-established in any bare or disturbed areas within the buffer and (d) the entity is not a secondary permittee for a project located within a common development or sale under this permit.

(iv). Except as provided above, for buffers required pursuant to Part IV.(i). and (ii) and (iii), no construction activities shall be conducted within a buffer and a buffer shall remain in its natural, undisturbed, state of vegetation until all land-disturbing activities on the construction site are completed. During coverage under this permit, a buffer cannot be thinned or trimmed of vegetation and a protective vegetative cover must remain to protect water quality and aquatic habitat and a natural canopy must be left in sufficient quantity to keep shade on the stream bed or marsh.

The Erosion, Sedimentation and Pollution Control Plan shall identify all potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges from the construction site. In addition, the Plan shall describe and the applicable permittee shall ensure the implementation of practices which will be used to reduce the pollutants in stormwater discharges associated with construction activity at the site and to assure compliance with the terms and conditions of this permit. The applicable permittee must implement and maintain the provisions of the Plan required under this part as a condition of this permit.

Except as provided in Part IV.A.2., a single Erosion, Sedimentation and Pollution Control Plan must be prepared by the primary permittee for the infrastructure construction project.

A. Deadlines for Plan Preparation and Compliance.

1. Except as provided in Part IV.A.2.and Part IV.A.6., the Erosion, Sedimentation and Pollution Control Plan shall be completed prior to submitting the NOI and prior to conducting any construction activity by any permittee.

2. For construction activities that began on or before the effective date of this permit and were subject to the regulations under the previous permit, the permittee(s) shall continue to operate under the existing Plan.

3. For construction activities that begin after the effective date of this permit, the primary permittee shall be required to prepare the Plan for that phase of the infrastructure development that corresponds with the NOI being submitted and the primary permittee(s) shall implement the Plan on or before the day construction activities begin.

4. Additional Plan Submittals.

a. For all projects identified under Part I.C.1.b., in a jurisdiction where there is no certified Local Issuing Authority regulating that project, a single copy of the Plan must be submitted to the EPD Watershed Protection Branch and a second copy of the Plan must be submitted to the appropriate EPD District Office prior to or concurrent with the NOI submittal. The second copy of the Plan must be submitted electronically as a Portable Document Format (PDF) file through the electronic submittal service provided by EPD, or by return receipt certified mail or similar service as a PDF on CD-ROM or other storage device to the appropriate EPD District Office. The permittee shall retain a copy of the proof of the submittal at the construction site or the proof of submittal shall be readily available at a designated alternative location from commencement of construction until such a time as a Notice of Termination (NOT) is submitted in accordance with Part VI. The EPD Watershed Protection Branch will review Plans for deficiencies using the applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted

b. For all projects where the construction activity as indicated on the existing NOI has changed, the amended Plans must be submitted in accordance with Part IV.A.4.a. In addition, the permittee must submit a modification NOI in accordance with Part II.

5. For infrastructure projects that begin construction activity after the effective date of this permit, the primary permittee must retain the design professional who prepared the Erosion, Sedimentation and Pollution Control Plan, or an alternative design professional approved by EPD in writing, to inspect the installation of the initial sediment storage requirements and perimeter control BMPs within seven (7) days after installation. Alternatively, for linear infrastructure projects, the primary permittee must retain the design professional who prepared the Erosion, Sedimentation and Pollution Control Plan, or an alternative design professional approved by EPD in writing, to inspect (a) the installation of the sediment storage requirements

and perimeter control BMPs for the *"initial segment"* of the linear infrastructure project and (b) all sediment basins within the entire linear infrastructure project within seven (7) days after installation. For the purposes of the specific requirements in Part IV.A.5., the disturbed acreage of the *"initial segment"* of a linear infrastructure project must be equal to or greater than 10% of the total estimated disturbed acreage for the linear infrastructure project but not less than one (1) acre. The design professional shall determine if these BMPs have been installed and are being maintained as designed. The design professional shall report the results of the inspection to the primary permittee within seven (7) days and the permittee must correct all deficiencies within two (2) business days of receipt of the inspection report from the design professional unless weather related site conditions are such that additional time is required.

6. For storm- or emergency-related repair work, the permittee shall implement appropriate BMPs and certified personnel (provided by the primary permittee) shall inspect at least once every seven (7) calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater. If the storm- or emergency-related repair work will not be completed within sixty (60) days of commencement of construction activity, a single copy of the Plan shall be submitted to EPD and the permittee shall comply with all requirements of this permit on the sixty-first (61st) day.

B. Signature and Plan Review.

1. The Erosion, Sedimentation and Pollution Control Plan shall be signed in accordance with Part IV., and be retained on the site (or, if not possible, at a readily accessible location) which generates the stormwater discharge in accordance with Part IV.F. of this permit.

2. The primary permittee shall make Plans available upon request to the EPD; to designated officials of the local government reviewing soil Erosion, Sedimentation and Pollution Control Plans, grading plans, or stormwater management plans; or in the case of a stormwater discharge associated with construction activity which discharges through a municipal separate storm sewer system with an NPDES permit, to the local government operating the municipal separate storm sewer system.

3. EPD may notify the primary permittee at any time that the Plan does not meet one or more of the minimum requirements of this Part. Within seven (7) days of such notification (or as otherwise provided by EPD), the primary permittee shall make the required changes to the Plan and shall submit to EPD either the amended Plan or a written certification that the requested changes have been made.

C. Keeping Plans Current. The primary permittee(s) shall amend their Plan whenever there is a change in design, construction, operation, or maintenance, which has a significant effect on BMPs with a hydraulic component (i.e., those BMPs where the design is based upon rainfall intensity, duration and return frequency of storms) or if the Plan proves to be ineffective in eliminating or significantly minimizing pollutants from sources identified under Part IV.D.3. of this permit. Amendments to the Plan must be certified by a design professional as provided in this permit.

D. Contents of Plan. The Erosion, Sedimentation and Pollution Control Plan shall include, as a minimum, best management practices, including sound conservation and engineering practices to prevent and minimize erosion and resultant sedimentation, which are consistent with, and no less stringent than, those practices contained in the "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the Georgia Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted, as well as the following:

1. Checklist. Each plan shall include a completed Erosion, Sedimentation and Pollution Control Plan Checklist established by the Georgia Soil and Water Conservation Commission (GSWCC) as of January 1 of the year in which the land-disturbing activity was permitted and amendments to the applicable Checklist as approved by the GSWCC up until the date of the NOI submittal. The applicable checklists are available on the GSWCC website.

2. Site description. Each site-specific Plan shall provide a description of pollutant sources and other information as indicated:

a. A description of the nature of the construction activity;

b. A detailed description and chart or timeline of the intended sequence of major activities which disturb soils for major portions of the site (i.e., initial sediment storage requirements and perimeter BMPs, clearing and grubbing activities, excavation activities, grading activities, infrastructure activities, immediate and final stabilization activities);

c. Estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading, or other activities;

d. An estimate of the runoff coefficient or peak discharge flow of the site prior to the construction activities and after construction activities are completed and existing data describing the soil or the quality of any discharge from the site;

e. A site-specific map or series of drawings indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance, an outline of areas which are not to be disturbed, the location of major structural and nonstructural controls identified in the Plan, the location of areas where stabilization practices are expected to occur, surface waters (including wetlands), and locations where stormwater is discharged to a surface water; and

f. Identify the receiving water(s) and areal extent of wetland acreage at the site;

3. Controls. Each Plan shall include a description of appropriate controls and measures that will be implemented at the construction site including: (1) initial sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) final BMPs. For construction sites where there will be no mass grading and the initial sediment storage

requirements and perimeter control BMPs, intermediate grading and drainage BMPs, and final BMPs are the same, the Plan may combine all of the BMPs into a single phase Plan. The Plan will include appropriate staging and access requirements for construction equipment. The Plan will clearly describe for each major activity identified in Part IV.D.2.b., appropriate control measures and the timing during the construction process that the measures will be implemented. The primary permittee is encouraged to utilize the document, Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, EPA 833-R-060-04, May 2007, when preparing the Plan. The description and implementation of controls shall address the following minimum components:

a. Erosion and sediment controls.

(1). Stabilization measures. A description of interim and permanent stabilization measures, including site-specific scheduling of the implementation of the measures. Site plans should ensure that existing vegetation is preserved and that disturbed portions of the site are stabilized. Stabilization measures may include: temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated shall be included in the Plan. Except as provided in paragraphs IV.D.3.(a).(1).(a). below, stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

(a). Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently cease is precluded by snow cover or other adverse weather conditions, stabilization measures shall be initiated as soon as practicable.

(2). Structural practices. A description of structural practices to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable. Such practices may include silt fences, earth dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins. Structural practices should be placed on upland soils to the degree attainable. The installation of these devices may be subject to Section 404 of the CWA.

(3). Sediment basins. For common drainage locations a temporary (or permanent) sediment basin providing at least 1800 cubic feet (67 cubic yards) of storage per acre drained, or equivalent control measures, shall be provided until final

stabilization of the site. The 1800 cubic feet (67 cubic yards) of storage area per acre drained does not apply to flows from off-site areas and flows from on-site areas that are either undisturbed or have undergone final stabilization where such flows are diverted around both the disturbed area and the sediment basin. For drainage locations where a temporary sediment basin providing at least 1800 cubic feet (67 cubic yards) of storage per acre drained, or equivalent controls is not attainable, sediment traps, silt fences, wood mulch berms or equivalent sediment controls are required for all side slope and down slope boundaries of the construction area. When the sediment fills to a volume at most of 22 cubic yards per acre for each acre of drainage area, the sediment shall be removed to restore the original design volume. This sediment must be properly disposed. Sediment basins may not be feasible at some construction sites. Careful consideration must be used to determine when a sediment basin cannot be used and/or when 67 cubic yards of storage per acre drained is not attainable and a written justification explaining the decision(s) must be included in the Plan. Perennial and intermittent waters of the State shall not be used for temporary or permanent sediment detention.

When discharging from sediment basins and impoundments, permittees are required to utilize outlet structures that withdraw water from the surface, unless infeasible. If outlet structures that withdraw water from the surface are not feasible, a written justification explaining this decision must be included in the Plan. Outlet structures that withdraw water from the surface are temporary BMPs and must be removed prior to submitting Notice of Termination. For construction activities where the NOI was submitted prior to January 1, 2014, this requirement of the permit is not applicable.

(4). Alternative BMPs. The use of alternative BMPs whose performance has been documented to be equivalent or superior to conventional BMPs as certified by a Design Professional may be allowed (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission).

(5). High performance BMPs. The use of infiltration trenches, seep berms, sand filters, dry wells, flocculants or coagulants, etc. for minimizing point source discharges except for large rainfall events is encouraged.

b. Stormwater management. A description of measures that will be installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed. Structural measures should be placed on upland soils to the degree attainable. The installation of these devices may be subject to Section 404 of the CWA. This permit only addresses the installation of stormwater management measures, and not the ultimate operation and maintenance of such structures after the construction activities have been completed and the site has undergone final stabilization. Operators are only responsible for the installation and maintenance of stormwater management measures prior to final stabilization of the site, and are not

responsible for maintenance after stormwater discharges associated with construction activity have been eliminated from the site.

(1). Such practices may include: stormwater detention structures (including wet ponds); stormwater retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff on-site; and sequential systems (which combine several practices). The Plan shall include an explanation of the technical basis used to select the practices to control pollution where flows exceed pre-development levels.

(2). Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel for the purpose of providing a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g., no significant changes in the hydrological regime of the receiving water(s)).

(3). Installation and use of green infrastructure approaches and practices that mimic natural processes and direct stormwater where it can be infiltrated, evapotranspirated or re-used with significant utilization of soils and vegetation rather than traditional hardscape collection, conveyance and storage structures are encouraged to the maximum extent practicable. Green Infrastructure practices or approaches include permeable or porous paving, vegetated swales instead of curbs and gutters, green roofs, tree boxes, rain gardens, constructed wetlands, infiltration planters, vegetated median strips, protection and enhancement of riparian buffers and floodplains, and the overall reduction in site disturbance and impervious area. Design information on Green Infrastructure practices and other ways to manage stormwater can be found in the Georgia Stormwater Management Manual and the Coastal Stormwater Supplement. Additional information on Green Infrastructure can be found at the USEPA website.

c. Other controls.

(1). Waste disposal. Locate waste collection areas away from streets, gutters, watercourses and storm drains. Waste collection areas, such as dumpsters, are often best located near construction site entrances to minimize traffic on disturbed soils. The Plan should include secondary containment around liquid waste collection areas to further minimize the likelihood of contaminated discharges. Solid materials, including building materials, shall not be discharged to waters of the State, except as authorized by a Section 404 permit.

(2). For building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site, provide cover (e.g. plastic sheeting, temporary roofs) to minimize the exposure of these products to precipitation and to stormwater, or a similarly effective means designed to minimize the discharge

of pollutants from these areas. Minimization of exposure is not required in cases where exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk to stormwater contamination (such as final products and materials intended for outdoor use).

(3). Off-site vehicle tracking of dirt, soils, and sediments and the generation of dust shall be minimized or eliminated to the maximum extent practical. The Plan shall include the best management practice to be implemented at the site or construction activity.

(4). Nothing in this permit relieves a permittee from any obligations to comply with all applicable State and/or local regulations of waste disposal, sanitary sewer, septic and petroleum storage systems.

(5). The Plan shall include best management practices for the remediation of all petroleum spills and leaks as appropriate.

(6). The Plan shall include best management practices for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of vehicles. Washout of the drum at the construction site is prohibited. Additional information about best management practices for concrete washout is available at the USEPA website.

(7). All permittees are required to minimize the discharge of pollutants from dewatering trenches and excavations. Discharges are prohibited unless managed by appropriate controls.

4. Inspections.

a. Permittee requirements.

(1). Each day when any type of construction activity has taken place at a primary permittee's site, certified personnel provided by the primary permittee shall inspect: (a) all areas at the primary permittee's site where petroleum products are stored, used, or handled for spills and leaks from vehicles and equipment and (b) all locations at the primary permittee's site where vehicles enter or exit the site for evidence of off-site sediment tracking. These inspections must be conducted until a Notice of Termination is submitted.

(2). Measure and record rainfall within disturbed areas of the site that have not met final stabilization once every 24 hours except any non-working Saturday, non-working Sunday and non-working Federal holiday. The data collected for the purpose of compliance with this permit shall be representative of the monitored activity. Measurement of rainfall may be suspended if all areas of the site have

undergone final stabilization or established a crop of annual vegetation and a seeding of target perennials appropriate for the region.

(3). Certified personnel (provided by the primary permittee) shall inspect the following at least once every fourteen (14) calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater (unless such storm ends after 5:00 PM on any Friday or on any non-working Saturday, non-working Sunday or any non-working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first): (a) disturbed areas of the primary permittee's construction site; (b) areas used by the primary permittee for storage of materials that are exposed to precipitation; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the primary permittee's site shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). For areas of a site that have undergone final stabilization or established a crop of annual vegetation and a seeding of target perennials appropriate for the region, the permittee must comply with Part IV.D.4.a.(4). These inspections must be conducted until a Notice of Termination is submitted.

(4). Certified personnel (provided by the primary permittee) shall inspect at least once per month during the term of this permit (i.e., until a Notice of Termination is submitted to EPD) the areas of the site that have undergone final stabilization or established a crop of annual vegetation and a seeding of target perennials appropriate for the region. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and the receiving water(s). Erosion and sediment control measures identified in the Plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s).

(5). Based on the results of each inspection, the site description and the pollution prevention and control measures identified in the Erosion, Sedimentation and Pollution Control Plan, the Plan shall be revised as appropriate not later than seven (7) calendar days following each inspection. Implementation of such changes shall be made as soon as practical but in no case later than seven (7) calendar days following each inspection.

(6). A report of each inspection that includes the name(s) of certified personnel making each inspection, the date(s) of each inspection, construction phase (i.e., initial, intermediate or final), major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan, and actions taken in accordance with Part IV.D.4.a.(5). of the permit shall be made and retained at the site or be readily available at a designated alternate location until the entire site or

that portion of a construction site that has been phased has undergone final stabilization and a Notice of Termination is submitted to EPD. Such reports shall be readily available by end of the second business day and/or working day and shall identify all incidents of best management practices that have not been properly installed and/or maintained as described in the Plan. Where the report does not identify any incidents, the inspection report shall contain a statement that the best management practices are in compliance with the Erosion, Sedimentation and Pollution Control Plan. The report shall be signed in accordance with Part V.G.2. of this permit.

5. Maintenance. The Plan shall include a description of procedures to ensure the timely maintenance of vegetation, erosion and sediment control measures and other protective measures identified in the site plan.

6. Sampling Requirements. This permit requires the monitoring of nephelometric turbidity in receiving water(s) or outfalls in accordance with this permit. The following procedures constitute EPD's guidelines for sampling turbidity.

a. *Sampling Requirements* shall include the following:

(1). A USGS topographic map, a topographic map or a drawing (referred to as a topographic map) that is a scale equal to or more detailed than a 1:24000 map showing the location of the infrastructure construction; (a) the location of all perennial and intermittent streams and other water bodies as shown on a USGS topographic map, and all other perennial and intermittent streams and other water bodies located during mandatory field verification, into which the stormwater is discharged and (b) the receiving water and/or outfall sampling locations for each representative stormwater outfall. When the permittee has chosen to use a USGS topographic map and the receiving water(s) is not shown on the USGS topographic map, the location of the receiving water(s) must be hand-drawn on the USGS topographic map from where the stormwater(s) enters the receiving water(s) to the point where the receiving water(s) combines with the first blue line stream shown on the USGS topographic map;

(2). A written narrative of site specific analytical methods used to collect and analyze the samples including quality control/quality assurance procedures. This narrative must include precise sampling methodology for each sampling location;

(3). When the permittee has determined that some or all outfalls will be sampled, a rationale must be included on the Plan for the NTU limit(s) selected from Appendix B. This rationale must include the size of the construction site, the calculation of the size of the surface water drainage area, and the type of receiving water(s) (i.e., trout stream or supporting warm water fisheries); and

(4). Any additional information EPD determines necessary to be part of the Plan. EPD will provide written notice to the permittee of the information necessary and the time line for submittal.

b. *Sample Type.* All sampling shall be collected by "grab samples" and the analysis of these samples must be conducted in accordance with methodology and test procedures established by 40 CFR Part 136 (unless other test procedures have been approved), the guidance document titled "NPDES Storm Water Sampling Guidance Document, EPA 833-B-92-001" and guidance documents that may be prepared by the EPD.

(1). Sample containers should be labeled prior to collecting the samples.

(2). Samples should be well mixed before transferring to a secondary container.

(3). Large mouth, well cleaned and rinsed glass or plastic jars should be used for collecting samples. The jars should be cleaned thoroughly to avoid contamination.

(4). Manual, automatic or rising stage sampling may be utilized. Samples required by this permit should be analyzed immediately, but in no case later than 48 hours after collection. However, samples from automatic samplers must be collected no later than the next business day after their accumulation, unless flow through automated analysis is utilized. If automatic sampling is utilized and the automatic sampler is not activated during the qualifying event, the permittee must utilize manual sampling or rising stage sampling during the next qualifying event. Dilution of samples is not required. Samples may be analyzed directly with a properly calibrated turbidimeter. Samples are not required to be cooled.

(5). Sampling and analysis of the receiving water(s) or outfalls beyond the minimum frequency stated in this permit must be reported to EPD as specified in Part IV.E.

c. *Sampling Points*.

(1). For construction activities the primary permittee must sample all perennial and intermittent streams and other water bodies shown on the USGS topographic map and all other field verified perennial and intermittent streams and other water bodies, or all outfalls into such streams and other water bodies, or a combination thereof. However, provided for in and in accordance with Part IV.D.6.c.(2). of this permit, primary permittees on an infrastructure construction project may sample the representative perennial and intermittent streams, other water bodies or outfalls, or a combination thereof. Samples taken for the purpose of compliance with this permit shall be representative of the monitored activity and representative of the water quality of the receiving water(s) and/or the stormwater outfalls using the following minimum guidelines:

(a). The upstream sample for each receiving water(s) must be taken immediately upstream of the confluence of the first stormwater discharge from the permitted activity (i.e., the discharge farthest upstream at the site) but downstream of any other stormwater discharges not associated with the permitted activity. Where appropriate, several upstream samples from across the receiving water(s) may need to be taken and the arithmetic average of the turbidity of these samples used for the upstream turbidity value.

(b). The downstream sample for each receiving water(s) must be taken downstream of the confluence of the last stormwater discharge from the permitted activity (i.e., the discharge farthest downstream at the site) but upstream of any other stormwater discharge not associated with the permitted activity. Where appropriate, several downstream samples from across the receiving water(s) may need to be taken and the arithmetic average of the turbidity of these samples used for the downstream turbidity value.

(c). Ideally the samples should be taken from the horizontal and vertical center of the receiving water(s) or the stormwater outfall channel(s).

(d). Care should be taken to avoid stirring the bottom sediments in the receiving water(s) or in the outfall stormwater channel.

(e). The sampling container should be held so that the opening faces upstream.

(f). The samples should be kept free from floating debris.

(g). Permittees do not have to sample sheet flow that flows onto undisturbed natural areas or areas stabilized by the project. For purposes of this section, stabilized shall mean, for unpaved areas and areas not covered by permanent structures, 100% of the soil surface is uniformly covered in permanent vegetation with a density of 70% or greater, or landscaped according to the Plan (uniformly covered with landscaping materials in planned landscaped areas), or equivalent permanent stabilization measures as defined in the Manual (excluding a crop of annual vegetation and a seeding of target crop perennials appropriate for the region). For infrastructure construction projects on land used for agricultural or silvicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or silvicultural use.

(h). All sampling pursuant to this permit must be done in such a way (including generally accepted sampling methods, locations, timing, and

frequency) as to accurately reflect whether stormwater runoff from the construction site is in compliance with the standard set forth in Parts III.D.3. or III.D.4., whichever is applicable.

(2). For infrastructure construction projects, the permittee is not required to sample a perennial or intermittent stream or other water bodies (or the associated outfall, if applicable) if the design professional preparing the Plan certifies that an increase in the turbidity of a specific identified receiving water to be sampled will be representative of the increase in the turbidity of a specific identified un-sampled receiving water. A written justification and detailed analysis shall be prepared by the design professional justifying such proposed sampling. A summary chart of the justification and analysis for the representative sampling must be included on the Plan. The justification and analysis shall include the location and description of the specified sampled and un-sampled receiving water and shall contain a detailed comparison and discussion of each such receiving water in the following areas:

(a). site land disturbances and characteristics;

(b). receiving water watershed sizes and characteristics; and

(c). site and watershed runoff characteristics utilizing the methods in Appendix A-1 (United States Department of Agriculture Soil Conservation Service's TR-55, Urban Hydrology for Small Watersheds) of the most recent version of the "Manual for Erosion and Sedimentation Control in Georgia" for the various precipitation events and any other such considerations necessary to show that the increase in the turbidity of a specific identified sampled receiving water will be representative of the increases in the turbidity of a specific identified un-sampled receiving waters.

(3). For infrastructure construction projects, when the permittee determines that some receiving water(s) will not be sampled due to representative sampling, the design professional making this determination and preparing the Plan must include and sign the following certification in the Plan:

"I certify that the permittee's Erosion, Sedimentation and Pollution Control Plan provides for the monitoring of: (a) all perennial and intermittent streams and other water bodies shown on the USGS topographic map and all other field verified perennial and intermittent steams and other water bodies, or (b) where any such specific identified perennial or intermittent stream and other water body is not proposed to be sampled, I have determined in my professional judgment, utilizing the factors required in the

General NPDES Permit No. GAR100002, that the increase in the turbidity of each specific identified sampled receiving water will be representative of the increase in the turbidity of a specific identified un-sampled receiving water."

(4). For infrastructure construction projects, if at any time during the life of the project a selected receiving water no longer represents another receiving water, then the permittee shall sample the latter receiving water until selection of an alternative representative receiving water.

(5). For infrastructure construction projects, if at any time during the life of the project a receiving water is determined not to be represented as certified in the Plan, the permittee shall sample that receiving water until a Notice of Termination is submitted or until the applicable phase is stabilized in accordance with this permit.

(6). For infrastructure construction projects, monitoring obligations shall cease for any phase of the project that has been stabilized in accordance with Part IV.D.6.c.(1).(g).

d. *Sampling Frequency*.

(1). The primary permittee must sample in accordance with the Plan at least once for each rainfall event described below. For a qualifying event, the permittee shall sample at the beginning of any stormwater discharge to a monitored receiving water and/or from a monitored outfall location within forty-five (45) minutes or as soon as possible.

(2). However, where manual and automatic sampling are impossible (as defined in this permit), or are beyond the permittee's control, the permittee shall take samples as soon as possible, but in no case more than twelve (12) hours after the beginning of the stormwater discharge.

(3). Sampling by the permittee shall occur for the following qualifying events:

(a). For each area of the site that discharges to a receiving water or from an outfall, the first rain event that reaches or exceeds 0.5 inch with a stormwater discharge that occurs during normal business hours as defined in this permit after all clearing and grubbing operations have been completed, but prior to completion of mass grading operations, in the drainage area of the location selected as the representative sampling location;

(b). In addition to (a) above, for each area of the site that discharges to a receiving water or from an outfall, the first rain event that reaches or exceeds 0.5 inch with a stormwater discharge that occurs during normal business hours as defined in this permit either 90 days after the first sampling event or after all mass grading operations have been completed, but prior to submittal of a NOT, in the drainage area of the location selected as the representative sampling location, whichever comes first;

(c). At the time of sampling performed pursuant to (a) and (b) above, if BMPs in any area of the site that discharges to a receiving water or from an outfall are not properly designed, installed and maintained, corrective action shall be defined and implemented within two (2) business days, and turbidity samples shall be taken from discharges from that area of the site for each subsequent rain event that reaches or exceeds 0.5 inch during normal business hours* until the selected turbidity standard is attained, or until post-storm event inspections determine that BMPs are properly designed, installed and maintained;

(d). Where sampling pursuant to (a), (b) or (c) above is required but not possible (or not required because there was no discharge), the permittee, in accordance with Part IV.D.4.a.(6), must include a written justification in the inspection report of why sampling was not performed. Providing this justification does not relieve the permittee of any subsequent sampling obligations under (a), (b) or (c) above; and

(e). Existing construction activities, i.e., those that are occurring on or before the effective date of this permit, that have met the sampling required by (a) above shall sample in accordance with (b). Those existing construction activities that have met the sampling required by (b) above shall not be required to conduct additional sampling other than as required by (c) above.

*Note that the Permittee may choose to meet the requirements of (a) and (b) above by collecting turbidity samples from any rain event that reaches or exceeds 0.5 inch and allows for sampling at any time of the day or week.

7. Non-stormwater discharges. Except for flows from fire fighting activities, sources of non-stormwater listed in Part III.A.2. of this permit that are combined with stormwater discharges associated with construction activity must be identified in the Plan. The Plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-stormwater component(s) of the discharge.

E. Reporting.

1. The applicable permittees are required to submit the sampling results to the EPD by the fifteenth day of the month following the reporting period. Reporting periods are months during which samples are taken in accordance with this permit. Sampling results shall be in a clearly legible format. Upon written notification, EPD may require the applicable permittee to submit the sampling results on a more frequent basis. Sampling and analysis of any stormwater discharge(s) or the receiving water(s) beyond the minimum frequency stated in this permit must be reported in a similar manner to the EPD. Sampling reports must be submitted to EPD using the electronic submittal service provided by EPD. Sampling reports must be submitted to EPD until such time as a NOT is submitted in accordance with Part VI.

2. All sampling reports shall include the following information:

a. The rainfall amount, date, exact place and time of sampling or measurements;
b. The name(s) of the certified personnel who performed the sampling and measurements;
c. The date(s) analyses were performed;
d. The time(s) analyses were initiated;
e. The name(s) of the certified personnel who performed the analyses;
f. References and written procedures, when available, for the analytical techniques or methods used;
g. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, etc., used to determine these results;
h. Results which exceed 1000 NTU shall be reported as "exceeds 1000 NTU;" and
i. Certification statement that sampling was conducted as per the Plan.

3. All written correspondence required by this permit shall be submitted by return receipt certified mail (or similar service) to the appropriate District Office of the EPD according to the schedule in Appendix A of this permit. The permittee shall retain a copy of the proof of submittal at the construction site or the proof of submittal shall be readily available at a designated location from commencement of construction until such time as a NOT is submitted in accordance with Part VI.

F. Retention of Records

1. The primary permittee shall retain the following records at the construction site or the records shall be readily available at a designated alternate location from commencement of construction until such time as a NOT is submitted in accordance with Part VI:

a. A copy of all Notices of Intent submitted to EPD;
b. A copy of the Erosion, Sedimentation and Pollution Control Plan required by this permit;
c. The design professional’s report of the results of the inspection conducted in accordance with Part IV.A.5. of this permit;

d. A copy of all sampling information, results, and reports required by this permit;
e. A copy of all inspection reports generated in accordance with Part IV.D.4.a. of this permit;
f. A copy of all violation summaries and violation summary reports generated in accordance with Part III.D.2. of this permit; and
g. Daily rainfall information collected in accordance with Part IV.D.4.a.(2). of this permit.

2. Copies of all Notices of Intent, Notices of Termination, inspection reports, sampling reports (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), or other reports requested by the EPD, Erosion, Sedimentation and Pollution Control Plans, records of all data used to complete the Notice of Intent to be covered by this permit and all other records required by this permit shall be retained by the permittee who either produced or used it for a period of at least three years from the date that the NOT is submitted in accordance with Part VI of this permit. These records must be maintained at the permittee's primary place of business or at a designated alternative location once the construction activity has ceased at the permitted site. This period may be extended by request of the EPD at any time upon written notification to the permittee.

Part V. STANDARD PERMIT CONDITIONS

A. Duty to Comply.

1. Each permittee must comply with all applicable conditions of this permit. Any permit noncompliance constitutes a violation of the Georgia Water Quality Control Act (O.C.G.A. §§12-5-20, et seq.) and is grounds for enforcement action; for permit termination; or for denial of a permit renewal application. Failure of a primary permittee to comply with any applicable term or condition of this permit shall not relieve any other primary permittee from compliance with their applicable terms and conditions of this permit.

2. Each permittee must document in their records any and all known violations of this permit at his/her site within seven (7) days of his/her knowledge of the violation. A summary of these violations must be submitted to EPD by the permittee at the addresses shown in Part II.C. within fourteen (14) days of his/her discovery of the violation.

3. Penalties for violations of permit conditions. The Federal Clean Water Act and the Georgia Water Quality Control Act (O.C.G.A. §§12-5-20, et seq.) provide that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit, makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine or by imprisonment, or by both. The Federal Clean Water Act and the Georgia Water Quality Control Act also provide procedures for imposing civil penalties which may be levied for violations of the Acts, any permit condition or limitation established pursuant

to the Acts, or negligently or intentionally failing or refusing to comply with any final or emergency order of the Director.

B. Continuation of the Expired General Permit. This permit expires on the date shown on the cover page of this permit. However, an expired general permit continues in force and effect until a new general permit is issued, final and effective.

C. Need to Halt or Reduce Activity Not a Defense. It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Duty to Provide Information. The permittee shall furnish to the Director; a State agency approving soil Erosion, Sedimentation and Pollution Control Plans, grading plans, or stormwater management plans; or in the case of a stormwater discharge associated with construction activity which discharges through a municipal separate storm sewer system with an NPDES permit, to the local government operating the municipal separate storm sewer system, any information which is requested to determine compliance with this permit. In the case of information submitted to the EPD such information shall be considered public information and available under the Georgia Open Records Act.

F. Other Information. When the permittee becomes aware that he/she failed to submit any relevant facts or submitted incorrect information in the Notice of Intent or in any other report required to be submitted to the EPD, the permittee shall promptly submit such facts or information.

G. Signatory Requirements. All Notices of Intent, Notice of Terminations, inspection reports, sampling reports, or other reports requested by the EPD shall be signed as follows:

1. All Notices of Intent and Notices of Termination shall be signed as follows:

    a. For a corporation: by a responsible corporate officer. For the purpose of this permit, a responsible corporate officer means: (1) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation; or (2) the manager of one or more manufacturing, production or operating facilities provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where

authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

c. For a municipality, State, Federal, or other public facility: by either a principal executive officer or ranking elected official; and

d. Changes to authorization. If an authorization under Part II.B. is no longer accurate, a modification NOI satisfying the requirements of Part II.B. must be submitted to the EPD prior to or together with any inspection reports, sampling reports, or other reports requested by the EPD to be signed by a person described above or by a duly authorized representative of that person.

2. All inspection reports, sampling reports, or other reports requested by the EPD shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person(s) described above and submitted to the EPD;

b. The authorization specifies either an individual or a position having responsibility for specified operation(s) of the regulated facility or activity, such as the position of manager, operator, superintendent, or position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may be either a named individual or any individual occupying a named position); and

c. *Certification.* Reports delineated in Part V.G.2. shall be signed by the permittee or duly authorized representative and shall make the following certification:

"I certify under penalty of law that this report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that certified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the Georgia Hazardous Waste Management Act, O.C.G.A. § 12-8-60, et seq. or under Chapter 14 of Title 12 of the

Official Code of Georgia Annotated; nor is the Operator relieved from any responsibilities, liabilities or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act or Section 106 of Comprehensive Environmental Response Compensation And Liability Act.

I. Property Rights. The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

J. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

K. Other Applicable Environmental Regulations and Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Clean Water Act. Nothing in this permit, unless explicitly stated, exempts the permittee from compliance with other applicable local, state and federal ordinances, rules, regulations, and laws. Furthermore, it is not a defense to compliance with this permit that a local government authority has approved the permittee's Erosion, Sedimentation and Pollution Control Plan or failed to take enforcement action against the permittee for violations of the Erosion, Sedimentation and Pollution Control Plan, or other provisions of this permit.

No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

L. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the required plans. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems, installed by a permittee only when necessary to achieve compliance with the conditions of the permit.

M. Inspection and Entry. The permittee shall allow the Director or an authorized representative of EPA or EPD or, in the case of a construction site which discharges through a municipal separate storm sewer system with an NPDES permit, an authorized representative of the municipal operator of the separate storm sewer system receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;

2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit; and
3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment).

N. Permit Actions. This permit may be revoked and reissued, or terminated for cause including but not limited to changes in the law or regulations. The filing of a request by the permittee for termination of the permit, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

Part VI. TERMINATION OF COVERAGE

A. Notice of Termination Eligibility. Notice of Termination signed in accordance with Part V.G.1. of this permit must be submitted:

1. For infrastructure construction projects, by the permittee where the entire project has undergone final stabilization, all stormwater discharges associated with construction activity that are authorized by this permit have ceased, the site is in compliance with this permit and all temporary BMPs have been removed. The permittee may also submit a Notice of Termination for each phase of the infrastructure project, not to exceed four (4) phases, that have undergone final stabilization and all stormwater discharges associated with construction activity for that phase authorized by this permit have ceased. Except for the final phase, the disturbed acreage for each phase must be equal to or greater than 25% of the total estimated disturbed acreage for the infrastructure project. For the final phase, the disturbed acreage for the final phase must be equal to or greater than 10% of the total estimated disturbed acreage for the infrastructure project. The Notice of Termination for each phase of the infrastructure project must include the GPS locations (decimal degrees) of the beginning and end of each phase and if applicable, a map identifying significant landmarks.

2. By the Owner or Operator or both when the Owner or Operator or both of the site changes. Where stormwater discharges will continue after the identity of the Owner or Operator or both changes, the permittee must, prior to filing the Notice of Termination, notify any subsequent Owner or Operator or both of the permitted site as to the requirements of this permit.

B. Notice of Termination Contents:

1. The NPDES permit number for the stormwater discharge associated with construction activity identified by the Notice of Termination (i.e., GAR100002 – Infrastructure);

2. The project construction site name, site location, GPS locations (decimal degrees) of the beginning and end of the infrastructure construction project or if applicable, of each phase in accordance with Part VI.A.1.,construction site location and if applicable, a map identifying significant landmarks, city (if applicable) and county of the site for which the notification is submitted. This information must correspond to the similar information as provided on the NOI.

The construction site location information must be sufficient to accurately locate the construction site;

3. The owner's legal name, address, telephone number and email address and the operator's legal name, address, telephone and email address;

4. The name of the receiving water(s), and when the discharge is through a municipal separate storm sewer system (MS4), the name of the local government operating the municipal separate storm sewer system and the name of the receiving water(s) which receives the discharge from the MS4;

5. Copies of all sampling reports not previously submitted to EPD and/or a written justification why sampling was not conducted. Copies of all sampling reports may be submitted as a Portable Document Format (PDF) file on CD-ROM or other storage device;

6. Any other information specified on the NOT in effect at the time of submittal; and

7. The following certification signed in accordance with Part V.G.1. (signatory requirements):

> "I certify under penalty of law that either: (a) all stormwater discharges associated with construction activity authorized by this permit have ceased, the site is in compliance with this permit and all temporary BMPs have been removed or; (b) I am no longer an Owner or Operator at the construction site and a new Owner or Operator has assumed operational control of the permitted construction site where I previously had ownership or operational control; and that discharging pollutants in stormwater associated with construction activity to waters of Georgia is unlawful under the Georgia Water Quality Control Act and the Clean Water Act where the discharge is not authorized by a NPDES permit."

C. Notice of Termination Submittal. All Notices of Termination (NOT) required by this permit shall be submitted to EPD using the electronic submittal service provided by EPD and a copy to the Local Issuing Authority in jurisdictions authorized to issue a Land Disturbance Activity permit for the permittee's construction site pursuant to O.C.G.A. 12-7-1, et seq.

APPENDIX A

EPD DISTRICT OFFICES

A. For facilities/construction sites located in the following counties: Bibb, Bleckley, Chattahoochee, Crawford, Dooly, Harris, Houston, Jones, Lamar, Macon, Marion, Meriwether, Monroe, Muscogee, Peach, Pike, Pulaski, Schley, Talbot, Taylor, Troup, Twiggs, Upson

Information shall be submitted to: West Central District Office
Georgia Environmental Protection Division
2640 Shurling Drive
Macon, GA 31211-3576
(478) 751-6612

B. For facilities/construction sites located in the following counties: Burke, Columbia, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Laurens, McDuffie, Montgomery, Richmond, Screven, Treutlen, Warren, Washington, Wheeler, Wilkinson

Information shall be submitted to: East Central District Office
Georgia Environmental Protection Division
3525 Walton Way Extension
Augusta, GA 30909-1821
(706) 667-4343

C. For facilities/construction sites located in the following counties: Baldwin, Banks, Barrow, Butts, Clarke, Elbert, Franklin, Greene, Hall, Hancock, Hart, Jackson, Jasper, Lincoln, Madison, Morgan, Newton, Oconee, Oglethorpe, Putnam, Stephens, Taliaferro, Walton, Wilkes

Information shall be submitted to: Northeast District Office
Georgia Environmental Protection Division
745 Gaines School Road
Athens, GA 30605-3129
(706) 369-6376

D. For facilities/construction sites located in the following counties: Carroll, Clayton, Coweta, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Heard, Henry, Rockdale, Spalding

Information shall be submitted to: Mountain District - Atlanta Satellite
Georgia Environmental Protection Division
4244 International Parkway, Suite 114
Atlanta, GA 30354-3906
(404) 362-2671

E. For facilities/construction sites located in the following counties: Bartow, Catoosa, Chattooga, Cherokee, Cobb, Dade, Dawson, Fannin, Floyd, Forsyth, Gilmer, Gordon, Habersham, Haralson, Lumpkin, Murray, Paulding, Pickens, Polk, Rabun, Towns, Union, Walker, White, Whitfield

Information shall be submitted to: Mountain District - Cartersville Office
Georgia Environmental Protection Division
P.O. Box 3250
Cartersville, GA 30120-1705
(770) 387-4900

F. For facilities/construction sites located in the following counties: Appling, Atkinson, Bacon, Brantley, Bryan, Bulloch, Camden, Candler, Charlton, Chatham, Clinch, Coffee, Effingham, Evans, Glynn, Jeff Davis, Liberty, Long, McIntosh, Pierce, Tattnall, Toombs, Ware, Wayne

Information shall be submitted to: Coastal District - Brunswick Office
Georgia Environmental Protection Division
400 Commerce Center Drive
Brunswick, GA 31523-8251
(912) 264-7284

G. For facilities/construction **sites located in the following counties:** Baker, Ben Hill, Berrien, Brooks, Calhoun, Clay, Colquitt, Cook, Crisp, Decatur, Dodge, Dougherty, Early, Echols, Grady, Irwin, Lanier, Lee, Lowndes, Miller, Mitchell, Quitman, Randolph, Seminole, Stewart, Sumter, Telfair, Terrell, Thomas, Tift, Turner, Webster, Wilcox, Worth

Information shall be submitted to: Southwest District Office
Georgia Environmental Protection Division
2024 Newton Road
Albany, GA 31701-3576
(229) 430-4144

H. For facilities/construction sites required to submit Plans required under Part IV.A.4.a. of this Permit:

Information shall be submitted to: Watershed Protection Branch
Environmental Protection Division
2 Martin Luther King Jr. Drive
Suite 1462 East
Atlanta, Georgia 30334
(404) 463-1511

APPENDIX B

Nephelometric Turbidity Unit (NTU) TABLES

Trout Streams

Site Size, acres	Surface Water Drainage Area, square miles							
	0-4.99	5-9.99	10-24.99	25-49.99	50-99.99	100-249.99	250-499.99	500+
1.00-10	25	50	75	150	300	500	500	500
10.01-25	25	25	50	75	150	200	500	500
25.01-50	25	25	25	50	75	100	300	500
50.01-100	20	25	25	35	59	75	150	300
100.01+	20	20	25	25	25	50	60	100

Waters Supporting Warm Water Fisheries

Site Size, acres	Surface Water Drainage Area, square miles							
	0-4.99	5-9.99	10-24.99	25-49.99	50-99.99	100-249.99	250-499.99	500+
1.00-10	75	150	200	400	750	750	750	750
10.01-25	50	100	100	200	300	500	750	750
25.01-50	50	50	100	100	200	300	750	750
50.01-100	50	50	50	100	100	150	300	600
100.01+	50	50	50	50	50	100	200	100

To use these tables, select the size (acres) of the construction site. Then, select the surface water drainage area (square miles). The NTU matrix value arrived at from the above tables is the one to use in Part III.D.4.

Example 1: For a site size of 12.5 acres and a "trout stream" drainage area of 37.5 square miles, the NTU value to use in Part III.D.4. is 75 NTU.

Example 2: For a site size of 51.7 acres and "waters supporting warm water fisheries" drainage area of 72 square miles, the NTU value to use in Part III.D.4. is 100 NTU.

SECTION 02221
EXCAVATION, TRENCHING AND BACKFILL FOR UTILITY SYSTEMS

1. SCOPE:

Under this heading shall be included the excavation, trenching and backfilling required for all underground utility systems.

Utility systems include sanitary sewers, storm sewers, water piping and force mains.

2. GENERAL:

Underground piping and utility systems which are to be installed in trenches whose lowest point of excavation is below the existing ground level, and are unaffected by an excavation for structures, may be installed at any time during the course of the work. Piping and systems to be installed in or over fill, backfill or new embankments shall not be installed until all earthwork has been completed to rough grade, nor until settlement of the fill or embankment has taken place.

Braced and sheeted trenches and open trenches shall comply with all state laws and regulations, and local ordinances relating to safety, life, health and property. Also, this shall conform to the Occupational Safety and Health Standards for Excavations, Final Rule (29 CFR Part 1926) as printed in the October 31, 1989 issue of the Federal Register.

The sides and bottoms of the trenches shall be protected against any instability which may interfere with the proper laying of the pipe and as necessary for the safety of the workmen and others and as may be necessary to protect adjacent structures. Protective systems for trenches shall be utilized by the Contractor and shall conform with Section 1926.652, 29 CFR Part 1926, Final Rule.

3. LOCATION AND PROTECTION OF UTILITIES AND STRUCTURES:

It shall be the responsibility of the Contractor to acquaint himself with the location of all utilities and structures both present and proposed, also all existing surface structures which may be affected by work under the Contract. The location of any underground structures furnished, shown on the Drawings or given on the site are based upon the available records but are not guaranteed to be complete or correct, and are given only to assist the Contractor in making a determination of the existence of underground structures.

Overhead utilities, poles, etc., shall be protected against damage by the Contractor, and if damaged by the Contractor, shall be replaced by him. The Contractor shall notify those who maintain utilities sufficiently in advance of the proposed construction so that they may locate, uncover and disclose such work.

The Contractor shall provide for the continuance of the flow of any sewers, drains, water pipes, and water courses, and the like. Where such facilities, water courses, or electric overhead

wires or conduits are interfered with by the work of the Contractor, the interruption shall be a minimum and shall be scheduled in advance with the Engineer and the utility owner.

The Contractor shall restore all facilities interfered with to their original condition or acceptable equivalent. The cost of such restoration or damage caused directly by his work shall be paid for by the Contractor and shall be included in the prices bid for the items to which it pertains.

4. EXCAVATION AND TRENCHING:

a) Excavation.
Excavate all materials encountered.

b) Caution in Excavation.
The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures in the trench zone may be determined before being damaged. He shall be held responsible for the repair or replacement of such structures when broken or otherwise damaged because of his operations.

c) Subsurface Explorations:
The Contractor shall make explorations and excavations at no additional charge to the Owner to determine the location of existing underground structures.

d) Depth of Trench.
Utilities and other piping shall be laid in open trenches as shown and specified. Trenches shall be excavated to the designated lines and grades, beginning at the outlet end and progressing toward the upper end in each case.

e) Minimum Width of Trench.
Trenches shall be of minimum width to provide ample working space for making joints and tamping backfill. Sides of trenches shall be closely vertical to top of pipe and shall be sheet piled and braced where soil is of unstable nature. Above the top of the pipe, trenches may be sloped. The width of the trench above this level may be wider for sheeting and bracing and the performance of the work. Minimum width shall comply with ASTM D2321. Minimum width shall not be less than the greater of either the pipe outside diameter plus 16-inches or the pipe outside diameter times 1.25, plus 12-inches.

f) Alignment and Grade.
Trenches shall be excavated on the alignments shown on the Drawings, and to the depth and grade necessary to accommodate the pipes at the elevations shown. Where elevations of the invert or centerline of a pipe are shown at the ends of a pipe, the pipe shall be installed at a continuous grade between the two elevations.

g) Over Excavation.

Excavation in excess of the depth required for proper shaping shall be corrected by bringing to grade the invert of the ditch with compacted coarse, granular material at no additional expense to the Owner. Bell holes shall be excavated to relieve bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel.

Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a sub-foundation of 1500 psi concrete, at no additional expense to the Owner.

If trenches are excavated to widths in excess of those specified, or if the trench walls collapse, the pipe shall be laid in accordance with the next better class of bedding at the expense of the Contractor.

h) Rock Excavation:

Stones found in trench shall be removed for a depth of at least six (6) inches below the bottom of the pipe.

5. TRENCHES:

Trenches shall be maintained in a safe condition to prevent hazardous conditions to persons working in or around the trench.

Braced and sheeted trenches and open trenches shall comply with all State and Federal Laws and Regulations, and local ordinances relating to safety, life, health and property.

The top portion of the trench may be excavated with sloping or vertical sides to any width which will not cause damage to adjoining structures, roadways, utilities, etc. The bottom of the trenches shall be graded to provide uniform bearing and support each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections excavated for bell holes and for the sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and in order that the pipe rests upon the trench bottom for its full length and shall be only of such length, depth and width for making the particular type of joints. The bottom of the trench shall be rounded so that at least the bottom one-third of the pipe shall rest on undisturbed earth for the full length of the barrel as jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying by workmen skilled in this type of work.

The sides of all trenches and excavation for structures shall be held by stay bracing, or by skeleton or solid sheeting and bracing according to conditions encountered, to protect the excavation, adjoining property and for the safety of personnel. Bracing and shoring may be removed when the level of the backfilling has reached the elevation to protect the pipe work and adjacent property. When sheeting or shoring above this level cannot be safely removed, it may be left in place. Timber left in place shall be cut off at least 2 feet below the surface.

6. DEWATERING AND PROTECTION AGAINST WATER:

The Contractor shall remove water from the site and shall lower the ground water level as necessary to complete the excavations to the required depths and so that all required work can be accomplished in the dry. The Contractor shall do such well construction, well pointing, sheeting, ditching, and pumping, and shall construct necessary drains, channels and sumps to keep his excavations and new structures clear of ground water, storm water or sewage and to keep his construction areas dry during the progress of the Work.

Adequate measures and protection shall be provided by the Contractor to protect his work from damage from uplift due to ground water, storm water, or flood water. Any damages which may result shall be the Contractor's responsibility.

The Contractor shall accept all responsibility for damage to the work of this Contract because of floods and water pressures and other water damages and shall accept all risks of floods and other events which may occur.

All water discharged by pumping operations shall be discharged so as not to interfere with work under this Contract or with existing structures and operations. Water from dewatering operations shall be conveyed to the existing drainage features, using piping and pumping facilities provided by the Contractor.

Route of dewatering pipe shall be subject to the Engineer's review. Discharge facilities and water quality shall comply with applicable regulations of State and Federal agencies.

Dewatering operations shall be uninterrupted and continuous during the course of the work so as not to endanger any construction in place or to present a hazard to workmen in and around the site. The Contractor shall take all measures necessary including, but not limited to, standby equipment and constant attendance to ensure that the dewatering system remains operational and effective throughout the period of time that it is required.

No water shall be allowed to run over any uncompleted portions of the work. No units of the work shall be constructed under water. The cost of dewatering shall be included in the price bid for the item of work for which it is required.

7. PILING EXCAVATED MATERIALS:

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing roadways.

8. LIMIT TO LENGTH OF OPEN TRENCH:

Backfill or properly secure all open trenches at the end of work day.

9. REMOVAL OF UNSUITABLE MATERIAL:

Removal of unsuitable material will be based on the following requirements:

a) Unsuitable materials for bedding and backfilling are those classified as MH, CH, OL, OH and PT in accordance with the Unified Soil Classification System. Excavated soils that are too wet to compact shall not be classified unsuitable due to high moisture content alone. Where, in the opinion of the Engineer, the subgrade of the pipe trench is unsuitable material, the Contractor shall remove the unsuitable material 6" deep and furnish and place stone backfill in the trench to stabilize the subgrade. Attention is invited to the fact that the presence of water does not necessarily mean that stone backfill is required. If well points or other types of dewatering will remove the water, the Contractor shall be required to completely dewater the trench in lieu of stone backfill. Stone backfill will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Stone shall be placed 6" deep and the width of the trench. The pipe shall be carefully bedded in the stone as specified or in accordance with the manufacturer's recommendations.

b) When the trench is excavated to the plan depth or as required by these Specifications, and soft or other material not suitable for bedding purposes is encountered in the trench, the Contractor shall immediately notify the Engineer for inspection and measurement of the unsuitable material to be removed.

c) No overdepth excavation or backfilling of the overdepth excavated trench shall start until proper measurements of the trench have been taken by the Engineer for the determination of the quantity in cubic yards of unsuitable material excavated. Backfill material and backfilling shall conform to the requirements specified in Article 12 below.

d) No payment will be made for any overdepth excavation of soft unstable material due to the failure of the Contractor to provide adequate means to keep the trench dry.

e) No payment will be made for any overdepth excavation of the unsuitable material and replacement not inspected and measured by the Engineer prior to excavation.

10. BEDDING OF DUCTILE IRON PIPE:

Pipe shall be laid on foundations prepared in accordance with ASTM C12 as modified herein, and in accordance with the various classes of bedding required by the trench width and trench depth for the size of pipe to be laid.

a) Class "A" Bedding.

Class "A" Bedding shall be achieved by either of the following two construction methods:

1. Concrete Cradle.

The pipe shall be bedded in a monolithic cradle of plain or reinforced concrete having a minimum thickness under the pipe barrel of one-fourth the inside diameter of the pipe but in no case less than 4 inches and extending up the sides to a height of at least one-fourth of the pipe outside diameter. The cradle shall have a width equal to the full width of the trench as excavated. The pipe shall be laid to line and grade on concrete blocking after which the concrete shall be placed to the limits described. Concrete shall be 3,000 psi concrete.

2. Concrete Arch.

The pipe shall be bedded in crushed stone or rounded gravel bedding material having a minimum thickness under the pipe barrel of one-fourth the outside diameter of the pipe but in no case less than 4 inches and shall extend up the sides of the pipe to the horizontal centerline. The top half of the pipe shall be covered with a monolithic plain or reinforced concrete arch having a thickness of one-fourth the inside diameter of the pipe but in no case less than 4 inches at the crown of the pipe. The arch shall have a width equal to the full width of the trench as excavated.

b) Class "B" Bedding.

Class "B" Bedding shall be achieved by either of two construction methods:

1. The bottom of the trench excavation shall be shaped to conform to a cylindrical surface with a radius at least 2 inches greater than the radius of the outside of pipe with a width sufficient to allow 6/10 of the width of the pipe barrel to be bedded in fine granular fill placed in the shaped excavation. Carefully compacted backfill shall be placed at the sides of the pipe to a thickness of at least 12 inches above the top of the pipe.

2. The pipe may be bedded in compacted crushed stone, placed on a flat trench bottom. The crushed stone bedding shall have a minimum thickness of 3 the outside pipe diameter and shall extend halfway up the pipe barrel at the sides. The remainder of the side fills and a minimum depth of 12 inches over the top of the pipe shall be filled with carefully compacted material.

c) Class "C" Bedding.

Class "C" Bedding shall be achieved by either of two construction methods:

1. The pipe shall be bedded in an earth foundation formed in the trench bottom by a shaped excavation which will fit the pipe barrel with reasonable closeness for a width of at least 50 percent of the outside pipe diameter. The side fills and area over the pipe to a minimum of 12 inches above the top of the pipe and shall be filled with compacted fill.

2. The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of 4 inches under the barrel and shall extend 1/6 of the outside diameter up the pipe barrel at the sides. The remainder of the side fills and area to a minimum depth of 12 inches over the top of the pipe shall be filled with compacted backfill. Class "C" Bedding shall be used except where the use of Class "A" or Class "B" bedding is shown on the Drawings.

d) Class "D" Bedding.

Class "D" Bedding is achieved by shaping bell holes only on a flat trench and no care is taken to secure compaction at the sides and immediately over the pipe. This type bedding is not permitted.

e) Bell Holes.

Bell holes shall be provided in all classes of bedding to relieve pipe bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel.

f) Coarse Granular Bedding.

Coarse Granular Bedding material shall consist of crushed stone or pea gravel, clean and graded, 95 to 100 percent of which shall pass a :"-inch sieve with 95 to 100 percent retained on a No. 4 sieve. Bedding material shall be placed on a flat bottom trench and thoroughly compacted by tamping or slicing with a flat blade shovel. Compacted bedding material shall be extended up the sides of the pipe to midpoint.

g) Overwidth Excavation.

If trenches are excavated to widths in excess of those specified below, or if trench walls collapse, pipe shall be laid in accordance with the requirements for at least the next better class of bedding at the expense of the Contractor.

h) Borrow Backfill.

Borrow backfill will be required if there is not sufficient suitable material available from other parts of the work to backfill the trenches. Borrow backfill from approved borrow pits shall be used. Only those soils in the borrow pits that meet the specified requirements for suitable material shall be used.

i) Trench Widths.

Trench widths at the top of the pipe and depths for ductile iron pipes using the various bedding classes, shall not exceed those shown below:

MAXIMUM TRENCH DEPTH

Pipe Size	Class D Bedding	Class C Bedding	Class B Bedding	Class A Bedding
6"	0	14'	20'	30'
8"	0	14'	20'	30'
10"	0	14'	22'	30'
12"	0	14'	22'	30'
15"	0	14'	22'	30'
21"	0	14'	22'	30'
24"	0	14'	22'	30'

11. BEDDING OF PVC PIPE:

a) Pipe shall be bedded true to line and grade with uniform and continuous support from a firm base in accordance with ASTM D2321 as modified herein. Blocking shall not be used to bring the pipe to grade.

b) Embedment materials listed here include a number of processed materials plus the soil types defined by the USCS Soil Classification Systems in ASTM D2487. These materials are grouped into categories according to their suitability for this application:

1. Class I.

Angular 6 to 40 mm (3 to 12 inches), graded stone including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

2. Class II.

Coarse sands and gravels with maximum particle size of 40 mm (12 inches), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

3. Class III.

Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM and SC are included in this class.

4. Class IV.

Silt, silty clays and clays including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not to be used for bedding, haunching or initial backfill.

5. Class V.

This class includes the organic soils OL, OH and PT as well as soils containing frozen earth, debris, rocks larger than 40 mm (1-1/2 inches) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching and initial backfill.

c) Compaction of foundation, bedding, haunching and initial backfill shall extend to the trench wall.

d) Embedment material in the area around the pipe shall be installed with care. Care shall be used to insure that sufficient material has been worked under the haunch of the pipe to provide adequate side support. Precautions must be taken to prevent movement of the pipe during placing of the material through the pipe haunch. Place initial backfill material in three stages: First, to the center line of the pipe: second, to the top of the pipe; and third, to a point 12 inches above the top of the pipe. Compact each stage of haunching and initial backfill by hand or mechanical tamping to a minimum of 100 percent Standard Proctor Density. Where unstable trench walls exist because of migratory materials such as water-bearing silts or fine sands, care shall be taken to prevent the loss of side support through the migratory action.

e) Avoid contact between the pipe and compaction equipment. Compaction of haunching, initial backfill and backfill material shall be done in such a way so that compaction equipment will not have a damaging effect on the pipe.

f) Trench depths, using the various bedding classes, shall not exceed those shown below:

MAXIMUM TRENCH DEPTH

Pipe Size	Class IV Bedding	Class III Bedding	Class I or Class II Bedding
All Sizes	Not To Be Used	16'	30'

Density (**Standard** Proctor) of 100 percent minimum in pipe zone.

g) ASTM D2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe" shall be used in conjunction with the above.

12. BACKFILLING:

Backfilling consists of placing suitable materials removed during the excavation into the excavated areas, placing embedment materials and compacting the same to a density equal to or greater than what exists before excavation or as specified herein.

Under backfilling operations is also included removal of excess materials and debris from the site, leveling all depressions caused by operation of equipment and maintaining the backfilled areas until accepted by the Owner.

All backfill material shall be free of stones, concrete and clay lumps larger than ⅓ cubic foot. Roots, stumps and rubbish which will decompose will not be permitted in the backfill. Backfill material shall have its moisture content corrected, as may be necessary before being placed in the trench to bring the moisture content to approximately "optimum" for good compaction. Any rock, stone, concrete, clay lumps larger than ⅓ cubic foot in volume, rubbish and debris shall be removed from the site and disposed of by the Contractor in a lawful manner.

Backfilling operations in this work are referred to herein as Backfilling at the Pipe Zone, Type "A" and Type "B".

Backfilling in the excavated areas below parts of proposed structures shall be referred to hereinafter as Type "A" Backfilling.

Where trenches cross or extend under structures or into present roadways, known future roadways or parking areas as shown on the Drawings, the backfilling shall be referred to hereinafter as Type " A " Backfilling.

Backfilling in all other areas shall be referred to hereinafter as Type "B" Backfilling.

a) Backfilling at the Pipe Zone.

Throughout the entire construction, backfilling at the pipe zone shall include bedding and shall be as follows: Backfill material shall be placed below, around each side, and over the top of the pipe, in approximately horizontal layers to a height of 12 inches over the top of the pipe. Layers shall be of such thickness to facilitate the required compaction. This backfill shall be well compacted by using mechanical tamping equipment in such manner as not to damage the pipe, pipe joints or shift the pipe alignment. Workmen shall not be permitted to walk over the pipe until at least 12 inches of compacted fill has been placed over the pipe. The Contractor shall not use water to obtain compaction except for adding water to the backfill material before placing in the trench to bring the moisture content to approximately "optimum" for good compaction.

b) Type "A" Backfilling.

Type "A" backfilling consists of placing sand and gravel or other suitable materials excavated from the trench in the trench in 6 inch thick layers from a point 12 inches above the top of the pipe and mechanically tamping or compacting by rolling until the backfill density after compaction is equal to 100 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). No water shall be used to secure compaction except for adding water to the backfill material before placing in the trench to bring moisture content to approximately "optimum" for good compaction. Each 6 inch thick layer shall be mechanically tamped before additional backfill material is placed in the excavated area.

c) Type "B" Backfilling.

Type "B" Backfilling consists of placing sand and gravel or other suitable material excavated from the trench in the trench in 12 inch thick compacted layers from a point 12 inches above the top of the pipe. Each 12 inch thick layer shall be compacted before additional backfill material is placed in the excavation. Only mechanical tamping, use of roller or small tractor will be allowed. The density of the backfilled material after compaction shall be equal to 95 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). Except in the upper 12 inches, water shall be added to backfill material only before being placed in the trench in order to bring the moisture content to approximately "optimum" for good compaction.

13. PROTECTION OF WATER SUPPLY PIPES:

a) Parallel Installation:

Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed sanitary sewer, storm sewer or sewer manhole. The distance shall be measured edge to edge. When local conditions prevent a horizontal separation of 10 feet, the water main maybe laid closer to a sewer (on a case-by-case basis) provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. The sewer materials and joints shall be the equivalent to

water main standards of construction and be pressure tested to assure water-tightness.

b) Crossing:

Water mains crossing sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. At the crossings, one full length of water pipe shall be located so that both joints will be as far apart as possible. When local conditions prevent a vertical separation of 18 inches, the sewer passing over or under the water mains shall be constructed of materials and with joints that are equivalent to water mains standards of construction and shall be pressure tested to assure water-tightness.

c) Special Conditions:

When water mains cross under sewers, additional measures shall be taken by providing:

1. a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;

2. that the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer; and,

3. both the sewer and the water main shall be constructed of water pipe materials and subjected to hydrostatic test, as prescribed in Section 02700 - Water Distribution System and/or Section 02710 - Sewer Force Mains. Encasement of the water pipe in concrete shall also be considered.

14. UTILITY CONSTRUCTION IN OTHER EXCAVATION:

Where utilities are required to be constructed in areas also requiring excavation and backfill for other work, coordinate the work so that the parts come together properly and the construction of the various parts can be done without damage to other parts. Place bedding which will form bearing for pipes, using suitable material and shaping to the lower ⅓ of the pipe to provide uniform and continuous bearing. Compaction of backfill material which will form bearing shall be equal to that specified hereinbefore under Type "A" Backfilling. After the pipe or other utility is placed, backfilling shall proceed as specified hereinbefore following the requirements specified under "Backfilling at the Pipe Zone," "Type 'A' Backfilling", and "Type 'B' Backfilling" as applicable.

15. TESTING:

a) General.

The Contractor shall select a qualified independent testing laboratory for the purpose of identifying soils, checking densities, and classifying soils materials during construction. Copies of all test results shall be furnished to the Engineer.

a) General.

The Contractor shall select a qualified independent testing laboratory, acceptable to the Engineer, for the purpose of identifying soils, checking densities, and classifying soils materials during construction. All testing will be paid for by the Contractor. Copies of all test results shall be furnished to the Engineer in accordance with Section 01400.

b) Moisture-Density Tests.

Testing shall be in accordance with ASTM Methods D698. A test shall be performed on each type of material used in the work regardless of source. Tests will be accompanied by particle-size analyses of the soils tested (ASTM Methods D421 and D422). Changes in color, gradation, plasticity or source of fill material will require the performance of additional tests. Copies of all test results shall be furnished to the Engineer.

c) Field Density Tests.

Tests shall be made in accordance with ASTM Method D1556. Tests shall be made in accordance with the following minimum schedule or as required by the soils technician or as may be directed by the Engineer:

One test for each lift of backfill for each 200 feet of trench or fraction thereof.

d) Submittals.

The soils technicians will submit formal reports of all compaction tests and retests. The reports are to be furnished to the Owner and the Engineer as soon as possible upon completion of the required tests.
This report information is to include but not be limited to the following:

1. Date of the test and date submitted.
2. Location of test.
3. Wet weight, moisture content and dry weight of field sample.
4. Description of soil.
5. Maximum dry density and moisture content of the lab sample which best matches the field sample in color, texture, grain size and maximum dry density.
6. Ratio of field dry density to maximum lab dry density expressed as a percentage.
7. Comments concerning the field density passing or failing the specified compaction.
8. Comments about re-compaction if required.

e) Compaction Results.

If any compaction test reveals that fill or backfill is not compacted as specified, the Contractor shall scarify and re-compact as required to achieve the specified density. Additional compaction tests shall be made to verify proper compaction. **These additional tests, required due to failure of the original**

test shall be paid for by the Contractor without reimbursement by the Owner.

The soils technician is to advise the Engineer and the Contractor's Superintendent immediately of any compaction tests failing to meet the specified minimum requirements. No additional lift is to be placed on a lift with any portion failing.

16. CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS:

a) Excavation, Trenching and Backfilling Operations.

Excavation, trenching and backfilling along highways, streets and roadways shall be in accordance with the applicable regulations of the Georgia State Highway Department with reference to construction operations, safety, traffic control, road maintenance and repair.

b) Protection of Traffic.

Provide suitable signs, barricades and lights for protection of traffic, in locations where traffic may be endangered by construction operations. All signs removed by reason of construction shall be replaced as soon as condition which necessitated such removal has been cleared. No highway, street or roadway shall be closed without first obtaining permission from the proper authorities.

c) Construction Operations.

The Contractor shall construct all work along highways, streets and roadways using the following sequence of construction operations, so as to least interfere with traffic:

1. Stripping.

Where the pipe line is laid along road shoulders, sod, topsoil and other material suitable for shoulder restoration shall be stripped and stockpiled for replacement.

2. Trenching, Laying and Backfilling.

Excavate trenches, install pipe line and backfill. The trench shall not be opened any further ahead of pipe laying operations than is necessary for proper laying operations. Trenches shall be progressively backfilled and consolidated and excess material removed immediately.

3. Shaping.

Immediately after completing backfilling operation, re-shape any damage to cut and fill slopes, side ditch lines, and shall replace top soil, sod and any other materials removed from shoulders.

d) Excavated Material.

Excavated material shall not be placed along highways, streets, and roadways in such manner as to obstruct traffic. Roadways and pavement will be maintained free of earth material and debris.

e) Drainage Structures.

All side ditches, culverts, cross drains and other drainage structures shall be kept clear of excavated material and be free to drain at all times.

f) Maintaining Highways, Streets, Roadways and Driveways.

The Contractor shall furnish proper equipment which shall be available for use at all times for maintaining highways, streets and roadways. All such streets, highways and roadways shall be maintained in suitable condition until completion and final acceptance of the work.

The Contractor shall repair all driveways that are cut or damaged and maintain them in suitable condition until completion and final acceptance of the work.

17. REMOVE AND REPLACE PAVEMENT:

Pavement and base course which must be removed for constructing sewers, manholes, forcemains, water lines, and all other appurtenances in streets shall be replaced as specified in Section 02500 or 02510.

a) The top 18 inches of subgrade material immediately under the paving base and also road shoulder shall be carefully removed and kept separate from the rest of the excavated material. This material shall be placed in the top 18 inches of the backfill. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone or gravel. Settlement in trenches shall be refilled with crushed stone or gravel, and such maintenance shall continue until replacement of pavement.

b) Where utility lines are constructed on unpaved streets, roads or easements, the top 18 inches of soil shall be stripped and windrowed separate from the excavation from trenches. After the line has been installed and the backfill completed within 18 inches of the original grade, the salvaged surfacing shall be replaced. This work shall be considered as general clean-up along with the removal of surplus excavated materials from the site and the restoring of the surface outside trench limits to its original condition, the cost of which shall be included in the price bid for the utility line.

17. REMOVING AND RESETTING FENCES:

Where existing fences must be removed to permit construction, the Contractor shall remove such fences. As construction progresses, reset the fences in their original location and to their original condition. All costs of removing and resetting fences and such temporary works as may be required shall be included in the prices for the utility line.

18. PROTECTING TREES, SHRUBBERY AND LAWNS:

Trees and shrubbery along trench lines shall not be disturbed unless absolutely necessary. Trees and shrubbery necessary to be removed shall be properly heeled-in and re-planted. Heeling-in and re-planting shall be done under the direction of an experienced nurseryman. Where utility trenches cross established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replaced.

Topsoil underlying lawn areas shall likewise be removed and kept separate from general excavated materials. Removal and replacement of sod shall be done under the direction of an experienced nurseryman.

19. WALKS, DRIVES, CONCRETE CURB AND GUTTER:

Walks and drives removed or damaged during the course of construction shall be replaced with Class "A" Concrete at the same thickness as removed. They will be cut to a neat edge with a masonry saw after backfilling and compacting trench in 6 inch layers to a density not less than 100 Percent Standard (ASTM Test D698) to a depth of 24 inches.

Concrete curb and gutter sections removed or damaged during the course of construction shall be replaced in full sections with concrete having a compressive strength of at least 3,000 psi.

END OF SECTION 02221

INDEX TO

SECTION 02275 – RIP–RAP

SECTION 02275

RIP–RAP

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Material placed as bank protection and erosion control.

1.2 RELATED SECTIONS

A. Section 02200 – Excavation, Filling and Grading

B. Section 02210 – Erosion and Sediment Control

C. Section 02400 – Storm Drainage

1.3 MEASUREMENT AND PAYMENT

A. Rip-Rap: Payment will be made at the contract unit price under the item "Rip-Rap for Blow off". Payment will include furnishing all labor, materials, and equipment and placing on a prepared surface.

1.4 ALLOWABLE TOLERANCES

A. Depth of rip–rap blanket as shown on the drawings and in these specifications is a minimum depth.

1.4 REFERENCES (LATEST REVISION)

A. ASTM C 150 – Portland Cement.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Stone Rip–Rap: Shall be hard quarry or field stone of such quality the pieces will not disintegrate on exposure to water, sunlight or weather. Stone shall be solid and non–friable and range in weight from a minimum of 25 pounds to a maximum of 150 pounds. At least 50 percent of the stone pieces shall weigh more than 60 pounds. The stone pieces shall have a minimum dimension of 12 inches. Documents indicating stone analysis, source and other pertinent data (i.e. – filter fabric) shall be submitted for review by the Engineer prior to delivery.

B. Sand–Cement Bag Rip–Rap:

1. Bags: Shall be of cotton, burlap, or fiber–reinforced paper capable of containing the sand–cement mixture without leakage during handling

and placing. Bags previously used for any purpose shall not be used. Capacity shall be not less than 0.75 cubic foot nor more than two cubic feet.

2. Cement: Portland cement shall be Type I meeting requirements of ASTM C 150. Cement which has been damaged, or which is partially set, lumpy, or caked shall not be used.

3. Fine Aggregate: Shall be composed of hard, durable particles, free from injurious amounts of organic impurities and shall contain, in the material passing the No. 10 sieve, not more than 7 percent clay, and not more than 20 percent passing the No. 200 sieve.

C. Filter Fabric: Shall be a woven fabric of monofilament and multifilament yarn equivalent to Mirafi FW700. Fabric shall be finished so the filaments will retain their relative position with respect to each other. Fabric shall contain stabilizers and/or inhibitors added to make filaments resistant to deterioration due to ultraviolet and/or heat exposure. Fabric shall be free of flaws, rips, holes or defects.

2.2 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.1 PREPARATION

A. The surface to receive rip–rap shall be prepared to a relatively smooth condition free of obstruction, depressions, debris, rises, and soft or low density pockets of material. Contours and elevations on construction drawings are to the surface of rip–rap material.

3.2 PLACEMENT

A. Filter fabric shall be placed with the long dimension running up slope. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. Fabric shall be anchored in place with securing pins of the type recommended by fabric manufacturer. Pins shall be placed on or within 3 inches of the over–lap. Place fabric so upstream strip will overlap the downstream strip. Fabric shall be placed loosely to give and avoid stretching and tearing during placement of the stones.

B. Minimum depth or thickness of stone blanket shall be 12 inches with no under tolerance. Stones shall be dropped no more than three feet during construction. Placing shall begin at bottom of slope. Provide a toe trench if required as detailed on the construction drawings. Entire mass of stone shall be placed to conform with lines, grades, and thickness shown on the plans. Rip–rap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying material. Placing of rip–rap in layers, or by

dumping into chutes, or by similar methods likely to cause segregation, will not be permitted.

Larger stones shall be well distributed and the entire mass of stone shall conform to gradation specified. All material used in rip–rap protection shall be placed and distributed so there will be no large accumulations of either the larger or smaller sizes of stone.

It is the intent of these specifications to produce a fairly compact rip–rap protection in which all sizes of material are placed in their proper proportions. Hand placing or rearranging of individual stones by mechanical equipment may be required to secure the results specified.

C. Sand–Cement Bag Rip–Rap: Bags shall be uniformly filled. Bagged rip–rap shall be placed by hand with tied ends facing the same direction, with close, broken joints. After placing, bags shall be rammed or packed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above or below required plane. When directed by the Engineer or required by construction drawings, header courses shall be placed.

END OF SECTION

SECTION 02400
STORM DRAINAGE SYSTEM

1. SCOPE:

Under this heading shall be included all operations in connection with the installation of the storm drainage system.

2. EXCAVATION AND BACKFILL:

Excavation and backfilling shall be as specified in Section 02221, Excavation, Trenching and Backfilling for Utility Systems.

3. DELIVERY, STORAGE, AND HANDLING OF MATERIALS:

a) Delivery and Storage.

Materials delivered to site shall be inspected for damage, unloaded, and stored with the minimum of handling. Do not store materials directly on the ground. Inside of pipes and fittings shall be kept free of dirt and debris.

b) Handling.

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried to the trench, not dragged. Gasket materials and plastic materials that are not to be installed immediately shall not be stored in the direct sunlight.

4. PIPE FOR CULVERTS AND STORM DRAINS:

Pipe for culverts and storm drains shall be as indicated and shall conform to requirements for the following types.

a) Concrete Pipe.

Pipe shall be reinforced concrete pipe conforming to ASTM C76, Class III. The minimum pipe diameter shall be 15".

1) Joints.

Joints shall be made by use of a continuous rubber gasket conforming to the requirements of ASTM C443. Type II or III rubber gaskets shall be used on the pipe. Joints which do not fit tightly and uniformly shall be grouted after that segment of the line has been installed. All pipe joints shall be wrapped with a two foot wide strip of non-woven filter fabric lapped two feet.

The assembly of the gasketed joint shall be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or pre-positioned in the bell joint or coupling at the factory. In all cases, clean the gasket, the bell or coupling interior, especially the groove spigot area to

remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and seating surfaces for damage or deformation. When gaskets are separate, use only gaskets which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer.

Lubricant should be applied as specified by the pipe manufacturer. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly.

5. DRAINAGE STRUCTURES:

Drainage structures shall be of the following types, constructed of the materials specified for each type and in accordance with the indicated details.

a) Manholes and Inlets.

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete or precast concrete segmental blocks, complete with frames and covers or gratings. Precast concrete manholes and inlets shall be designed for the required depth and to sustain the required wheel loads and/or surface pressures. When manholes and inlets are to be constructed of prefabricated materials, shop drawings shall be submitted for approval before ordering the material.

b) Connection to Existing Inlets and/or Manholes.

Pipe connections to existing inlets and/or manholes shall be in such a manner that the finished work will conform as nearly as practicable to the applicable requirements specified for new inlets and/or manholes, including all necessary concrete work, cutting and shaping.

6. MATERIALS FOR DRAINAGE STRUCTURES:

a) Mortar.

Mortar for connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except the maximum placement time shall be one half hour.

Hydrated lime may be added to the mixture of sand and cement in a quantity equal to 25 percent of the volume of cement used. Hydrated lime shall conform to F.S. SS-L-351, Type M, or ASTM C141, Type A.

The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 5 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water.

b) Precast Reinforced Concrete Manholes.

Manholes shall conform to ASTM C478 or AASHTO M199. Joints between precast concrete risers and tops shall be flexible plastic gasket and shall provide a flexible watertight joint. Flexible plastic gasket shall be RAM-NEK, or equal.

c) Precast Concrete Segmental Blocks.

Blocks shall conform to ASTM C139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

d) Bricks.

Bricks shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part Portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 3/4 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

e) Frame and Cover or Gratings.

Fabrication shall be from one or more of the material options presented in F.S. RR-F-621, except the malleable cast iron option shall conform to ASTM A220, Grade 40010. Weight, shape, size and waterway openings for grates and curb inlets shall be as indicated on the Drawings. Frames and covers for curb inlets and for areas not subject to vehicular traffic or storage may be malleable iron if so indicated. Malleable iron frames and covers shall conform to ASTM A220 and shall be of the weight, shape and size indicated.

7. BEDDING:

See Section 02221 "Excavation, Trenching and Backfill for Utility Systems," for additional requirements.

8. PLACING PIPE:

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe lines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Pipe shall be moved horizontally into place by use of a winch or other suitable means. A backhoe bucket or other means which could damage the pipe shall not be used. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling, and those damaged during placement shall be removed and replaced at no additional cost to the Owner. No additional

compensation will be given to the Contractor for the required diversion of drainage and/or de-watering of trenches.

9. BACKFILLING:

Backfilling shall be done in accordance with Section 02221, "Excavation, Trenching and Backfill for Utility Systems."

10. RIPRAP:

a) Materials.

Bag riprap shall consist of sand and Portland cement mixed at the ratio of 4:1 by weight. The amount of water used shall be sufficient to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T134.

b) Placement.

The bags shall be uniformly filled to the maximum capacity which will permit satisfactory tying. The bagged rip-rap shall be placed by hand with the tied ends facing the same direction, with close, broken joints. After placing, the bags shall be rammed or placed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above the required plan.

11. STONE RIPRAP:

a) Materials.

The stone used for stone slope protection shall be sound, rough, dense and resistant to the action of air and water and satisfactory to the Engineer. The stone shall have a density of not less than 150 pounds per cubic foot. Neither the breadth nor the thickness of any piece of stone shall be less than one-third of its length. The stone will be subject to inspection on delivery and if found to be improper gradation or quality, it will be rejected. The stone shall consist of quarry run sizes, graded as specified below:

STONE SLOPE PROTECTION

SIZE OF STONE	PERCENT OF TOTAL WEIGHT SMALLER THAN THE GIVEN SIZE	
	Class I	
100 lb.		100
60 lb.		80
25 lb		50
2 lb.	Not to Exceed	10

b) Placement.

The slope protection shall be placed in such a manner as to produce a reasonable well-graded mass of material with the minimum practicable percentage of voids, and

shall be constructed within the limits and to the lines, grades, and sections shown on the Drawings. A tolerance of plus 6 inches or minus 3 inches from the limits shown on the Drawings will be allowed in the finished surface on the slope protection except that the extreme of this tolerance shall not be continuous over an area greater than 100 square feet. Materials shall be placed in horizontal layers starting on the riverward edge of the section and worked up the slope. Dumping down the slope will not be permitted. Materials shall not be dropped from a height greater than 3 feet. Any damage to the slope due to the fault of the Contractor shall be repaired at no expense to the Owner. Stone shall be placed on geotextile fabric.

12. GEOTEXTILE FABRIC:

Geotextile fabric shall have excellent puncture and tear resistance properties and act as a separation barrier between fine grain soils and load distributing aggregate fill material. Geotextile fabric shall be a woven fabric meeting the following requirements:

Fabric Property	Unit	Test Method	Typical Values
Grab Tensile Strength	lb	ASTM D-1682	200
Grab Tensile Elongation	%	ASTM D-1682	30 (MAX)
Burst Strength	psi	ASTM D-3786	400
Trapezoid Tear Strength	lb	ASTM D-1117	115
Puncture Resistance	lb	ASTM D-3787	85

Fabric shall be Mirafi 500X, or equal.

13. SUBGRADE DRAINS:

Subgrade drains will be provided from storm drain inlets where required because of the groundwater table. The subgrade drain will consist of a trench containing a 6 inch perforated pipe embedded in granular material as shown in the detail on the Drawings. The drain will extend 10 feet in two directions from the inlet and will be extended beyond that point when instructed by the Owner or his representative. The drains will be constructed on a uniform slope toward the inlet.

14. SHOP DRAWINGS:

Shop drawings shall be submitted on each manufactured item supplied under this Section along with other information as specified.

END OF SECTION 02400

SECTION 02500
BASE COURSE AND BITUMINOUS PAVEMENT

1. SCOPE:

Under this heading shall be included the furnishing and installation of base course and pavement as shown including subgrade preparation, base course and pavement.

2. GENERAL:

Subgrade preparation shall include leveling, compacting and proof-rolling of the subgrade as required. Installation of the base course shall include the placing and compacting of the material with appropriate equipment. Pavement shall be placed as shown on the plans with the necessary equipment and shall include any prime coats or tack coats required. All work shall be in conformity with the lines, grades and typical cross-sections shown on the Plans. The Contractor must have all equipment and workers on the job site necessary to perform a given operation when it is initiated.

3. SUBGRADE PREPARATION:

The subgrade shall be brought to the line and grade necessary to accommodate the base and pavement at the required finished grades. All subgrade shall be proof-rolled as specified, before base course is placed on the subgrade.

4. BASE COURSE:

a) Preparation of Base.

The surface of the base course will be inspected by the Engineer for adequate compaction and surface tolerances specified in applicable base course or sub-base course. Any ruts or soft yielding spots that may appear in the base course, any areas having inadequate compaction, and any deviations of the surface from the requirements specified for the base course shall be corrected by loosening the affected areas, by removing unsatisfactory material and adding approved material where required, and by reshaping and re-compacting to line and grade and to the specified density requirements. Compaction of base material shall be done by conventional means using a 30,000 to 40,000 pound vibratory roller or other means of obtaining the required compaction.

The lines and grades shown on the Contract Drawings for each pavement category of the Contract shall be established and maintained by means of line and grade stakes placed at the site of the work by the Contractor.

b) Graded Aggregate Base Course.

The aggregate in the base course shall consist of a mixture of either crushed gravel, together with sand, sand-gravel, soil or other materials having similar characteristics combined as necessary to give a mixture conforming to the requirements, prescribed herein. The material and installation shall meet the requirements of Section 310 of the Georgia Department of Transportation Standard Specifications.

Sieve Designation	Percent by Weight Passing
2"	100
1-1/2"	97-100
3/4"	60-90
No. 10	25-45
No. 60	5-30
No. 200	0-15

5. BITUMINOUS PRIME:

Bituminous prime shall be cutback asphalt RC-70 applied at the rate of 0.25 gallons per square yards. The material and application shall comply with the applicable portions of the Department of Transportation Standard Specifications and the material and application rate can be adjusted when the applicable section so recommends.

6. BITUMINOUS TACK COAT:

The bituminous tack coat shall be an asphaltic material which meets the requirements of Section 413 of the Georgia Department of Transportation Standard Specifications. Application rate shall be at the rate indicated in the appropriate section on the plans or, as a minimum, 0.05 gallon per square yard of surface.

7. BITUMINOUS PAVEMENT:

The bituminous wearing surface shall be a plant mix conforming to the requirements of Section 400 of the Georgia Department of Transportation Standard Specifications. The job mix shall meet the requirements of 9.5mm or 12.5mm Superpave, Section 828 of the Georgia Department of Transportation Standard Specifications and shall have a Marshall Stability of 1500 pounds (50 blow) and a percent voids between 4 and 5.

A job mix formula indicating the single definite percentage for each sieve fraction of aggregate and for asphalt shall be submitted prior to surfacing operations. The job mix formula shall also show the stability as determined by the Marshall Method, the percent voids, the percent voids filled with asphalt, and the unit weight per cubic foot of compacted mix.

The general composition limits are extreme ranges of tolerances to govern mixtures made from any raw materials meeting the specifications. The submission of the job mix formula shall bind the Contractor to furnish paving mixture meeting the exact formula within allowable tolerances of plus or minus 2 percent for asphalt, plus or minus 7 percent of 2 inch and larger sieve sizes, plus or minus 5 percent for material passing the 2 inch thick sieve and retained on the No. 200, and plus or minus 2 percent of material passing the No. 200.

Compaction shall be done with an 8 to 10 ton steel-wheeled roller or other means approved by the Engineer. Thickness shown on the Drawings is a minimum. Smoothness shall not exceed one-eighth inch for a ten foot straight edge.

8. TESTING:

The following tests will be made in accordance with the current edition of the appropriate Department of Transportation Standard Specifications.

At least one density determination shall be made for each 500 square yards of base. Asphalt extraction and aggregate gradation on the asphaltic concrete plant mix: one for each 500 tons of material, or fraction thereof, delivered to the job site.

9. PROOF-ROLLING:

Proof-rolling will be done with a loaded tandem dump truck (15 yards heaped) or as specified in the Department of Transportation Standard Specifications. Test rolling will be done parallel to the centerline at speeds between 2 and 5 miles per hour; 3 to 4 passes depending on width of road shall be completed prior to final walk along proof roll.

END OF SECTION 02500

SECTION 02520
CONCRETE SIDEWALKS, CURB AND GUTTER

1. SCOPE:

Under this heading shall be included the construction of all concrete sidewalks, curb and gutter.

2. CONCRETE:

Concrete shall be composed of cement, admixtures, fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix in accordance with the requirements of American Concrete Institute (ACI) Manual of Concrete Practice (Latest Edition), and shall be suitable for the specific conditions of placement. Concrete shall be Class "A" and shall have 28-day compressive strength of not less than 4,000 psi (unless shown otherwise on the drawings), and contain not less than 611 pounds of cement per cubic yard of concrete. The maximum size of coarse, hard aggregate shall be : -inch.

All concrete shall be ready mixed concrete in accordance with ASTM C94. All reinforcement shall comply with ASTM A615.

3. PREPARATION:

Before placing concrete, all debris and water shall be removed from the places to be occupied by the concrete. Wood forms shall be thoroughly wetted or oiled, and the reinforcement cleaned of coatings. Formwork and the placement of reinforcement, pipes, anchors and other inserts shall be inspected by the Engineer before any concrete is deposited.

4. PLACING:

The placing and depositing of all concrete shall be done in accordance with requirements of the ACI. Concrete shall be rapidly handled from mixer to forms and deposited as nearly as possible in its final position to avoid segregation due to re-handling or flowing. Concrete shall not be allowed to drop freely more than 4 feet. For greater drop a tremie or other means must be used. Concrete shall be spaced and worked by hand and vibrated to assure close contact with all surfaces of forms and reinforcement and leveled off at proper grade to receive finish. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work. Concrete shall never be deposited upon soft mud or dry porous earth.

5. VIBRATION:

Concrete shall be placed with the aid of manual vibration. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete into place, but shall not be long enough to cause segregation of the mix. To secure even and dense surfaces, vibration shall be supplemented by hand spading in the corners and angles of forms and along form surfaces while the concrete is plastic under the vibratory action. Caution must be exercised to prevent any injury to the inside face of the forms or any movement of the reinforcement.

6. CONSTRUCTION JOINTS, CONTROL JOINTS AND EXPANSION JOINTS:

Joints shall be formed and located as indicated on the Plans, or as recommended by applicable requirements of MCP. Final locations are subject to review.

The rate and method of placing concrete and the arrangement of construction joint bulkheads shall be such that the concrete between construction joints shall be placed in a continuous operation. Whenever it is necessary to stop work, such stops shall be located and temporary bulkheads erected. Before concreting is resumed, the surfaces of previously placed concrete shall be roughened, cleaned, wetted and slushed with grout immediately before additional concrete is placed. Grout shall be one part Portland cement and two parts sand.

Expansion joints shall be provided in walks, and curb and gutter where shown and at walls, intersecting walks and buildings. Expansion joints in walks and curb and gutter shall be made with 2 inch thick pre-molded, non-extruding expansion joint filler, "Flexcell," or "Meadows" or equal, extending through the full thickness of the concrete except the upper 1/4 inch at 80 foot intervals. When sidewalk is adjacent to curb the expansion joints shall coincide, where possible. These shall be set accurately in place to straight lines and concreted in. Control joints in sidewalks shall be spaced at intervals equal to the width of the sidewalk and in curb and gutter at 10 foot intervals. Edges of grooves, expansion joints and edges of walks and curb and gutter shall be rounded to a 1/4 inch radius with suitable grooving and edging tools.

7. FINISHING:

Walks and curb and gutter shall be finished as specified for troweled concrete except that final finishing shall be with wood floats or broomed, as directed, to produce non-slippery finish at right angles to the length unless otherwise directed. Completed work shall be finished true to line and grade and when tested with a 10 foot straightedge shall not show a variation of more than 1/4 inch from a straight line.

8. PROTECTION AND CURING:

Protect concrete against frost, freezing temperatures, rapid drying and heavy rain after placing during this period, concrete shall be maintained above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days.

Walks and other exterior concrete shall be cured by covering first with sprayed-on curing compound applied immediately after finishing and then also completely covered with an impermeable fiber filled paper for a period of not less than 72 hours.

Membrane curing compound shall comply with ASTM C309 for Type I and paper shall comply with ASTM C171.

Exterior concrete work constructed during hot weather shall be protected, in addition to the curing specified above, with Spencer Kellogg Anti-Spalling Compound, or Carter-Waters "Dek-Seal," or equal, applied as soon as conditions will permit after curing and when the concrete is clean and dry. The mixture shall be applied uniformly in 2 applications, in

accordance with the manufacturer' s recommendations. The second application shall not be made until after the first coat has been completely absorbed by the concrete.

9. REMOVAL OF FORMS:

Care shall be taken in the removal of the forms not to damage the surface of the concrete. Immediately after the forms are removed, all damaged or imperfect work shall be patched in a neat and workmanlike manner, or if badly damaged or imperfect, the work shall be rebuilt. Leave shoring in place until concrete member will support its own weight safely plus any loads that may be placed upon it.

Freshly stripped surfaces shall not be pointed up or touched in any manner before having been inspected by the Engineer.

10. PATCHING AND FINISHING CONCRETE FORMED SURFACES:

Immediately after removing forms, all concrete surfaces shall be inspected, and any honeycomb, voids, stone pockets, and tie holes shall be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 1 inch with the edges perpendicular to the surface. The area to be patched and a space of at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. The patch shall be finished in such a manner as to match the adjoining surface.

Immediately upon removing forms from finished concrete surfaces, they shall be cleaned of all cement fins and any air pockets shall be carefully filled with cement mortar worked in to insure a bond with the concrete and finished off to match the surrounding surface.

All vertical exterior surfaces exposed in the finished work shall be finished to a smooth rubbed finish having a uniform appearance.

END OF SECTION 02520

INDEX TO

SECTION 02570 – TRAFFIC CONTROL

SECTION 02570

TRAFFIC CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section covers furnishing, installation, and maintenance of all traffic control devices, portable signal equipment, warning signs, and temporary traffic lanes used during construction of the project.

1.2 RELATED WORK

A. Section 02667 – Water Distribution System

1.3 MEASUREMENT AND PAYMENT

A. Traffic Control: There will be no measurement for this item. Payment shall be subsidiary to the contract price.

1.4 RESPONSIBILITY

A. The Contractor shall furnish, install, and maintain all necessary automated signals, barricades, concrete traffic barriers, warning signs, traffic barriers, traffic lanes, and other protective devices. Ownership of these temporary warning devices shall remain with the Contractor provided devices are removed promptly after completion and acceptance of work to which devices pertain. If such warning devices are left in place for more than 30 days after specified time for removal, Owner shall have the right to remove such devices and to claim possession thereof.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All barricades signs, and traffic control signal devices shall conform to requirements of the current Georgia Manual on Uniform Traffic Control Devices except as may be modified in these project specifications.

B. Portable traffic control signal devices, barricades, signs and other Control Devices shall be either new or in acceptable condition when first erected on Project and shall remain in acceptable condition throughout the construction period.

A. All signs shall have a black legend and border on an orange reflectorized background and will be a minimum of engineering grade reflective.

PART 3 – EXECUTION

3.1 ERECTION

A. Prior to commencement of any actual construction on the project, Contractor shall

erect appropriate advance warning signs and place concrete traffic barriers where necessary. Subsequently, as construction progresses and shifts from one side of road to the other, temporary lanes must be installed to provide continuous two way traffic and bike thoroughfare. All appropriate signs and traffic control devices pertinent to the work shall be erected ahead of construction site to advise and warn travelling public of activity and any necessary detours.

3.2 DELAYS TO TRAFFIC

A. Except in rare and unusual circumstances, two–way traffic shall be maintained at all times by temporary and/or permanent roads. There are to be no traffic delays during the hours between 7 AM – 10 AM and 4 PM – 10 PM. Between the hours of 10 AM and 4 PM the maximum delay is to be 15–minutes.

B. When traffic is halted temporarily due to transition procedures including the ingress and egress of construction vehicles, Contractor shall provide necessary flagging personnel with proper equipment and clothing to hold such traffic.

C. If Contractor's proposed traffic control plan involves more than occasional disruption to alternating one way traffic through the work, then temporary, signalized control equipment will be required.

3.3 TEMPORARY TRAFFIC LANES

A. Two–lane traffic shall be maintained at all times unless prior written permission has been given and all necessary flagging personnel and/or signage has been installed. Temporary lane line stripes shall be applied to the detour paving, as agreed to by Engineer and Owner's representative. The no–passing double center–line stripes shall be yellow. Such stripes shall be a temporary, degradable, reflectorized tape strip. All temporary striping shall be maintained throughout the period traffic control is needed.

B. Contractor is responsible for installation and removal of all temporary roads and trails throughout the construction process. These detour roads are to be in accordance with the Pavement Specifications herein.

3.4 SIGNS AND BARRICADES

A. Contractor shall provide a detailed map showing location and verbage of all traffic control signs and methods for the project. All critical warning signs for the project will be a minimum of engineering grade reflective material and include appropriate flashing lights.

B. Appropriate Safety Barricades shall be installed between bicycle trails, sidewalks, and the temporary traffic lanes. These barricades shall be impact resistant for passenger vehicles with a travelling speed of 40 mph.

1. Advance warning signs: These signs shall be placed approximately 500 feet in advance of the construction site and detour on each approach to the construction area with subsequent warning signs every 250 feet, until construction site is met.

2. Barricades: While detour is open to traffic, a line of concrete traffic barricades shall be placed across the closed roadway to channelize traffic onto detour. They shall be spaced across the blocked roadway end to end so no vehicle will be able to pass between any two adjacent barricades.

3. Barriers: Shall be wooden having a minimum of 3 horizontal 6 inch rails spaced 20 inches on center. Markings for barrier rails shall be 6 inches wide alternate orange and white reflectorized stripes sloping downward at 45 degrees in the direction traffic is to pass.

   During hours of darkness, the Contractor shall place and maintain flashing warning lights on tops of all barriers.

4. Direction Arrow Signs: At each change in traffic direction along the detour, Contractor shall install a sign with an arrow indicating change in traffic direction. This sign is to be located across the pavement from and facing on–coming traffic.

5. End Construction Sign: This sign shall be 60 inches x 24 inches and erected approximately 200 feet beyond end of construction area on the right–hand side.

END OF SECTION

INDEX TO

SECTION 02668 – PREFABRICATED BOOSTER PUMP STATION

SECTION 02668

PREFABRICATED BOOSTER PUMP STATION

PART 1 – GENERAL

1.1 DESCRIPTION

The work covered by this section consist of furnishing pumps, skid, VFD and controls from single source. The pumping system manufacturer shall design, furnish, deliver and warranty complete factory built system with all necessary piping, controls and appurtenances as mentioned in this specification and the contract.

The pumping station shall include five (5) pumps in appropriate metallurgy with premium efficiency electric motors, variable frequency drive unit and controllers as needed. The pumps, variable speed drive and controller shall be manufactured by a US manufacturer pre-approved by owner and engineer to ensure system component compatibility. For drinking water services, the unit will include components, materials, coatings certified to NSF61 safe for Drinking Water. Package will be UL-NSF listed, as required.

The manufacturer shall provide necessary start-up and training through factory trained authorized representative, if included in offering.

1.2 WORK INCLUDED

A. Packaged Pumping System

B. Centrifugal pumps manufactured by the pumping system manufacturer.

C. Pump Controls system

1. Control Panel
2. Variable Frequency Drive
3. Electrical Installation
4. Sequence of Operation
5. Low Flow Stop Function

D. Single skid base with pumps, piping, valves and fittings.

E. Sensor transducers and gauges

1.3 MEASUREMENT AND PAYMENT

A. Prefabricated Booster Pumping System: No unit measurements will be made for the Prefabricated Booster Pumping System, payment will be made at the lump sum price for "Prefabricated Booster Station – Complete, in service". Includes pumps, motors, piping, valves, skid, crane, and all appurtenances required to complete a full operational system.

1.4 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

A. AWWA – American Water Works Association Hydraulic Institute
B. ANSI – American National Standards Institute
C. ASTM – American Society for Testing and Materials
D. HI – Hydraulic Institute
E. ASME – American Society of Mechanical Engineers
F. IEEE – Institute of Electrical and Electronics Engineers
G. NEMA – National Electrical Manufacturers Association
H. NEC – National Electrical Code
I. ISO – International Standards Organization
J. UL – Underwriters Laboratories, Inc.
K. IEC – International Electrotechnical Commission
L. NSF – NSF International

1.5 SUBMITTALS

A. Submittals shall include the following:
   1. Piping and Instrumentation Diagram (P&ID)
   2. Packaged System General Arrangement Drawing
   3. Electrical On-Line Diagram
   4. Equipment Approval Check List
   5. Control Wiring Diagrams
   6. Sequence of Operations
   7. Pump Data Sheets or Catalog Sheets
   8. Motor Data Sheets or Catalog Sheets
   9. Valves Data Sheets or Catalog Sheets
   10. Instrumentation Data Sheets or Catalog Sheets

B. Submittals must be specific to this project. Generic submittals will not be accepted. Components listed in this specification are subject to change based on availability. A like component will be substituted and submitted for information when required.

1.5 QUALITY ASSURANCE

A. The pumping package shall be manufactured and assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all project system components supplied by the pumping system manufacturer. Further, to ensure system responsibility, the pump package manufacturer must also be the manufacturer of the pumps, the controller(s), the VFD's (if applicable), and the controls. Pumping package assemblers who do not manufacture the pumps and/or the controllers/controls will not be considered equal nor acceptable

B. The manufacturer shall have a minimum of 10 years' experience in the design and construction of packaged pumping systems.

C. Bidders shall comply with all sections of this specification relating to packaged pumping systems. Any deviations from this specification shall be bid as a voluntary alternate clearly defined in writing. If no exceptions are noted, the supplier or contractor shall be bound by these specifications.

D. The packaged system manufacturer (Vendor) shall construct the equipment in an ISO 9001-2008 certified facility.

E. The packaged system manufacturer (Vendor) shall have a NSF61 certificate on the packaged system.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:

1. Grundfos
2. Syncroflo
3. Pre-Approved Equal.

2.2 MANUFACTURED UNITS

A. Furnish and install as shown on the plans a Packaged Pumping System as manufactured by Grundfos, Syncroflo or approved equal. Pumps shall be capable of delivering at design condition total 11,111 gpm @ total dynamic head (TDH) of 46 psi at 1800 rpm maximum rpm. Total system losses are not considered in overall performance and may vary per installation. Pumped liquid will be water at a temperature of 68 Deg F. System to achieve total flow capacity using five (5) number of pumps.

B. The pumps and motors shall be suitable for operating under the following design conditions:

Design Option #1:

Pump No.	GPM	TDH	HP	RPM	EFF
1, 2	1042	106' (46 PSI)	60	1800	83
3, 4, 5	3300	106' (46 PSI)	125	1780	89
X (Future)					

Design Option #2:

- Minimum Inlet Pressure: 40 psig
- Estimated Internal Losses: 10 feet.
- System Discharge Pressure: 88 psig.

Pump No.	Duty Point	Pump TDH	% Efficiency	Horsepower	RPM
1	1600 GPM	120'	85%	60	1780
2	1600 GPM	120'	85%	60	1780
3	3500 GPM	120'	86%	125	1780
4	3500 GPM	120'	86%	125	1780
5 (Future)	3500 GPM	120'	86%	125	1780

C. The packaged pump system shall include, pump & motor assemblies, microprocessor based pump controller, variable frequency drive(s), suction and discharge piping and additional equipment as specified. Pressure transducers shall be mounted on the package headers.

D. Provide pumps as indicated on the pump schedule. Pumps and motors shall be furnished as specified in respective sections of this document.

E. The suction and discharge of each pump shall be fitted with an isolation valve so that the pump can be serviced while system is still operational. The discharge of each pump will be fitted with a check valve.

F. Piping and valves shall be sized to maintain a maximum fluid velocity of 10 ft/sec for discharge headers.

G. System shall require only user interface piping connections for suction and discharge headers, relief valves or flow meters where applicable. Electrical requirements may be single point power or multiple connections as required for the site.

H. Pressure gauges and transducers shall be installed on the suction and discharge headers with isolation ball valves.

I. All components including pumps, piping and controls shall be mounted and shipped as a single unit. Controls may be shipped loose due to size or as directed.

2.3 COMPONENTS

A. PUMPS – DESIGN OPTION #1

2.3.1 VERTICALLY MOUNTED SPLIT COUPLED SPLIT-CASE PUMPS

a. Furnish and install vertically mounted split coupled, split-case pumps as per plans and pump schedule.

b. The pump, stand, coupling, and electric motor shall be factory assembled at the pump manufacturer's facility. The pump manufacturer shall have complete unit responsibility.

2.3.1.1 PUMPS

a. The pumps shall be split coupled, vertical mounted, single stage, double suction, between bearing, axial split case design, in cast iron or ductile iron bronze fitted construction specifically designed for quiet operation.

b. Pumps shall have the casing divided on the vertical centerline. The casing halves shall be accurately machined, bolted and doweled together. A non-asbestos type gasket material shall be furnished between the casing halves. The casing material shall be close-grained cast iron ASTM A48 - Class 35 with a minimum tensile strength of 35,000 P.S.I. Pumps shall be fitted with lead-free bronze renewable case wear rings indexed with a dowel pin for fixed positioning. Removal of the upper casing half and bearing housings shall permit removal of the complete rotating assembly without disturbing piping connections or motor. Volute shall have integrally cast support feet, gauge ports at nozzles, and vent and drain ports. Pumps with larger than 4-inch discharge flanges shall be of the double volute design extending to both upper and lower half of the casing. Casings shall be designed for scheduled working pressure and shall be hydrostatically tested at 150% of the maximum working pressure under which the pump could operate at design speed. Suction and discharge flanges shall be drilled to ANSI Standards and be machined flat face. Flanges shall be extra heavy-duty design and will be of 250# thickness while capable of being drilled for 125# ANSI flat face use.

c. Pumps shall be provided with removable upper and lower bearing housings which will permit inspection and/or replacement of the mechanical seal and bearing without removing the rotating assembly or upper half of the casing. Straightening vanes shall be cast in both the bearing housings and casing to reduce pre-rotation of fluid prior to entry into the impeller.

d. The upper and lower bearing housings shall be removable and supply support for the sleeve bearing, with required provision for purging or flushing. The pump shaft shall be adequately supported by the pump bearings to limit the shaft deflection to 0.008 inches. Sleeve bearings shall be Graphalloy material. Each bearing housing shall be bolted to the upper and lower casing halves for a full 360-degree support registered fit to insure positive alignment.

e. The pump shaft shall be of solid AISI 416 stainless steel without sleeves.

f. The pump manufacturer shall recommend the proper mechanical seal based on the pressure, temperature and liquid outlined on the equipment schedule. Mechanical seals, at a minimum, shall have ceramic stationary seats, carbon rotating seats, Buna elastomers and stainless steel hardware. The mechanical seal and bearings shall have external flushing lines. Seals shall be capable of being inspected and easily replaced without removing the upper half of the casing. The pump shall have no mechanical seal at the bottom, for easy maintenance.

g. Impeller shall be of the enclosed Francis Vane type, double suction design, made of aluminum bronze, ASTM B148 UNS C95400, both hydraulically and dynamically balanced to ISO 1940-1:2003 balance grade G6.3 and keyed to the shaft. The impeller shall be trimmed to meet the specific hydraulic requirements.

h. Pump shall be connected to the drive motor by a rigid, aluminum, axially split coupling capable of withstanding all torsional, radial and axial loads. The coupling design shall facilitate alignment of the motor and pump shaft.

i. The pump shall be supported from below by a cast iron, ductile iron, or fabricated steel mounting stand, which shall be bolted directly to the bottom of the casing and fully support the weight of the complete pump and motor. Supporting the casing from the side or top shall not be required, nor allowed.

j. Pump rotation shall be clockwise or counter-clockwise as viewed from the pump's motor end.

k. Pump shall be of a maintainable design for ease of maintenance and should use machine fit parts, which are easily disassembled.

l. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5, section 1.4.6.1.1 for recommended acceptable unfiltered field vibration limits (as measured per HI 1.4.6.5.2, Figure 1.108).

m. Each pump shall be painted with one coat of high quality factory approved paint and name-plated before shipment from the factory.

n. Pump manufacturer shall be ISO-9001 certified.

o. Standard Pump Construction

- Volute: Cast iron ASTM A 48 – Class 35
- Case wear ring: Lead-Free Bronze, ASTM B584-90500
- Impeller: ASTM B148 UNS C95400
- Shaft: AISI 416 stainless steel
- Mechanical Seal: Carbon–Ceramic with Buna elastomers and stainless steel hardware
- Bearings: Sleeve bearing- Graphalloy
- Optional special material shall be available based on requirements

2.3.1.1.1 MOTORS

a. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned.
b. Motors shall be suitably sized per ISO5199 and shall meet NEMA specifications and conform to the standards outlined in EISA 2007.

2.3.2 INSTALLATION

The pump shall be installed per manufacturer's recommendations and according to the standards of the Hydraulics Institute.

2.3.3 TESTING

Where noted on schedule, pumping equipment may require the following:

- Certified Performance test
  The testing shall be in accordance with Hydraulic Institute level B or the latest HI standard as noted in the pump schedule.

2.3.4 WARRANTY

The warranty period shall be a non-prorated period of 12 months from date of installation, not to exceed 18 months from date of manufacture. Warranty shall cover against defective material and/or faulty workmanship.

B. PUMPS – DESIGN OPTION #2

2.3.1 END SUCTION CENTRIFUGAL PUMPS

a. Furnish and install horizontal close coupled end suction centrifugal pumps with flow and head as defined in this Section.

b. The pump, stand, coupling, and electric motor shall be factory assembled at the pump manufacturer's facility. The pump manufacturer shall have complete unit responsibility.

2.3.2.1 PUMPS

a. The pumps shall be horizontal close coupled end suction centrifugal pumps with flow and head as defined below. The pumps shall be manufactured according to the standards of the Hydraulic Institute and to ANSI specification No. B58.1. The pump casing material shall be ASTM A48, class 30, cast–iron capable of hydrostatic test @ 150% of maximum discharge pressure. The pump shall have replaceable suction and hub wear rings. All mating parts shall have a register fit to ensure alignment.

b. The impeller shall be an enclosed, single piece casting, from ASTM B505, B148, B271, UNS C95800 lead free nickel-aluminum bronze and shall be completely machined on all outside surfaces and dynamically balanced at time of pump assembly. The impeller shall be keyed to the shaft and securely fastened with a vibration resistant lock screw and washer.

c. Casing wear rings shall be the same lead free nickel-aluminum bronze as the impeller.

d. The packing box shall contain a mechanical seal for the specific application.

e. Mechanical seal shall be equivalent to John Crane, type 21 standard seal.

f Rotary seal shall be from carbon.

g. Stationary seat shall be from ceramic.

h. Metallic parts shall be from 316 stainless steel.

i. Elastomeric parts shall be from Buna–N.

j. The impeller shall not contact the suction or hub wear ring under any operating load condition.

k. The pump and motor shall be connected by an ASTM 48 class 30, cast–iron bracket incorporating a full isolating shield with neoprene slinger ring to prevent moisture from entering the front motor bearing.

l. Pumps with suction and discharge connections shall have flanges conforming to the flange pattern of ANSI 125 psi flanges.

m. Pump volutes shall be "Double Volute" type with external casing ribs in the casting.

n. Maximum pump suction pressure shall be 100 PSIG at 250°.

o. Maximum working pressure shall be no less than 175 PSIG at 250°.

p. The pump shall be as manufactured by Cornell or Gould's.

q. The pumping systems manufacturer shall have a network of service centers which shall have available spare parts and trained pump technicians to handle service, repair and warranty procedures.

2.3.2.1.1 MOTORS

a. Motor enclosure shall be TEFC, TCZ frame, premium efficient.

b. Motor shall have a 1.15 service factor, class F insulation, and 95% full load efficiency.

c. Motors shall be inverter ready, wound for 3/60/460 Volt full voltage starting.

d. Maximum pump horsepower shall not be greater than motor nameplate rating exclusive of service factor.

e. The motor shaft shall be high–strength steel protected by a 416 stainless steel shaft sleeve secured to the shaft.

f. Motor frames shall be cast iron with steel end bells and conduit boxes.

g. Motors shall be "Super E" type as manufactured by Baldor.

2.3.3 INSTALLATION

The pump shall be installed per manufacturer's recommendations and according to the standards of the Hydraulics Institute.

2.3.5 TESTING

Where noted on schedule, pumping equipment may require the following:

- Certified Performance test
  The testing shall be in accordance with Hydraulic Institute level B or the latest HI standard as noted in the pump schedule.

2.3.6 WARRANTY

a. The manufacturer shall warrant that the water pumping system shall be free of defects in workmanship for a period of one year from date of authorized start–up but not to exceed eighteen months from date of manufacturer's delivery to the site.

b. Provided that all installation and operation responsibilities have been properly performed, manufacturer shall provide a replacement part or component during the warranty life. Any repairs to be accomplished at manufacturer's expense must be pre–authorized. The start–up certificate must be on file with manufacturer to activate warranty. Upon request, manufacturer shall provide advice for trouble shooting of a defect during the warranty period.

c. Manufacturer shall use only first quality material. As with any mechanical or electrical device, some preventive maintenance efforts are required to assure an adequate service life. A periodic preventive maintenance program recommendation shall be included in the owner's manual. Manufacturer shall support a large national network of technical service technicians. Manufacturer's field service technicians shall be contacted for service.

C. CONTROL PANEL AND PUMP SYSTEM CONTROLS (W / PANEL MOUNTED DRIVES AS NEEDED)

1. Control Panel:

1.1 All power and controls components including the controller, HMI, VFD's, and other electrical components shall be housed and mounted in UL Type 12 rated enclosures (or others as required per site specification). A self-certified NEMA enclosure rating shall not be considered equal. The entire control panel shall be UL 508 listed as an assembly and warranted by the pump station manufacturer. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled for proper identification. A complete wiring circuit diagram and legend with terminals, components, and wiring completely identified shall be provided. The control panel shall include a main disconnect, branch circuit protection for each pump-motor and the control circuit and control relays for alarm functions.

Control panel shall include as standard:

- Main Disconnect Switch
- Service Disconnect Switches (External / Lockable)
- Alarm Circuit
- System Fault Light
- Pump Run Light
- Surge Arrestor

1.2 All control enclosures and controls shall have been manufactured on the pumping system manufacturer's site by the pumping system manufacturer.

1.3 One properly sized cooling fan and exhaust vent shall be provided for each VFD.

1.4 In order to assure complete system integration, Manufacturer, without exception, shall maintain a fully equipped UL and ETL authorized panel shop at his facility under the same roof as the fabrication, painting, and assembly of the mechanical components.

1.5 Manufacturer, without exception, shall be authorized by Underwriters' Laboratories to label its manufactured control panels as UL Listed under category NITW/NITW7.

1.6 Manufacturer, without exception, shall conform to the latest edition of NFPA 70 in the manufacturing of its control panels.

1.7 The control enclosures shall be constructed of 12 gauge steel and the back plate assembly shall be constructed of 12 gauge steel.

1.8 Pump run lights, pump selector switches, the general alarm light, the reset button, and the touch screen shall be mounted on an enclosure door. All of these components and shall be rated NEMA 4.

1.9 All internal components shall be mounted and secured to the removable back plate assembly. All equipment and wiring shall be mounted within the enclosure and labeled for proper identification.

1.10 All adjustments and maintenance shall be able to be done from the front of the control enclosure.

1.11 A complete wiring circuit and legend with all terminals, components, and wiring identification shall be provided.

2. Pump System Controller

2.1 The pump system controller shall be a standard product developed and supported by the pump manufacturer. The design of the pump system controller(s) shall be the responsibility of the manufacturer and shall account for low- and high-flow operation.

2.2 The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller shall provide data entry and read-out capabilities. The controller user interface shall have a color display with a minimum screen size of 3-1/2" x 4-5/8" OR a 10.1" high-definition widescreen graphic touch screen for easy viewing of system status parameters and for field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.

2.3 The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.

2.4 The controller shall have the ability to be connected to a battery to maintain power on controller during periods of loss of supply power.

2.5 The controller shall have built in data logging capability. Logged values shall be graphically displayed on the controller and able to be exported to computer via standard connection. A minimum of 3600 samples per logged value with the following parameters available for logging:

a. Estimated flow-rate
b. Total gallons pumped
c. Gallons pumped per day history
d. Speed of pumps
e. Pump starts and run hours and system status indicators
f. All alarms and alarm history
g. Inlet pressure

h. System discharge pressure
i. Power consumption
j. Controlling parameter (process value)
k. Automatic and digital manual adjustment speed control
l. Pressure, flow, speed, calibration, time, and clock settings

2.6 The controller shall display the following as status readings from a single display on the controller (this display shall be the default):

a. Current value of the control parameter, (typically discharge pressure)
b. Most recent existing alarm (if any)
c. System status with current operating mode
d. Status of each pump with current operating mode and rotational speed as a percentage (%)
e. Estimated flow-rate not requiring flow meter connection (discharge sensor and predicted pump curve required)

2.7 The controller shall have hardware inputs and outputs that shall be compatible with the manuafcturer's system, and as a minimum include the following:

a. Three analog inputs (4-20mA or 0-10VDC)
b. Three digital inputs
c. Two digital outputs
d. Ethernet connection
e. Field Service connection to PC for advanced programming and data logging

2.8 Pump system programming (field adjustable) shall include as a minimum the following:

a. Water shortage protection (analog or digital)
b. Transducer Settings (Suction and Discharge Analog supply/range)
c. PI Controller (Proportional gain and Integral time) settings
d. High system pressure indication and shut-down
e. Low system pressure indication and shut-down
f. Low suction pressure/level shutdown (via digital contact)
g. Low suction pressure/level warning (via analog signal)
h. Low suction pressure/level shutdown (via analog signal)
i. Flow meter settings (if used, analog signal)

2.9 The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).

2.10 All pumping system shutdowns shall be of the controlled type which gradually ramps down sequences pumps off.

2.11 The controller shall have advanced water shortage protection. When analog sensors (level or pressure) are used for water shortage

protection, there shall be two indication levels. One level is for warning indication only (indication that the water level/pressure is getting lower than expected levels) and the other level is for complete system shut-down (water or level is so low that pump damage can occur). System restart after shut-down shall be manual or automatic (user selectable).

2.12 The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically pressure) by measuring an additional parameter. (Example: Lower the system pressure set-point based on a flow measurement to compensate for lower friction losses at lower flow rates).

2.13 The controller shall be able to adjust the ramp time of a change in set point on both an increase or decrease change in set point.

2.14 The pump system controller shall store up to 24 warning and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:

a. High System Pressure
b. Low suction pressure (warning and alarm)
c. VFD trip/failure
d. Loss of remote set-point signal (4-20mA)
Low system pressure
Individual pump failure
Loss of sensor signal (4-20 mA)
System power loss

2.15 The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).

2.16 The controller shall have a pump "Test Run" feature such that pumps are switched on during periods of inactivity (system is switched to the "off" position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of two to three (3-4) seconds every 24 hours, 48 hours or once per week and at specific time of day (user selectable).

2.17 The controller shall be capable of changing the number of pumps available to operate or have the ability limit the maximum power consumption by activation of a digital input for purposes of limited generator supplied power.

2.18 The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).

2.19 The controller shall be capable of displaying instantaneous specific energy use (kw/gpm), (optional flow meter must be connected).

2.20 The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller or be able to input manually into controller based on three points on pump curve of pumps controlled.

2.21 The controller shall be capable of displaying an estimated flow-rate on the default status screen.

2.22 The controller shall have the ability to communicate common field-bus protocols (BACnet, Modbus, Profibus, or Ethernet IP and LON), via optional communication expansion card installed inside controller.

2.23 The controller shall have a built in Ethernet connection allowing controller to connected to network and access of controller via web browser and internet anywhere around the world where internet communication is available.

2.24 All operating variables, totals, operating status, alarms, and history within the controller will be made available to the SCADA provider as desired.

2.25 The controller shall have a programmable Service Contact Field that can be populated with service contact information including: contact name, address, phone number(s) and website.

3. Variable Frequency Drives

3.1 The VFD shall convert incoming fixed frequency single-phase or three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.

3.2 The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.

3.3 The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or de-rating.

3.4 The VFD shall utilize an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. VFD's

that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.

3.5 VFD shall automatically boost power factor at lower speeds.

3.6 The VFD shall be able to provide its full rated output current continuously at 110% of rated current for 60 seconds.

3.7 An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation.

3.8 Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.

3.9 Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.

3.10 The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.

3.11 VFD shall provide full torque to the motor given input voltage fluctuations of up to +10% to -15% of the rated input voltage.

3.12 The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor between each VFD and its circuit breaker. The line reactors shall be the high Z type with 5% impedance. The line reactors shall be rated for 480 nominal operating voltage.

3.13 VFD to be provided with the following protective features:

a. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.

b. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

c. VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

d. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.

e. VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. Speed can be reduced, but not stopped.

f. The VFD shall have the option of an integral RFI filter. VFD enclosures shall be made of metal to minimize RFI and provide immunity.

3.14 VFD to be provided with the following interface features:

a. VFD shall provide an alphanumeric backlit display keypad, which may be remotely mounted using standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

b. VFD shall display all faults in plain text; VFD's, which can display only fault codes, are not acceptable.

c. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.

d. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.

e. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

f. A start guide menu with factory preset typical parameters shall be provided on the VFD to facilitate commissioning.

g. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.

h. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

i. There shall be three programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. An additional digital input is preprogrammed for start/stop.

j. The VFD shall have two analog signal inputs. One dedicated for sensor input and one for external set point input.

k. One programmable analog output shall be provided for indication of a drive status.

l. The VFD shall provide two user programmable relays with selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.

m. The VFD shall store in memory the last 5 faults with time stamp and recorded data.

n. The VFD shall be equipped with a standard RS-485 serial communications port for communication to the multi-pump controller. The bus communication protocol for the VFD shall be the same as the controller protocol.

3.15 VFD service conditions:

a. Ambient temperature operating range, -10 to 45°C (14 to 113°F).

b. 0 to 95% relative humidity, non-condensing.

c. Elevation to 1000 meters (3,300 feet) without derating.

d. VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -15% variations. Line frequency variation of ± 2% shall be acceptable.

e. No side clearance shall be required for cooling of the units.

4. Electrical Installation

4.1 Electrical Design

a. All electrical material shall be UL Listed or recognized.

b. Conduit shall be nominally sized per NEC but shall not be less than ¾" minimum.

c. Flexible conduit is permitted to be ½".

d. External ground provisions shall be provided for all major equipment and main electrical devices (motors, control panels, power panels, transformers, disconnects, gutters, etc.)

e. Individual grounding shall be provided for each power circuit. Multiple grounds shall not be acceptable.

4.2 Electrical materials and installation for above skid finish surface and building electrical

a. EMT shall be provided and installed per NEC Article 358

b. Standard 4" x 11-1/2" 1900 boxes fittings shall be provided and installed per NEC Article 210, 220, and 314

c. XHHW wiring shall be sized, provided, and installed per NEC Articles 110, 300, 430, 695.

d. Wiring for control and power circuits (except electric motor circuits) shall be labeled on the end of each circuit with heat shrink type tagging. Motor circuit wiring shall be marked with phasing tape.

e. Flexible conduit and seal tight fittings shall be provided and installed per NEC Article 348 in runs up to 36".

f. Grounding shall be provided and installed per NEC Article 250

g. Electrical boxes and panels shall be NEMA 12 minimum.

h. Terminal strips shall be rated for 35A at 600V and shall be suitable for #26 AWG to #10 AWG wire size.

i. Transformer shall be general purpose dry type.

j. Load centers shall be QO, plug-on type panels.

k. Circuit breakers shall be plug-on type and provide protection for over current and short circuit.

l. Disconnects shall be general duty 3PH 600V devices and shall be NEMA 12 minimum enclosure.

m. Gutters shall be NEMA 12 minimum

n. Distribution blocks shall be 3-pole 600V and shall be 4 tap or 6 tap load side type

5. Sequence of Operation

5.1 The system controller shall operate equal capacity variable speed pumps to maintain a constant discharge pressure (system set-point). The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge

manifold, indicating the actual system pressure. As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 96% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point all pumps in operation shall reach equal operating speeds. As flow demand decreases the pump speed shall be reduced while system set-point pressure is maintained. When all pumps in operation are running at low speed the system controller shall switch off pumps when fewer pumps are able to maintain system demand.

5.2 The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.

5.3 All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.

5.4 The system controller shall be able to control a pressure maintenance pump, (jockey pump), in the system. The set point of the pressure maintenance pump shall be able to be any value above or below the pump system's set point. The pressure maintenance pump shall be able to be staged on as back-up pump when capacity of pump system is exceeded.

6. Low Flow Stop Function

6.1 The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable.

Standard Low Flow Stop and Energy Saving Mode

If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off

band). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

6.2 Low Flow Restart: If the drop in pressure is slow when the start pressure is reached (indicating the flow is still low), the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.

6.3 Normal Flow Restart: If the drop in pressure is fast (indicating the flow is greater than 10% of pump nominal flow) the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

2.4 SYSTEM CONSTRUCTION

A. Skid Base Structure

1. Materials

1.1 All skids shall be constructed of fabricated carbon steel.

1.2 All materials used in the construction of the skid base, equipment mounting provisions, and support materials shall be new.

1.3 All structural steel shapes, bars, plates shall be ASTM A36 grade meeting the requirements of ASTM A6.

1.4 All structural channel, I-beam, and square tubing provided as skid running members (main supports) shall be provided with MTR reports upon request at time of order.

2. Standards of Design

2.1 Load bearing beams shall be contained within and welded to a steel, I-beam or structural channel exterior.

2.2 Appropriate space and clearance shall be provided for access, operation, and maintenance of supplied equipment.

2.3 Unit will be constructed as open I-beam or C-channel base that shall be sized for the weight of the equipment being provided. Open frame design shall be filled with compactable material, finished with concrete, and sloped to drain by installing contractor. All equipment will be attached to main skid members and connected appropriately (including pump, driver, controller)

2.4 Lifting provisions shall be incorporated into the skid design. The preferred method of lifting provision shall be lifting lugs installed in the exterior running members of the skid structure.

3. Standards of Manufacture

3.1 All welded structural members, brackets, pipe supports, equipment supports, and racks will be completely seal welded. Plates may be stitch welded.

3.2 All structural welds will be performed by AWS D1.1 certified welders.

3.3 All welds shall be of high quality and ground clean. The welds shall be free of slag, pinholes, and undercut.

3.4 All major equipment shall be bolted to main skid structural members. Equipment may be installed on stands, risers, etc. No equipment may be attached to floor plate or light weight (less than ¼") angle brackets.

3.5 All skids shall be provided with two drilled and tapped grounding lugs located at opposite corners of the skid and seal welded to the exterior structural member web.

3.6 The measurement of the skid diagonal will fall within ¼" of the calculated value using the square root of the sum of the squares of the measured length and the measured width.

3.7 The main welded skid joints (4 corners) shall be liquid penetrant tested in accordance with ASTM E1417-95a, Standard Practice for Liquid Penetrant Examination Using Solvent Removable Process.

3.8 The lifting lugs shall be liquid penetrant tested in accordance with ASTM E1417-95a, Standard Practice for Liquid Penetrant Examination Using Solvent Removable Process.

B. Piping

1. Materials

1.1 All carbon steel pipe used in the system shall be a minimum schedule 20 ERW API5LX-52 or ASTM A53B grade material.

1.2 All piping, 10" and smaller, shall be constructed from ASTM A105 or ASTM A–53 schedule 40 pipe.

1.3 Piping greater than 10" shall be standard weight and conform to the same specification.

1.4 Piping 10" to 24" size shall be plasma cut and beveled, including ends, and side penetrations, on a single machine, capable of tilting, extending, and rotating the pipe for making three dimensional cuts. All entrances and exits to the piping shall also be cut in this fashion. Machine shall cut manifolds and branches to be welded onto the manifolds, including any cuts that are not 90 degrees to the axis of the pipe.

1.5 Maximum velocity in manifolds shall be no greater than 10 feet per second (FPS).

1.6 Maximum velocity in branches 7.5 FPS.

1.7 Grooved piping fittings shall be cast iron, ductile iron, or carbon steel construction. Grooved fittings shall have a maximum allowable working pressure of 300 PSI or greater.

1.8 Flanged carbon steel fittings shall be Class 150 as appropriate for system working pressure.

1.9 Welders performing structural and pipe welds shall be certified to ASME section IX, and their certificates shall be on file with the manufacturer. Upon request by the engineer or owner, the certificates shall be made available for inspection.

1.10 After fabrication and before coating, piping shall be hydrostatically tested to 150% of maximum pump shutoff pressure plus stated suction pressure, or greater.

1.11 Fusion bonded epoxy shall be equivalent to 3M 134 FEBC.

1.12 Optional Materials For Drinking Water

a. Carbon steel as noted above with NSF61 Scotchkote 134HG coating on pipe interior.

2. Piping Supports

2.1 Piping support shall be manufactured from structural rectangular tubing, sized according to the weight and size of the piping to be supported.

2.2 Each tubing member shall be capped to prevent internal corrosion.

2.3 Vertical tubing members shall be solidly welded to the skid and shall support the weight of the piping when filled with water.

2.4 Horizontal tubing members shall be solidly welded to the vertical members, shall extend beyond the pipe OD, and shall support the weight of the piping when filled with water.

2.5 Piping shall be secured to the members through the use of piping U bolts designed for this purpose.

2.6 Thrust of the piping, whether the thrust is in the vertical or horizontal direction, shall be restrained on site by the installing contractor.

3. Standard of Manufacture

a. All pipe connection welds will be performed by ASME Section IX certified welders.

b. All welds shall be of high quality and ground clean. The welds shall be free of slag, pinholes, and undercut.

c. Piping and piping components shall be installed and supported to prevent excess strain as required by pump and valve manufacturers.

4. Piping designed for the removal of smaller pumps to be replaced with larger (future) pumps as the demand for water increases for this application.

C. Valves

1. Butterfly Valves

a. All butterfly valves shall be provided in the sizes shown on the pump station plan drawings. Included are the pump suction, discharge, and bypass isolation valves.

b. Valves shall be capable of bi-directional and end of line, drop tight service.

c. Valve shall have one piece ASTM A-536 ductile iron body.

d. Upper and lower shafts shall be 416 stainless steel.

e. Disc materials may be ASTM A-536 ductile iron with ENP plating or Nylon 11 coating or CF8M stainless steel or aluminum bronze.

f. Shaft seals shall be self–adjusting V-type with full length Nylatron bushings.

g. Seats shall be a replaceable one piece BUNA-N seal with a three groove fit to the body.

h. Manual actuators shall be of the traveling nut, self–locking type and shall be designed to hold the valve in any position intermediate between fully open and fully closed without creeping or fluttering. Hand wheel operators shall be provided.

i. Valves shall be rated at 150 PSI working pressure.

j. Valves shall be the BF Series as manufactured by Henry Pratt Company.

2. Ball Valves:

a. Isolation valves from 1/4 inch to 1 inch sizes, shall full port ball valves.

b. Valve shall be a two piece bronze full port ball valve rated at 300 PSI CWP.

c. Valve shall have adjustable packing, blow–out proof stem, RPTFE seats and stuffing box ring, hardened ball, and actuator mounting pad.

d. Stem and gland shall be from B16 bronze.

e. Ball shall be chrome plated, from B16 bronze.

f. Retainer and body shall be from B584–C84400 bronze.

g. Body seal shall be from PTFE.

h. Quarter turn manual actuator shall be from zinc plated steel, with Vinyl cover.

i. Ball valve shall be as manufactured by American, Apollo, Conbraco, or Watts.

3. Grooved Couplings:

a. A grooved coupling shall be provided in the suction piping of each pump with the sizes matching the suction valves shown on the pump station plan drawings.

b. Grooved coupling body material shall be ASTM A536 ductile iron.

c. Grooved coupling gasket material shall be NSF 61 approved EPDM.

d. The grooved couplings shall be as manufactured Victaulic, Groove Lock, or Equal.

4. Check Valves:

a. Check valves shall be provided on the discharge of each pump and in the bypass piping with the sizes shown on the pump station plan drawings.

b. Check valve shall be globe body silent type. Check valves shall begin to close as forward velocity diminishes and shall be fully closed at zero velocity preventing flow reversal.

c. The valve body materials shall be ASTM A126, CLASS B cast iron and shall be lined with NSF approved fusion bonded epoxy.

d. The seat shall be lead-free bronze with a Buna–N insert for positive sealing to the disc.

e. The concave shaped disc materials shall be lead-free bronze.

f. Springs and retaining screw materials shall be T 316 stainless steel.

g. Bushing shall be as manufactured from lead free bronze.

h. Retaining screws shall be as manufactured from 316 stainless steel 9.

i. The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends, having a short linear stroke that generates a flow area equal to the pipe diameter.

j. Valves shall be sized to permit the design flow rates to pass through them without exceeding a pressure drop of 3 feet of water column. The check valves shall be rated at a maximum internal velocity of 10 FPS.

k. Check valves shall be rated at 150 psi working pressure.

l. Check valves shall be 1800 series as manufactured by Val–Matic.

D. Air Release Valves:

a. 1" air release valves shall be provide as shown on the pump station plan drawings. An isolation ball valve shall be provided upstream of each air release valve.

b. Air release valves shall have a ductile iron body, a stainless steel ball, and stainless steel trim.

c. Air release valves shall be rated at 300 psi working pressure with a 1/16 inch orifice.

d. Air release valves shall have a drop tight synthetic seat

e. Air release valves shall be model 22.9 as manufactured by Val–Matic.

E. Hose Bibs:

a. A hose bibb with vacuum breaker shall be installed on the suction and discharge headers.

F. Sensors and Gauges **(Factory Choice**)

1. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made

of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.

2. A bourdon tube pressure gauge, 2.5 inch diameter minimum, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2-1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.

3. Transducers and Gauges shall include isolation shut-off valves to permit isolation and replacement of the component.

G. Overhead Crane

Overhead crane designed to lift 2 TONS (4,000lbs) welded to skid members. Crane designed for individual pump removal if required.

2.5 COATINGS: EQUIPMENT, STRUCTURAL STEEL, AND PIPING

1. All equipment that is provided within the packaged system should be supplied with the respective manufacturer's standard coating, unless otherwise noted. See Coating Specification No. 9000 for specific details.

2. Structural steel, piping, equipment support brackets and other packaged system items as necessary shall be protectively coated (RAL 9005 Black Low Gloss OR otherwise defined).

3. All steel piping shall be blasted inside to SSPC SP10, near white metal, and lined with an FDA/NSF 61 approved fusion bonded epoxy, meeting the requirements of AWWA Standard C213 and C550, tested and found to be without holidays. Fusion bonded epoxy shall be applied to the thicknesses required by AWWA Standards C213 and C550, and the manufacturer's recommendations regarding temperature, and duration. Manufacturer's certificate of application shall be retained on file, and shall be available for inspection when requested by the engineer or owner.

2.6 TESTING

The piping system shall undergo a factory hydrostatic test at the end of the production cycle. The piping system shall be filled with water and pressurized to 1.5 times the pump nameplate design pressure. The pressure shall be maintained for a minimum of 10 minutes with no leakage prior to shipment. Full system hydro-test can be offered if requested. Once package is installed at site, another hydrotest shall be required to ensure all bolts and fittings are tightly secured prior to startup (per installation instructions.

Electrical verification shall be performed at the factory, consisting of but not limited to proper function of lights, outlets, fans, dampers, AC units, and Controls operation. Grounded continuity testing and Hi-Pot testing on motor wiring shall be performed and recorded as part of the quality process.

2.7 WARRANTY

The manufacturer shall warrant the water pumping system to be free of defects in material and workmanship for one year (12 months) from date of authorized start-up, not to exceed eighteen (18) months from date of manufacturer's invoice. Complete terms and conditions will be provided upon request.

END OF SECTION

SECTION 02700
WATER DISTRIBUTION SYSTEM

1. SCOPE:

Under this heading shall be included installation of the water distribution system as shown and as specified herein.

The Contractor shall comply with all local codes and regulations of local utilities. He shall coordinate work necessary for the completion of utilities with local utility companies and cooperate with the companies as required.

2. EXCAVATION AND BACKFILL:

Excavation and backfill shall be as specified in Section 02221, Excavation, Trenching and Backfilling for Utility Systems. A minimum cover over the top of the pipe of 36-inches from the proposed paving subgrade, shoulder or finish grade shall be provided.

3. MATERIALS:

All pipe material, solder and flux shall be lead free (less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings). All materials shall be certified for conformance with American National Standards Institute / National Sanitation Foundation Standard 61 (ANSI/NSF61).

a) Metal Pipe.

1) Ductile Iron Pipe.

Ductile iron pipe shall be manufactured in accordance with ANSI /AWWA C151/A21.51, latest revision.

Ductile iron pipe shall be of the thickness according to ANSI/AWWA C150/A21.50, latest revision, for Laying Condition Type 2, at a minimum.

Flange Pipe or Victaulic grooved pipe shall be Pressure Class 350.

2) Fittings.

Fittings shall conform to ANSI/AWWA C111 A21.11, latest revision, and shall be push-on-type unless otherwise shown.

Flanged Fittings shall conform to ANSI/AWWA C110/A21.10, latest revision. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115 threaded-on flanges which also match ANSI B16.1 Class 125 flanges except where Class 250 are specifically noted.

Mechanical Fittings shall conform to ANSI/AWWA C153/A21.53, latest revision. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts

shall conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

3) Joints.
Push-on Joints shall conform to ANSI/AWWA C111/A21.11, latest revision.

Flanged Joints shall conform to ANSI/AWWA C115/ A21.15, latest revision.

Mechanical Joints shall conform to ANSI/AWWA C111/A21.11, latest revision. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

4) Lining.
Lining for ductile iron pipe and fittings shall be a cement mortar lining meeting the ANSI/AWWA C104/ A21.4, latest revision, for standard thickness lining. After cement lining, the interior of the pipe shall be given a seal coat of approved bituminous material in accordance with ANSI/AWWA C104/A21.4, latest revision.

5) Exterior Coating.
Exterior coating shall be an approved bituminous coating one mil thick in accordance with ANSI/AWWA C151/ A21.51, latest revision.

6) Conductive Joints
Where conductive joints are indicated on ferrous pipe that are subject to electrical thawing service, metal contact strips molded into the gasket are acceptable. Conductive gasket shall be capable of carrying 600 amps. These gaskets are not to be used where corrosion monitoring and cathodic protection are a requirement.

7) Bonded Joints
Where indicated on ferrous pipe, a metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of non-ferrous-metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

b) PVC Pipe.
PVC pipe shall be Underwriters' Laboratories approved and listed and must meet all requirements of ASTM D2241 and bear the seal of conformance to NSF61.

PVC pipe used for water mains shall be blue in color only. It shall meet or exceed AWWA C900 with the following supplemental specifications:

1) Pressure Pipe.
Pipe less than 4 inches shall be Polyethylene Pipe , 200 psi, SIDR-7CTS. Pipe 4 inches to 12 inches shall be Class 150 with Dimension Ratio 18 or lower (thicker).

Pipe 14" and larger shall be Class 235 C905 DR 18.

2) Routine Hydrostatic Proof Test Requirements.
Each piece of pipe shall be tested at four (4) times rated pressure class.

3) Outside Diameter.
Pipe shall have cast iron pipe outside diameter.

4) Joints.
Pipe shall have elastomeric-gasket integral bell end. Bell section shall have a thickened wall. Gasket groove Wall thickness shall meet or exceed the thickness of the pipe barrel.

5) Fittings.
Ductile iron shall be mechanical-joint type conforming to ANSI /AWWA C153/A21.53, latest revision, with cement mortar lining and seal coat in accordance with ANSI/AWWA C104/A21.4,latest revision, and one mil thick petroleum exterior coating in accordance with ANSI/AWWA C104/ A21.4, latest revision, unless otherwise shown.

6) Affidavit of Compliance.
The manufacturer shall furnish an affidavit that all materials delivered comply with the requirements of this standard and supplemental specifications.

7) Couplings and Fittings.
Couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used. They shall have the same minimum pressure rating as the pipe. Coupling method shall allow for expansion or contraction of each pipe section to be taken up at each end of the pipe. Couplings shall permit five (5) degree deflection (2 2 degrees on each side) of the pipe with any evidence of infiltration, exfiltration or breaking.

8) Gaskets:
PVC pipe joint gaskets shall meet the requirements of ASTM F477.

c) Gate Valves.

Gate valves shall be as shown on the Drawings and shall conform to the following Specifications:

1) Resilient-Seated Gate Valves (3 Inches to 12 Inches).

Resilient-seated gate valves 3 inches to 12 inches shall conform to AWWA C509 with non-rising stem.

Unless otherwise indicated or specified, gate valves shall be designed for a working pressure of not less than 250 psig.

Valves shall take full pressure on either face. Valves shall be from one manufacturer and similar sizes shall be identical and parts interchangeable. They shall be constructed with bolted bonnets provided with two O-ring stem seals which can be replaced with the valve under pressure in the full-open position.

Valves shall be constructed of materials conforming to AWWA C509. All internal and external surfaces shall be coated with fusion bonded epoxy to a minimum thickness of 8 mils.
Valve seats shall be coated with a rubber material conforming to AWWA C509 so that there shall be no rubber to metal contact when the valve is in the fully closed position.

Valves shall be hydrostatically tested in accordance with AWWA C509.

Valves shall be American, Waterous or approved equal and shall be furnished with standard hand wheels, chain wheels or nuts as shown on the Drawings and/or as specified.

2) Ball Valves (2 Inches & Smaller.)

Ball valves 2 inches and smaller shall be designed for a working pressure of not less than 300 psi, domestic made brass, and shall conform to AWWA standard C 800-89.

a) Standard tee head stops in body permit 90 degree turn only.
b) Padlock wings shall be used on the tee head.

d) Butterfly Valves 14 Inches and Larger:

Butterfly valves 14-inches and larger shall be of the tight-closing, rubber seated type, with rubber seat positively locking in place against flow from either direction. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction. Butterfly valves shall conform to ANSI/AWWA C504, Class 150B.

1) Valve body shall be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valves shall have Mechanical Joints per AWWA C111. All MJ accessories (bolts, glands, gaskets) shall be supplied by the valve manufacturer. Valves for below ground service shall be installed using restrained joints.

2) Valve shafts shall be 304 stainless steel and shall consist of a one-piece, extending full size through the entire valve or 18-8 stainless steel stub shaft design keyed to the vane with stainless steel torque plugs.

3) Valve discs shall be solid ductile iron with an epoxy coating making it corrosion resistant. The thickness of the discs shall not exceed 2-1/4 times the shaft diameter.

4) Valve seats shall be natural or synthetic rubber providing 360 degrees uninterrupted seating. The resilient seat shall be adjustable or replaceable in the field without burning or grinding. The seat shall be molded over a stainless steel ring for support and secured to the disc by corrosion resistant, self locking stainless steel screws.

5) All internal ferrous metal surfaces in the waterway shall be factory coated with a non-toxic, two-component, holiday-free, thermosetting epoxy to a nominal thickness of 4 mils. All external surfaces shall be coated with an epoxy coating conforming to AWWA C-550, with a minimum thickness of 10 mils.

6) All butterfly valves shall be manually operated. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position without creeping or fluttering. Operators shall be furnished with externally adjustable mechanical stop limiting devices. Valves shall have a 2-inch square operating nut and shall be installed with extension stems to extend the operating nut in accordance with the project details. The operator shall be integrally mounted on the valve mounting flange and shall have all gearing totally enclosed for buried service. Maximum force for operating nut shall be 40 pounds.

7) All valves shall be M&H model 4500, or approved equal.

e) Hydrants.

Hydrants shall conform to AWWA C502. Main Valve opening size shall be 4-2 inches minimum and inside barrel diameter shall be 7 inches minimum with 3 feet minimum bury. Hose connections shall be two 22 inches and one 42 inches. Nipple caps shall be chained to the barrel. Hydrant shall be DRY TOP type protecting operating threads from coming in contact with water. Operating

threads will be grease lubricated through easily accessible Alemite fitting in top of operating nut. Direction of opening shall be counterclockwise and be cast on the head of the hydrant. Hose nipples shall be bronze or non-corrosive metal and threads shall be National Standard.

Hydrants shall be traffic type utilizing stem breaking coupling and breakaway traffic flange. (Breakable bolts or nuts are not acceptable.)

Hydrants shall be painted with 1 coat of red paint and 2 finish coats of approved paint of fire hydrant yellow color or as otherwise directed.

Hydrants shall be American Darling, Mueller, M&H or approved equal.

f) Tapping Sleeves and Valves

Tapping sleeves and valves shall be used for making branch connections to an existing water main. Tapping sleeves shall be provided at the locations indicated on the Drawings and shall be mechanical joint type, Mueller No. H-615, Clow F-5205 or approved equal. Tapping valves shall be mechanical joint type gate valves, Mueller No. 667, Clow F-5093 or approved equal, and shall conform to the requirements of this Section.

g) Tapping Saddles (Service Saddle):

Tapping saddles shall be used for making service connections on 4" and larger PVC and/or Ductile Iron Pipe. Drawings shall show a Smith Blair Series 317 service saddle or approved equal. At each point where a 1 2" or 2" connection is required.

h) Air Release Valves

Air Release Valve shall be 2-inch screwed inlet. The air release valve shall be designed to permit automatic escape of large quantities of air from the pipeline when the line is being filled and must also allow accumulating air to escape while the line is in operation and under pressure. The body and cover shall be able to operate at pressures up to 300 psi. The open end of and air relief pipe from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

Air release valve manufacturer shall be Crispin Model No. PL-10 or VENT O MAT Series RBX, or approved equal.

i) Water Service Pipe Material

Pipe shall conform to AWWA Specifications C901-96, Polyethylene Pressure Pipe and Tubing, and shall be marked with AWWA requirements and the following:

Polyethylene	To Be Marked On Pipe
Nominal Size	X
ASTM D2837	X
SDR 9	X
PE 3408	X
Working Pressure - 160 psi	X
Water Service Tubing	X
National Sanitation Foundation (NSF 14)	X
Pipe Color	Blue

Unmarked pipe, without information noted above, will not be accepted. Polyethylene pipe shall comply with ASTM D1248 PE3408 Class III, A, 5, P34. Brass (Domestic Made) or bronze compression type fittings shall be used. Flared connections will not be permitted. Continuous metallic tape over the pipe and tracing wire will be required. No gooseneck will be allowed nor will solvent weld joints be allowed. Corporation and curb stops will be required on all laterals. Minimum nominal size shall be 1 inch.

j) Corporation Stops.

At each tapped point a connection to the pipe shall be made by installing a corporation stop. Corporation stops shall be Ford F 1000-4-G AWWA/CC Ground Key Corporation Stop, or approved equal, as required for the type of pipe being tapped.

k) Curb Stops

Curb stop shall be 1 inch size or as shown on the Drawings and shall be Ford C14-44G1 FIP x GJCTS with a Brass, domestic made, square head cored plug, or approved equal.

l) Service Saddles

Service saddles shall epoxy coated, ductile iron, double strap - stainless steel manufactured by Smith-Blair, Model 317 Service Saddle, or approved equal.

m) Post Indicator Valve

Each post indicator valve shall consist of a gate valve which meets these specifications and an indicator post which meets National Fire Protection Association Code, NFPA 13. The gate valve and post indicator shall be

compatible. Post indicator shall be painted with one coat of red paint and two coats of paint suitable for exterior finish.

n) Post Hydrant

Post hydrant shall have main valve opening of 2-3/16-inches, with all working parts brass. The operating rod shall be non-turning, and all operating parts shall be removable from above ground with no special wrenches. The hydrant shall have a two and one half (2 2) inch NFS outlet and a two(2) inch inlet, unless otherwise specified on the Drawings. The hydrant shall be non-freezing, and self-draining with a three (3) inch ductile iron barrel. Post hydrant shall be M&H Post Hydrant Style 33, or approved equal.

o) Valve Box

Each buried valve shall be accompanied by a valve box of the adjustable type of heavy pattern, constructed of cast iron, and provided with cast iron cover.

The upper section of each box shall have a flange at the bottom, having sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the operating nut of the valve. Boxes shall be of lengths consistent with pipe depths as shown on the Drawings. Boxes shall be adjustable, with a lap of at least 6-inches when in the most extended position. Covers shall have the word "WATER" cast in the top. Each valve box shall have a concrete round collar installed around the top along with a concrete valve marker at each valve.

p) Valve Manhole

a) General.

Manholes shall be constructed at such points as designated on the Drawings. Riser and top sections shall be installed level and plumb, such that all manhole steps are in alignment. The top of manholes outside of roads, streets and highways shall be built to grades 2 inches above ground surface, unless otherwise shown. Manholes in roads, streets and highways shall be built to grades shown on the Drawings.

b) Precast Concrete Manholes.

Precast Concrete manholes shall be constructed of reinforced Class "A" Concrete. Walls shall be not thinner than 5 inches, or 1/12 of the inside diameter, which ever is greater. Precast manholes shall meet all requirement of ASTM C478, "Specification for Precast Reinforced Concrete Manhole Sections."

Rings shall be custom made with openings to meet the necessary pipe alignment conditions and invert elevations. All inlets and outlets shall be cast in or core drilled. Joints and gaskets shall conform to the applicable provisions of ASTM

C443, "Joints for Circular Concrete Sewer and Culvert Pipe using Rubber Gasket" or Ram-Nek Pre-molded Plastic Joint Sealer. The sealing compound shall not leak at the joints (while being tested, if required, at 10 psi) for a period of 24 hours. Bell and spigot surfaces shall be smooth, accurately formed, and provide a loose, sliding fit, with a clearance between the bell and spigot of not more than 1/6 inch. Precast manholes shall be bedded on not less than 6 inches of compacted crushed stone at the Contractor's expense. The crushed stone shall extend not less than 6 inches outside the walls of the manhole and under the entire length of pipe within the excavation for the manhole.

q) Meter Box - 3/4" and 1"

Meter boxes shall be of cast iron and shall be 3/4" stretch box Ford LYLV141-243T or stretch box Ford LY 111-444-YBL-T, or approved equal. The lid shall have the word AWATER@ cast in it.

r) Polyethylene Encasement

Polyethylene encasement of pipes and fittings shall be installed on all Ductile Iron Pipe. The polyethylene encasement shall have a nominal thickness of eight (8) mils and shall conform to AWWA C105.

s) Yard Hydrants

Yard hydrant shall have large cushion type plunger, positive shut-off, automatic drain feature to prevent freezing, with a depth of bury of four (4) feet. Yard hydrant shall have a 1" NPT inlet and a brass nozzle with 3/4" hose threads. Yard hydrants shall be Woodford Freezeless IOWA Model Y1, or approved equal.

t) Backflow Preventer:

Backflow preventer shall comply with the Effingham County=s Backflow - Prevention and Cross-Connection Control Manual.

u) Sampling Station

Sampling Station shall have a 3/4-inch un-threaded nozzle. All stations shall be enclosed in a lockable, non-removable, aluminum-cast or stainless steel housing. When opened, the station shall require no key for operation and the water will flow in an all brass waterway. All parts shall be brass and be removable from above ground with no digging. A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth. The exterior piping will be galvanized and shall be Model Eclipse No. 88 as manufactured by Kupferle Foundry or approved equal.

v) Insulated Enclosures:

Insulated enclosures shall consist of a fiberglass shell, insulated with urethane foam, provide security and freeze protection and shall provide drains sized for

full port discharge, testing and maintenance access, vandal protection and optional freeze protection. The enclosure shall be GREEN in color. Insulated enclosures shall be manufactured by EzBox - Jacksonville, Florida, or approved equal.

w) Tracing Wire:

Tracing wire shall be single strand #12 AWG, Vinylon - A THWN or THHN or gasoline and oil resistant II VW 600V or AWM. Tracing wire shall be continuous with all water mains, fire hydrants, post hydrants, sample stations. Tracing wire for water laterals shall be a single strand from the main to the end of the service lateral terminating in the meter box. Tracing wire shall be a single strand installed from the main to all Utility Marking Post line markers with sufficient length at the marker to be wrapped around the marker several times.

x) Concrete Valve Marker

Concrete valve marker shall be 4"x4" square by 4'-6" in length with 4-#3 re-bar cast in 4,000 psi concrete. All corners shall have a 3/4" chamfer. A 2" brass marker plate with anchor shall be embedded in the top. The brass plate shall have a directional arrow pointing to valve with the distance to the nearest foot and shall be labeled "Water Valve". The concrete valve marker shall be set 24" in the finish grade and shall be painted BLUE.

y) Utility Marking Post:

Utility parking post shall be placed every 500 feet or as shown on the Drawings above the utility and at fittings and labeled accordingly. The marking post shall be rigid enough to be easily installed in most soil conditions and durable to withstand repeated impacts. The marking post shall be a four (4) inches in width and remain flexible from -40E F to +140EF with UV stabilizers. The marker shall highly visible standard fade resistant colors, White Background and Blue Lettering with the following imprinted thereon: international ANo Dig@ symbol, federal law warning,@WATER PIPELINE BELOW@ with letter size and stroke to comply with the Federal Office of Pipeline Safety Specifications, Effingham County=s name, phone number and State one-call number. Markers shall be Rhino 3-Rail with poly tech coating, or approved equal.

4. INSTALLATION.

a) General.

Pipe, fittings, valves, hydrants and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground. In distributing the material at the site of the

work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Coated pipe shall be handled in such a manner that a minimum of damage to the coating will result. Damaged coating shall be repaired. Pipe shall be placed on the site of work parallel with the trench alignment and with bell ends facing the direction in which the work will proceed unless otherwise directed. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing before installation. Before installation of any materials, an Effingham County representative shall inspect and approve all material before installation.

Cutting pipe for inserting fittings, or closure pieces, shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise directed, pipe shall be laid with the bell ends facing the direction of laying. For lines on an appreciable slope, bells shall face upgrade. Wherever necessary to deflect the pipe from straight line, whether in the vertical or horizontal plane to avoid obstructions, the degree of deflection shall not exceed 2-1/2 degrees. No pipe shall be laid in water or when the trench condition or the weather is unsuitable for such work. Installation shall be in accordance with manufacturer's instructions.

All pipe and fittings shall be carefully lowered into the trench piece by piece by means of derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to the pipe. Under no circumstances shall pipe or accessories be dropped into the trench. Before lowering and while suspended, ductile iron pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench and it shall be kept clean by approved means during and after laying. Care shall be taken to prevent dirt from entering the joint space. At all times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe.

b) Ductile Iron Pipe.

Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work.

c) PVC.

Pipe shall be installed in accordance with AWWA C605. Excavation, bedding and backfill shall be as specified in Section 02221.

d) Hydrants.

Hydrants shall be set at such elevations that the connecting pipe will have the same depth of cover as the distribution mains. The connecting pipe shall be

ductile iron pipe. The hydrant assembly shall be restrained from the main to the hydrant. Hydrants and valves shall have the interior cleaned of all foreign matter before installation. Not less than one (1) cubic foot of broken stone shall be placed around the base of the hydrant. Contractor shall place a bag over the hydrant to indicate its not being in service until after the water main is put into service.

e) Water Service Connection

Service lines shall be connected to 4-inch and larger mains with a corporation stop. Connections to mains smaller than 4-inches shall be made with a rigid connection. Plugged tees or crosses for future connections shall be installed where shown on the Drawings. A house service connection shall be provided to vacant lots and the exact location marked on the curb with a AW@. The mark shall be made on the vertical face of the curb and shall be a minimum of 1/4-inch deep made with a branding iron. Where services are provided at locations without curb, a 2"x4" 30-inch long pressure treated flag stake painted white shall locate the end of the lateral. Minimum cover of 30-inches shall be provided until a short transition to the service is stubbed out of the ground.

Water service laterals installed under roadways shall be installed a minimum of 30 inches below the road (laterals shall not be installed in the base of the road). Water service laterals shall be installed one foot short of the property line of all lots along street and right -of-ways in which water main is constructed.

f) Brass Nipples and Brass Pipe Fittings (Domestic Made):

Threads shall be cleanly cut with sharp tools and the jointing procedure shall conform with the best practice. Before jointing, all scale shall be removed from pipe by some suitable means. After cutting, all pipe shall be screwed together with an application for graphite and engine oil, Teflon tape, or other sealing compound applied to all threads and once a joint has been screwed on it shall not be backed off unless the threads are re-cleaned and new compound or Teflon tape applied. Unions shall be installed at every connection to the supply line.

g) Hydrostatic Tests.

The Contractor shall provide all necessary equipment and shall perform all work required in connection with the tests. Each section shall be tested by hydrostatic pressure of 150 pounds per square inch. Each section shall be slowly filled with water, care being taken to expel all air from the pipes. If necessary, the pipe shall be tapped at high points to vent the air. The required pressure as measured at the point of lowest elevation shall be applied for not less than 2 hours and all pipe, fittings, valves, hydrants and joints shall be carefully examined for defects. Each valve shall be opened and closed several times during the test. All defective joints shall be repaired or replaced.

h) Connection to Existing Water System.
The Contractor shall furnish necessary materials and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new main to the existing water main. The Contractor shall notify the Engineer and Effingham County, a minimum of 48 hours in advance of construction. The Contractor shall be responsible for coordinating his construction with Effingham County.

i) Damage to Water System.
Damage to any part of the water system by the Contractor, or subcontractors, that is repaired by Effingham County shall be charged to the Contractor on the basis of time and material, plus 30 percent for overhead and administration.

j) Protection of Water Supply Systems.
See Section 02221, Paragraph 13 for protection of Water Supply Systems.

k) Polyethylene Encasement
Polyethylene encasement shall conform to ANSI/AWWA C107/A21.5, latest revision for high density, cross-laminated polyethylene film. Polyethylene encasement shall be used where noted on the contract drawings or directed by the Engineer on all ductile iron piping, fittings, valves and appurtenances and installed according to the requirements of ANSI/AWWA C105/A21.5, Sec. 4.4, Method A.

l) Joint Restraints:
All restraints shall be used in accordance with engineering and manufacturer=s specifications. Thrust block is not allowed. Joint restraints shall be:
Ford 1390 Series, Mega-Lug, EBBA Series 1100 for Ductile Iron 4" and larger, EBBA Series 2000 PV for PVC Pipe 4" and larger, Flexlock, T-lock, Uni-Flange, or approved equal.

5. HYDROSTATIC TESTING:
All pressure and leakage test shall be performed in accordance with the latest edition of AWWA C600. Leakage test shall be conducted simultaneously with the pressure test. The duration of the test shall be 2 hours and during the test the main or section of main under test shall be subjected to a pressure of 150 psi based on the lowest point in the line or section under test, and connected at that elevation to the test gauge. Test pressure shall not vary more than ∀5 psi for the duration of the test. Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the test pressure after the pipe has been filled with water and the air has been expelled. Testing allowance shall not be measured by a drop in pressure in a test section over a period of time. Testing allowance is defined as the quantity of water to be supplied into the newly laid pipe or any valved section thereof, necessary to maintain the specified leakage test pressure after

the air has been expelled and the pipe has been filled with water at the test pressure. No pipe installation will be accepted until the testing allowance is less than the number of gallons per hour as determined by the formula.

$$L = \frac{S \times D \times /P}{133{,}200}$$

L = testing allowance (makeup water) in gallons per hour
S = the length of pipe tested in linear feet.
D = the nominal diameter of the pipe in inches
P = the average test pressure during the hydrostatic test in pounds per square inch (gauge).

Should any test of pipe laid disclose leakage greater than the above specified, the Contractor shall at his own expense locate and repair the defective joints until leakage is within the specified testing allowance. All visible leaks shall be repaired regardless of the allowance used for testing. Line shall be retested until Testing Allowance requirement are within the allowable leakage. All additional testing shall be at the Contractors=s expense.

6. CLEANING AND DISINFECTION OF NEW MAINS:

All water mains, as well as those taken out of service for inspection, repair or other activities that might lead to contamination of water shall be disinfected before they are placed in or returned to service. The water passing through them must show by laboratory tests safe results before the system can be placed in service. Disinfection of all water lines and the disposal of the heavily chlorinated water, following the disinfection, shall be in accordance with AWWA C651, latest revision. Approved methods for the accomplishment of these are as follows:

The Atablet method@ of disinfection which consist of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is completed is not allowed.

Clean the interior of all pipe by brushing, swabbing or washing out all debris before laying. Stop up all branches and other openings with wooden plugs or heads until either capped or connected. The use of a cross connection device during flushing and disinfection to protect the active part of the water system shall be required. Before the main is chlorinated, it shall be filled to eliminate air pockets and shall be flushed to remove particulates. A flushing velocity of not less than 2.5 feet per second shall be maintained in pipe sizes less than 24-inches in diameter. For larger diameter mains, an alternative to flushing, such as broom-sweeping of the main, is acceptable prior to chlorinating the main.

Install sufficient number of sample points to give representative sampling on the newly installed lines. The hydrants should be at least 18 inches higher than main and must discharge toward the ground.

Quality of water used during the disinfection procedure shall meet the required drinking water standards.

Flush the new pipe lines for a full pipe open end flush until the water runs clear at the end of all mains and laterals. This should be done after the pressure test and before disinfection. Each valved section of the newly laid pipe should be flushed separately with potable water.

Disinfect the pipe lines with chlorine. The preferable point of application of the chlorinating agent is at the beginning of the pipe line extension, or any valved section of it, and through a corporation cock inserted in the horizontal axis of the newly laid pipe. Water from the existing distribution system should be controlled to flow very slowly into the newly laid pipe during the application of the chlorine. Partially open all hydrants or valves on the newly laid line under treatment to prevent the building up of water pressure. The chlorine solution used for disinfection of water mains shall have a free chlorine residual concentration not less than 25 mg/l. This heavily chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants shall be operated to ensure disinfection of the appurtenances.

Allow the treated water to remain in the pipe line for at least 24 hours, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine. Re-chlorinate if required results are not obtained on all samples. After the applicable retention period, the heavily chlorinated water must not be disposed in a manner that will harm the environment. Neutralizing chemicals, such as Sulfur Dioxide, Sodium Bisulfite, Sodium Sulfite or Sodium Thiosulfate can be used to neutralize the chlorine residual remaining in the water to be wasted. Flush all mains and lines until all the heavily chlorinated water has been removed.

Test water samples to make sure all chlorine has been flushed out or until the concentration of chlorine in the newly laid lines is no higher than that of a sample taken on the supply line. After final flushing and before the water main is placed into service, water samples shall be collected from the main and tested for microbiological quality in accordance with the Georgia Rules for Safe Drinking Water, Chapter 391-3-5. The laboratory results must show the absence of coliform organisms in the water. Re-flush and re-disinfect the lines, as necessary, until satisfactory bacteriological results are obtained.

AMOUNT OF CHLORINE NECESSARY FOR DISINFECTION

Chlorine required to produce 25 mg/l concentration in 100 feet pipe by diameter.

Pipe Diameter (inches)	100% Chlorine (lbs)	(g)	1% Chlorine Solution (gal)	(L)
4	0.013	5.9	0.16	0.6
6	0.030	13.6	0.36	1.4
8	0.054	24.5	0.65	2.5
10	0.085	38.6	1.02	3.9
12	0.120	54.4	1.44	5.4
16	0.217	98.4	2.60	9.8

Note: 1 % chlorine solution may be prepared with sodium hypochlorite (contains 5% to 15% available chlorine) or calcium hypochlorite (contains approximately 65% available chlorine by weight). To prepare 1% chlorine solution using calcium hypochlorite, add one (1) pound (454 grams) of calcium hypochlorite in approximately 8 gallons of water.

Amounts and types of chemicals advised to be used for neutralizing various residual chlorine concentrations on 100,000 gallons of water.

Residual Chlorine Concentrations	Chemicals							
	Sulfur Dioxide (SO_2)		Sodium Bisulfate ($NaHSO_3$)		Sodium Sulfide ($Na_2 SO_3$)		Sodium Thiosulfate ($Na_2S_2O_3.5H_2O$)	
mg/l	lb	Kg	lb	Kg	lb	Kg	lb	Kg
1	0.8	0.36	1.2	0.54	1.4	0.64	1.2	0.54
2	1.7	0.77	2.5	1.13	2.9	1.32	2.4	1.09
10	8.3	3.76	12.5	5.67	14.6	6.62	12.0	5.44
50	41.7	18.91	62.6	28.39	73.0	33.11	60.0	27.22

The Engineer will arrange for the Effingham County inspection. Lines will not be placed in operation until Effingham County approval and Engineer directs Contractor to do so.

A hydrant flow test will be performed after the lines are placed in service as directed by the Engineer. Results of the test will be reported in writing by the Engineer to Effingham County.

7. IDENTIFICATION AND TRACER WIRE:

a. Mylar tape shall be installed 18 inches below the finished grade over the top of the water mains. The tape shall be 2 inches wide, of blue color and have imprinted on the tape "Caution - Water Line Below." The tape shall be laid the entire length of the trench.

b. No. 12 AWG solid plastic-coated copper wire shall be installed on top of all water mains where non-metallic pipe is used and attached by means of securing the wire on top of the water main with a 12-inch long by 2-inch wide piece of duct tape. Attach the wire to the main every ten (10) feet.

Wire shall be bonded at splices with 3M DBY-6 Direct Bury Splice Kit at every connection

The wire shall be laid the entire length of the trench and shall be continuous. The Contractor shall demonstrate continuity in wire through the entire length of the project. At every valve manhole the wire shall be run through the pipe opening, up to the ring and cover, secured at the ring by means of grouting the ring to the top of the manhole. The wire shall continue in the same loop back to the opposite pipe opening, through it and continuing in one continuous loop along the main.

At every fire and post hydrant, the wire shall be run from the main to the hydrant tee, to the gate valve, wrapped around the gate valve once, then run to the bottom of the hydrant flange, up the hydrant, wrapped around it once at the finish grade, then back to the main in one continuous loop, and continuing along the water main.

At every water service lateral, the wire shall be run from the main and corporation stop to the curb stop and attached to the polyethylene pipe by a piece of duct tape wrapped around the wire and tubing. The wire shall be connected to the tracer wire at the main with a single strand from the water main to the curb stop or into the meter box.

At every sampling station, the wire shall be run from the main service connection up to the bottom inside of the sampling station, then back in one continuous loop to the water main, then continuing with the utility along the water main.

The Effingham County will test all tracer wire prior to acceptance.

8. SHOP DRAWINGS:

Shop drawings shall be submitted on each manufactured item supplied under this Section along with other information as specified herein.

9. CLEANUP

Upon completion of the installation of water lines and appurtenances, all debris and surplus materials resulting from the work shall be removed.

10. WATER VALVES:

All 4-inch or larger gate valves that are installed on the transmission line(s) and /or tie into a major transmission line shall be installed in a manhole. All Gate Valves that are located at the entrance of subdivision or other development that tie into a transmission line shall be installed in a manhole. All other Gate Valves can be install in a cast iron valve box with a concrete collar and concrete valve marker post.

11. RECORD DRAWINGS:

The Effingham County will require Record Drawings seventy two (72) hours before final inspection will be made. The Contractor shall keep on the work site one (1) set of clean Drawings to which at the end of every day the necessary information will be marked by the Contractor=s superintendent. All deviations from the Drawings shall be stationed and clearly marked. Record drawings shall include measurements between each valve, bends, permanent land markers, manholes, laterals locations from property corners, fire hydrants & manholes.

END OF SECTION 02700

INDEX TO

SECTION 02831 – CHAIN LINK FENCES AND GATES

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases; concrete foundation for posts, and center drop for gates.

C. Manual gates and related hardware.

1.2 OMITTED

1.3 MEASUREMENT AND PAYMENT

A. Chain Link Fences and Gates: No separate measurement and payment will be made for Chain Link Fences and Gates. These items will be paid as part of the work for the item to which it pertains.

1.4 REFERENCES (Latest Revision)

A. ASTM A 90/A 90M – Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc–Alloy Coatings.

B. ASTM A 116 – Metallic–Coated, Steel Woven Wire Fence Fabric.

C. ASTM A 121 – Metallic–Coated Carbon Steel Barbed Wire.

D. ASTM A 123/A 123M – Zinc (Hot–Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A 153/A 153M – Zinc Coating (Hot–Dip) on Iron and Steel Hardware.

F. ASTM A 392 – Zinc–Coated Steel Chain–Link Fence Fabric.

G. ASTM A 1011 – Steel, Sheet and Strip, Hot–Rolled, Carbon, Structural, High Strength Low–Alloy, High–Strength Low–Alloy with Improved Formability, and Ultra–High Strength.

H. ASTM A 653/A 653M – Steel Sheet, Zinc Coated (Galvanized) or Zinc–Iron Alloy–Coated (Galvannealed) by the Hot–Dip Process.

I. ASTM A 491 – Aluminum–Coated Steel Chain–Link Fence Fabric.

J. ASTM F 668 – Polyvinyl Chloride (PVC) and Other Organic Polymer–Coated Steel Chain–Link Fence Fabric.

K. ASTM A 428/A 428M – Weight (Mass) of Coating on Aluminum–Coated Iron or Steel Articles.

L. ASTM C 94/C 94M – Ready–Mixed Concrete.

M. ASTM F 567 – Installation of Chain–Link Fence.

N. ASTM F 1043 – Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.

O. ASTM F 1083 – Pipe, Steel, Hot–Dipped Zinc–Coated (Galvanized) Welded, for Fence Structures.

P. Chain Link Fence Manufacturers Institute (CLFMI) – Product Manual.

1.5 SYSTEM DESCRIPTION

A. Fence Height: as indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding ten (10) feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

1.6 SUBMITTALS FOR REVIEW

A. Section 01300 – Submittals: Procedures for submittals.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

1.7 SUBMITTALS FOR INFORMATION

A. Section 01300 – Submittals: Procedures for submittals.

B. Manufacturer's Installation Instructions: Indicate installation requirements.

1.8 SUBMITTALS FOR CLOSEOUT

A. Section 01730 – Operation and Maintenance Data and Section 01740 – Warranties and Bonds.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM F567 and manufacturer's instructions.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 – PRODUCTS

2.1 OMITTED

2.2 MATERIALS

A. Framing (Steel): ASTM A653 Grade D; hot rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; coating conforming to ASTM F1043 Type B on pipe exterior and interior.

B. Fabric Wire (Steel): ASTM A116 galvanized wire.

C. Barbed Wire: ASTM A121 galvanized steel.

D. Concrete: ASTM C94; Normal Portland Cement, 2,500 psi strength at 28 days, three (3) inch slump.

2.3 COMPONENTS

A. Line Posts: 2.38-inch diameter.

B. Corner and Terminal Posts: 3.5.

C. Gate Posts: 4.5 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fittings and truss rod fabrication.

F. Fabric: 1.75-inch diamond mesh interwoven wire, 9 gage thick, top selvage knuckle end closed.

G. Tension Wire: 6 gage thick steel, single strand.

H. Tension Band: 3/8 inch thick steel.

I. Tension Strap: 3/8 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.4 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Gate Hardware: Center gate stop and drop rod; two (2) 180 degree gate hinges per leaf and hardware for padlock.

E. Padlocks: 2" size – Equivalent to No. 17D by Master Lock Co. with chain. All padlocks keyed alike.

F. Privacy Slats: Vinyl coated fabric strips, sized to fit fabric weave, color as selected.

2.5 FINISHES

A. Components and Fabric: Galvanized to ASTM A123; 2.0 oz/sq ft coating.

A. Vinyl Components: White color; as selected.

B. Hardware: Galvanized to ASTM A153, 2.0 oz/sq ft coating.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on inside of posts and rails.

C. Set intermediate, terminal, gate, and posts plumb, in concrete footings with top of footing 2 inches above and 6 inches below finish grade. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: ASTM F567 feet.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

H. Install center and bottom brace rail on corner gate leaves.

I. Do not stretch fabric until concrete foundation has cured 14 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension strap stretched taut between terminal posts.

O. Install support arms sloped outward and attach barbed wire; tension and secure.

P. Do not attach the hinged side of gate from building wall; provide gate posts.

Q. Install gate with fabric and barbed wire overhang to match fence. Install three hinges per leaf, latch, catches, drop bolt, retainer and locking clamp.

R. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.2 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch.

B. Maximum Offset from True Position: 1 inch.

C. Components shall not infringe on adjacent property lines.

3.3 SCHEDULES

A. Property Perimeter: 6 feet high, with galvanized, coated fabric.

END OF SECTION

INDEX TO

SECTION 02900 - LANDSCAPING

SECTION 02900

LANDSCAPING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work covered in this section consists of soil preparation, fine grading, lawns, trees, shrubs and ground cover planting and protection and maintenance of planted areas until acceptance.

1.2 RELATED WORK

A. Section 02204 - Earthwork

1.3 MEASUREMENT AND PAYMENT

A. Landscaping: Payment will be made at the contract Lump Sum price in the bid proposal. Payment includes furnishing all labor, material, vegetation, soil, equipment, site preparation for the complete landscaping.

1.4 QUALITY ASSURANCE

A. Qualifications of Workmen: Contractor shall provide at least one person present at all times during execution of work who is thoroughly familiar with the type of materials being installed and proper equipment and methods for their installation and who shall direct all work performed under this section.

B. Standards: All seed, sod, trees, shrubs, and ground covers shall meet or exceed the specifications of Federal, State, and County laws requiring inspection for disease and insect control.

1. Plants and planting methods shall conform to the latest edition of American Standard for Nursery Stock, American Association of Nurserymen, 230 Southern Building, Washington, D.C. 2005

2. Plants shall be true and representative of their genus, species, cultivar, or variety. One of each bundle or lot shall be tagged with name and size of the plant in accordance with American Association of Nurserymen. In all cases, botanical names shall take precedence over common names. Landscape Architect should be consulted in the event questions arise about nomenclature of plants to be used and their availability.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging. Damaged packages are not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Deliver sod on pallets.

D. Handling of plants shall be by lifting the root mass or container and not by lifting plant by trunk or branches. Handling of plants in an improper fashion shall be cause for rejection of plant materials. Care must be taken during all phases of the location and planting procedures not to damage root system, trunk or branches. All plant materials shall be planted as soon after arrival at the site as possible. Contractor is responsible for keeping plants safe from injury by the construction activity and watered to prevent drying out before planting. Balled and burlapped plants shall be "Heeled-in" and protected with burlap or other accepted material if they cannot be planted upon delivery. Plants with broken major branches, badly bruised or damaged bark are not acceptable and will be rejected.

1.6 PLANTING DATES

A. Permanent grass seed, sod, and plants shall be planted no earlier than March 15 and no later than September 1. Contractor has the option and assumes full responsibility for planting during unseasonable conditions.

B. Temporary grass shall be planted between September 15 and November 15.

C. Contractor is responsible for planting permanent grass the following Spring.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Contractor shall, at time of delivery, furnish Landscape Architect invoices of all materials received, in order the quality and source of materials may be determined.

2.2 TOPSOIL

A. Topsoil shall be fertile, friable natural loam capable of sustaining vigorous plant growth. It shall be free of any admixture of subsoil, stones over 1" diameter, clods of hard earth, plants, roots, sticks or other extraneous material. It shall not be excessively acid or alkaline.

2.3 SEED

A. Hulled common Bermuda grass, pure line seed to be 82% by weight, with a maximum weed seed of 0.50%.

B. Temporary grassing shall consist of annual rye grass seed at a rate of 75 pounds per acre.

2.4 SOD

A. Sod shall be centipede grass, with dense, healthy root systems free of weeds, insects, and diseases.

1. Before cutting, sod shall be mowed to a height of not less than 1-1/2" or more than 3". Sod shall be cut in uniform widths of 12" or 18" and in lengths not exceeding 6'.

2. Sod shall be delivered to site in a fresh, moist condition with healthy green foliage. It shall be unloaded from delivery trucks on pallets and placed in final position within 24 hours of delivery. Sod shall be protected from wind and sun and shall not be allowed to dry out before planting.

2.5 PLANT MATERIALS

A. Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs or larvae, and shall have healthy, well developed root systems. Plants shall have been grown under climate conditions similar to those in the locality of project. Trees for planting in rows shall be uniform in size and shape.

B. Plants shall possess a normal balance between height and width. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to the main body of plant and not from branch tip to tip. Plants larger in size than specified may be used with no change in contract price.

C. Plants shall be dug with firm natural balls of earth, of diameter not less than recommended by American Standard for Nursery Stock and of sufficient depth to include fibrous and feeding roots. Plants will not be accepted if ball is cracked or broken before or during planting operations.

D. Trees specified for Street Tree Grade shall conform to standards of the A.A.N.:

1. Suitable for planting as street trees.

2. Free of branches to approximately 50% of height from ground.

3. Crown of tree shall be in good balance with the trunk.

2.6 FERTILIZER

A. Commercial fertilizer shall be 5-10-10 or 6-12-12, uniform in composition, free flowing, and suitable for application with appropriate equipment. Deliver to site unopened in manufacturer's standard containers showing weight, analysis and name of manufacturer.

2.7 PEAT MOSS

A. Peat moss shall be finely shredded, 90% organic moss peat, brown in color and suitable for horticultural purposes. Peat shall be measured in air dry condition, containing not more than 35% moisture by weight. Ash content shall not exceed 10%.

2.8 MULCH FOR TREES, SHRUBS, AND GROUND COVERS

A. Mulch shall be pine straw.

2.9 STAKING EQUIPMENT

A. Shall consist of treated wood stakes, 18 gauge galvanized guy wire, 1/4" x 4" galvanized turnbuckle and 1/2 inch rubber hose.

PART 3 – EXECUTION

3.1 FINE GRADING

A. All areas within limits of construction shall be fine graded to the desired grades. All areas within limits of construction are to be fine graded, free of roots, debris and/or other objectionable material, before planting or grassing commence. Any additional fill material needed to fill low or uneven areas shall be provided by the Contractor. Positive drainage shall be provided in all plant beds so standing water does not occur.

B. Planting and grassing areas, if not loose, shall be loosened to a minimum depth of 3-inches before fertilizer, seed or sod is applied.

3.2 FERTILIZER

A. Apply fertilizer after fine grading and mix thoroughly into upper 2 inches of soil.

B. Fertilizer shall be applied at a rate of 12 pounds per 1,000 square feet of area to be grassed.

3.3 SODDING

A. Do not begin grasswork until irrigation system is completely installed, tested and operational. Grassed areas lost due to an inoperable irrigation system shall be regrassed at no additional cost to Owner.

B. All areas to be sodded shall be brought to the proper line grade or cross section as was existing prior to construction. Sod shall be placed so edges of the sodded areas will be smooth and will conform to previous existing conditions. Sod shall be laid smooth, edge to edge, with staggered joints. Sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling, to eliminate any air pockets. A true and even surface shall be provided, to insure knitting without displacement of sod or deformation of the sodded surface area. Following compaction, screened soil of good quality shall be used to fill all cracks, and excess soil shall be worked into the grass with rakes or other suitable equipment. On slopes steeper than 3 to 1, the sod shall be fastened in place with suitable wood or metal pins to hold the sod in place. Any damage by erosion or other causes occurring after completion of grading operations shall be repaired before commencing with the sod placement.

C. Immediately before sodding, moisten topsoil with a fine spray to a minimum 1 inch depth.

D. Within 2 hours after sod has been placed, thoroughly water to a minimum depth of 4 inches.

3.4 SEEDING

A. Seeding shall be performed during the period between March 15 and September 1, unless otherwise accepted.

B. Seed shall be sown within 24 hours following the application of fertilizer and preparation of seed-bed.

C. Apply seed evenly at a rate of 40 pounds per acre using acceptable mechanical seed drills.

D. Seeds shall be covered and lightly compacted by means of a cultipacker or light roller if the drill does not perform this operation.

E. Apply water with fine spray immediately after each area has been sown.

F. Do not sow immediately following rain, when ground is too dry, or during windy periods.

3.5 SEED PROTECTION

A. All areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 1-1/2 tons of straw per acre.

3.6 LAYOUT OF TREES, SHRUBS, AND GROUND COVERS

A. All plants shall be placed in the proper location as shown on construction plans, allowing Landscape Architect to review all plant locations prior to actual planting. Landscape Architect may make minor adjustments which shall not be cause for changes to the contract price.

3.7 OBSTRUCTIONS BELOW GROUND

A. Prior to excavating planting holes, Contractor shall determine the exact location of electrical, phone, or television cables or conduits, water, drainage or sewer lines, and any other subsurface structures and take precautions to protect them. Any damage to underground utilities shall be repaired immediately at the Contractor's expense.

B. In the event rock, underground construction work, or other obstructions are encountered in any plant hole excavation under this contract, alternate locations may be selected.

3.8 PLANTING HOLES

A. For trees, shall be 12" deeper and 24" wider than the size of root ball. Planting holes for shrubs and containerized ground covers shall be 6" deeper and 12" wider than the root mass.

3.9 PLANTING HEIGHTS

A. Shall be same as grown in the nursery and/or container soil level. Adjust bottom soil mix to insure proper planting level with the proposed surrounding grades. Check plants to insure proper vertical alignment.

3.10 BALLED AND BURLAPPED PLANTS

A. Shall have all bindings removed and the top half of burlap removed from around root ball. The burlap can be laid back from root mass or can be cut away. All weeds growing on the root mass shall be removed prior to planting.

3.11 CONTAINER GROWN PLANTS

A. Shall have the container removed prior to planting. Care shall be taken to protect root mass from injury and the root mass intact. If root mass shows evidence of being bound or matted, three vertical 1/2" deep cuts shall be made on alternate sides of the root mass and roots pulled away slightly. This is to untangle roots which have begun to "circle" the root mass and to encourage new root growth. All weeds growing in the root mass shall be removed prior to planting.

3.12 SOIL MIX

A. Shall consist of 25% peat moss and 75% native soil. The soil mix shall be added to planting holes and compacted to the proper level prior to setting plants. Level of soil mix shall be adjusted to achieve the proper planting height. The soil mix shall be added to all sides equally and tamped until planting hole is 1/4 full. Water in well and then complete addition of soil mix and tamping soil until the level is at grade. Water in well once again.

3.13 EARTH SAUCERS

A. Shall be constructed around the perimeter of planting holes of all trees and all single planted shrubs. Earth saucers shall be minimum 3" high and compacted to retain water. Earth saucers shall not be installed around mass shrub or groundcover plantings.

3.14 STAKING OF TALL PLANTS

A. Shall take place immediately after planting of the trees. Three 2" x 2" x 2' - 6" stakes shall be driven into ground equidistant around the plant a distance from plant equal to one third of its height. Stakes shall be driven into ground at an acute angle away from the plant. Insert twisted guy wires through the rubber hose and loop around trunk of tree above first set of branches or at a point on trunk of plant equal to one third of height, whichever is higher. Twist guy wire tightly around itself to form a loose loop around the trunk. Make sure the hose makes contact with trunk rather than wire. Attach each section of guy wire to turnbuckles and then to the wood stakes and tighten turnbuckles and guy wire so plant is vertical and immobile to wind action. Attach flagging to all guy wires at eye level for proper visibility.

3.15 MULCHING

A. All plants shall be mulched with an evenly thick 3" layer of clean pine straw immediately after planting. Mass plant beds shall be completely mulched to outer limits of all plants 12" past the existing dripline. Limit of mulching for individual trees and shrubs shall be slightly beyond the saucer berm. The areas mulched shall be tidy and clean in appearance.

3.16 WEEDING

A. All planted areas shall be kept free from weeds and undesirable grasses until final acceptance by the Owner.

3.17 INSECT AND DISEASE CONTROL

A. All plant materials shall be disease or insect free upon arrival to the site, however, should any plants show signs of insect or disease infestations, Contractor shall identify nature of infestation and submit to Architect a proposed method of control. Contractor shall treat all infested plants at its expense. Should the infestation be wide spread and uncontrollable, plants affected shall be removed from site, fresh plants brought in and all other plants treated to prevent infestation of remaining plants at Contractor's expense.

3.18 CLEAN UP

A. Contractor is responsible for removing all trash, debris, rubbish and all other materials associated with the construction from site on a daily basis. All tags, flags, and labels will be removed from plants and trees. The site shall be left broom clean and tidy. Clean up of the site is a prerequisite to final acceptance by the Owner.

PART 4 – MAINTENANCE AND WARRANTY

4.1 MAINTENANCE

A. All landscaping (grass, plants and trees) shall be protected and maintained by the Contractor immediately after installation.

B. Maintenance shall include but is not limited to watering, weeding, cultivating, removal of dead material, resetting plants to proper grades or upright position, lawn mowing, fertilizing, and other necessary operations.

C. The Contractor shall repair immediately any areas damaged as a result of construction operations or erosion.

D. The Owner will be responsible for maintenance from time of acceptance.

4.2 WARRANTY

A. All lawns, shrubs, ground cover, and trees shall be guaranteed by the Contractor to be alive and healthy for a two year period after substantial completion.

B. Any lawn, plant, or tree which is dead or not showing satisfactory growth shall be replaced at Contractor's expense at the end of warranty period. All replacements

shall be of original quality and of a size equal to adjacent plants or trees of the same kind.

END OF SECTION

INDEX TO

SECTION 02902 - GRASSING

SECTION 02902

GRASSING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Seeding, planting grass, and fertilizing graded areas behind the structures, pipeline rights-of-way, roadway shoulders and other disturbed areas.

B. Seed protection.

C. Maintaining seeded areas until final acceptance.

1.2 RELATED WORK

A. Civil and Landscape plans and specifications.

1.3 MEASUREMENT AND PAYMENT

A. Grassing: When the season or stage of project is such results of grassing work cannot be determined, conditional acceptance will be made on work completed. When conditional acceptance is made for items of work covered, Contractor shall be entitled to 50% of bid price for the actual work placed and shall receive remaining 50% of bid price when final acceptance is made. Conditional acceptance shall not apply to the remaining items of work, and full bid price payment shall be made when work is acceptably placed and completed in accordance with specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable. Store in cool, dry locations away from contaminants.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Damaged bags are not acceptable. Store in cool, dry locations away from contaminants.

C. Deliver sod on pallets.

D. All material shall be acceptable to Engineer prior to use.

1.5 PLANTING DATES

A. This specification provides for establishment of a permanent grass cover between the dates of March 1 and September 30. If finished earth grades are not completed in time to permit planting and establishment of permanent grass during the favorable season between dates specified above unless otherwise accepted, Contractor will be required to plant a temporary cover to protect new graded

areas from erosion and to keep windborne dust to a minimum. The temporary cover shall be planted between October 1 and February 28 unless otherwise permitted.

PART 2 – PRODUCTS

A. Contractor shall submit source and species certification documents to Engineer and Owner's Representative for review prior to installation. Supply complete information on all analysis/test methodologies and results; laboratory certifications, manufacturer's specifications, and agency approvals to the Landscape Architect/Project Engineer prior to placement of soil mixtures. In addition, provide the Landscape Architect/Project Engineer with thoroughly mixed sample of soil mixes for acceptance prior to placement. Landscape Contractor shall make modifications and improvements to soil mixes deemed necessary by the soil analysis to meet requirements specified here in before, and to ensure proper growing medium for plant material.

2.1 SEED

A. All seed shall conform to State Laws and requirements and regulations of the State Department of Agriculture.

B. The varieties of seed, as specified in Section 2.2, shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, germination, lot number, and other information required by the State Department of Agriculture.

C. Engineer reserves the right to test, reject, or accept all seed before seeding.

2.2 SEEDING SCHEDULE

A.

SEED	RATE	PLANTING DATES
Bermuda	50-lbs/acre	March 1 – September 30
Rye	75-lbs/acre	October 1 – February 28

2.3 FERTILIZER

A. Commercial fertilizer of accepted type, conforming to State fertilizer laws at the rate as recommended by soils test.

2.4 LIME

A. Agricultural grade, ground limestone at the rate as recommended by soils test.

2.5 SPRIG

A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes and from 4 to 6 inches long. Obtain from heavy, dense certified sod. Provide sprigs which have been grown under climatic conditions similar to those in the locality of project. Coordinate harvesting and planting operations to prevent exposure of sprigs to

the sun for more than 30 minutes before covering and moistening. Sprigs showing signs of wilt, mold, containing weeds or other detrimental material or are heat damaged will be rejected.

B. Varieties of sprig, as specified in section 2.6, shall be individually packaged or bagged, and tagged to show name of sprig, net weight, origin, and other information required by the State Department of Agriculture.

C. Sprigs shall be pure to variety specified and shall be free of other grass species, weeds or foreign matter.

D. Sprigs shall be harvested by digging (not collected above soil level), shredding sod, rototilling sod and raking, vericutting, or with a sprig harvester. Sprigs shall consist of mostly rhizomes and crowns with only a few green leaves.

2.6 SPRIGGING SCHEDULE

A.

SPRIG	RATE	PLANTING DATES
'Tifsport' Bermuda	1,000 bushels/acre (Maximum 12 week grow-in)	April 1 – August 31
Stabilize site with temporary grass seed		September 1 – March 31 (See section 2.2)

B. In areas where existing grass is to be matched, Contractor shall sprig at the rate and dates recommended by sprig distributor.

2.7 SOD

A. Sod shall be premium grade, densely rooted, good quality grass of the species and certified variety as shown on the plans, free from noxious weeds with no surface soil being visible. The sod shall be obtained from areas where the soil is reasonably fertile. Sod of specified species shall be grown from seed or sprig with not less than 95 percent germination, 85 percent pure seed, and not more than 0.5 percent weed seed. The sod shall be machine cut to a uniform soil thickness that shall contain practically all of the dense root system and not be less than 1–inch thick.

B. Before cutting, sod shall be mowed to a height of not less that 1–1/2-inches or more than 2-inches. Sod shall be cut in minimum uniform widths of 12-inches and lengths of 24 inches.

C. Sod shall be delivered to site in a fresh, moist condition with healthy green foliage. It shall be unloaded from delivery trucks on pallets or in rolls and placed in final position within 24 hours of delivery. Sod shall be protected from wind and sun and shall not be allowed to dry out before planting.

D. Sod shall be strong enough to support its own weight and retain its size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

2.8 ACCESSORIES

A. Straw Mulch: Oat or wheat straw, reasonably free from weeds, foreign matter detrimental to plant life, and in dry condition.

B. Excelsior Mulch: Excelsior mulch shall consist of wood fibers cut from sound, green timber. The average length of fibers shall be 4 to 6 inches. Cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood to cause splintering of fibers when weathering in order to provide adherence to each other and to soil.

C. Wood cellulose fiber shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. Mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate into underlying soil. The mulch shall be heat processed to contain no germination or growth-inhibiting factors. It shall be dyed (non-toxic) an appropriate color to facilitate metering of material.

2.9 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.1 PREPARATION

A. Areas to be seeded shall be made smooth and uniform and shall conform to the finished grade indicated on plans.

B. Remove foreign materials, plants, roots, stones, and debris from surfaces to be seeded.

C. Grassing areas, if not loose, shall be loosened to a minimum depth of 3 inches before fertilizer, seed or sod is applied.

D. Amendments to soils shall be incorporated into loosened 3-inch top soil layer as recommended by soils tests.

E. Contractor shall provide Topsoil Analysis Tests performed by a State Agricultural Experiment Station, Soil and Water Conservation District, State University, or other qualified private testing laboratory, as acceptable to Landscape Architect/Project Engineer. Soils test shall identify existing pH and nutrient levels, as well as recommended adjustments based on the type of grass to be installed.

3.2 STAND OF GRASS

A. Before acceptance of seeding, sodding, or sprigging is performed for the establishment of permanent vegetation, Contractor will be required to produce a

satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of re-establishment in spring.

B. Before acceptance of seeding is performed for the establishment of temporary vegetation, Contractor will be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or establishment of permanent vegetation is to commence.

3.3 SEEDING AND SPRIGGING DATES

A. Seeding and sprigging shall be performed during periods and at rates specified in their respective schedules. Seeding and sprigging work may, at discretion of Contractor, be performed throughout the year using schedule prescribed for given period. Seeding and sprigging work shall not be conducted when the ground is frozen or excessively wet. Contractor will be required to produce a satisfactory stand of grass regardless of the period of year work is performed.

3.4 APPLYING LIME AND FERTILIZER

A. Following advance preparation and placing selected material for shoulders and slopes, lime and fertilizer, if called for based on soil tests, shall be spread uniformly over the designated areas, and shall be thoroughly mixed with the soil to a depth of approximately 2 inches. Fertilizer and lime shall be applied at the rate recommended by required soils test. Unless otherwise provided, lime will not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer. On steep slopes subject to slides and inaccessible to power equipment, the slopes shall be adequately scarified. Fertilizer may be applied on steep slopes by hydraulic methods as a mixture of fertilizer and seed. When fertilizer is applied with combination seed and fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when Wood Cellulose Fiber Mulch is used. Any stones larger than 2-1/2 inches in any dimension, larger clods, roots, or other debris brought to the surface shall be removed.

3.5 SEEDING

A. Seed shall be sown within 24 hours following application of fertilizer and lime and preparation of the seedbed as specified in Section 3.4. Seed shall be uniformly sown at rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on steep slopes or on other areas inaccessible to seed drills.

B. Seeds shall be covered and lightly compacted by means of cultipacker or light roller if the drill does not perform this operation. On slopes inaccessible to compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.

C. Apply water with fine spray immediately after each area has been sown.

D. Do not sow seed when ground is too dry, during windy periods or immediately following a rain.

E. If permitted by the special provisions, wood cellulose fiber mulch or excelsior fiber mulch may be used.

3.6 SEED PROTECTION (STRAW MULCH)

A. All seeded areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 2 tons of straw per acre.

3.7 SEED PROTECTION (EXCELSIOR MULCH)

A. Seed shall be sown as specified in Section 3.5. Within 24 hours after covering of seed, excelsior mulch shall be uniformly applied at the rate of 2 tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. Engineer may require light rolling of the mulch to form a tight mat.

3.8 SEED PROTECTION (WOOD CELLULOSE FIBER MULCH)

A. After the lime has been applied and ground prepared as specified in Section 3.4, wood cellulose fiber mulch shall be applied at a rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for application of fertilizer, seed, and slurry of the prepared wood pulp. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide an even distribution of slurry on various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

Seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by hydraulic seeding method specified herein. Materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be regulated so amounts and rates of application shall result in a uniform application of all materials at rates not less than amount specified. Using the color of wood pulp as a guide, equipment operator shall spray prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream to fall like rain, allowing wood fibers to build upon each other until an even coat is achieved.

3.9 SPRIGGING

A. Sprigs shall be placed at the date and rates as shown in section 2.6. The sprigging method shall be by broadcast sprigging, hydroplanting or row planter. Sprigging procedure shall ensure even coverage.

B. Sprigs applied by broadcast over the site with a distributor or hydroseeder shall be planted at the rates listed in section 2.6. Cover broadcast sprigs with straw mulch immediately after broadcast and water in immediately (within 2 hours).

C. Sprigs installed by row planter creating a narrow furrow that covers 50 to 80% of the sprig with soil may use less sprig material. Rate shall be as recommended by sprig supplier to provide a solid stand of turf within the time required in Section 2.6. Water in immediately (within 1 hour).

3.10 SODDING

A. Sod shall be placed between March 1st and December 1st. However, if sod is to be placed during periods of temperatures over 90 degrees F., the Contractor shall take extra care for quick placement of sod with adequate, consistent watering necessary to ensure sod thrives as planted.

B. Sod shall be placed within 24 hours of cutting.

C. Place top elevation of sod 1/2 inch below adjoining paving or curbs.

D. All areas to be sodded shall be brought to the proper line grade or cross section as was existing prior to construction. Sod shall be placed so, upon completion, edges of sodded areas will be smooth and will conform to the proposed finished grade. Sod shall be laid smooth, edge to edge, with staggered joints. Sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling, to eliminate any air pockets. A true and even surface shall be provided, to insure knitting without displacement of the sod or deformation of the sodded areas surfaces. Do not stretch or overlap sod pieces. Following compaction, screened soil of good quality shall be used to fill all cracks. Excess soil shall be worked into the grass with rakes or other suitable equipment. On slopes steeper than 3 to 1, sod shall be fastened in place with suitable wood or metal pins to hold the sod in place. Any damage by erosion or other causes occurring after completion of grading operations shall be repaired, before commencing with the sodding operations.

E. Immediately before sodding, moisten topsoil with a fine spray to a minimum 1-inch depth. Sod shall not be laid on dry or powdery soil.

F. Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. The length of strips shall be at right angles to flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. Sod shall be immediately pressed firmly into the ground by tamping or rolling. Fill all joints between strips with fine screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement.

G. Within two hours after sod has been placed, thoroughly water to a minimum depth of 4-inches. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove depressions and irregularities. Roll sodded areas with a roller not exceeding 150 lbs. per foot of roller width.

PART 4 – MAINTENANCE, WARRANTY AND ACCEPTANCE

4.1 MAINTENANCE

A. Maintain grassed surfaces until final acceptance.

B. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp, and repairing any areas damaged as a result of construction operations or erosion. Maintenance shall also include, but is not limited to, watering, weeding,

cultivating, removal of dead material, lawn mowing, fertilizing, and other necessary operations.

C. The Contractor shall maintain all proposed plantings until the date of substantial completion issued by the Owner.

4.2 WARRANTY

A. All grassed areas shall be guaranteed by Contractor to be alive and healthy for a one (1) year period from date of substantial completion issued by the Owner. A final walk through with the Owner shall be conducted at end of warranty period to determine if any areas require replanting. At end of warranty period, sod shall show evidence of rooting to underlying soil and shall have no competitive weed growth from either the sod or from between sod joints.

B. Any grassed area which is dead or not showing satisfactory growth shall be replaced at Contractor's expense at the end of warranty period. All replacement shall be of original quality. Replacement required because of vandalism, excessive use, or other causes beyond the control of Contractor are not part of this contract.

4.3 ACCEPTANCE

A. Before acceptance of seeding performed for the establishment of permanent vegetation, Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of reestablishment in spring.

B. A minimum coverage of 80% density over 100% of the disturbed area is required for seeded areas before project acceptance. Sprig and sod areas shall have 95% coverage over 100% of the disturbed area prior project acceptance.

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete pile caps.

B. Formwork, form accessories and bracing.

C. Reinforcement.

1.2 RELATED SECTIONS

A. Section 01300 – Submittals.

1.3 MEASUREMENT AND PAYMENT

A. All concrete work, will be considered a part of the structure in which it is used and no direct measurement or payment will be made.

1.4 REFERENCES (latest revisions)

A. ACI 301 – Specifications for Structural Concrete.

B. ACI 305R – Hot Weather Concreting.

C. ACI 306R – Cold Weather Concreting.

D. ACI 308 – Standard Practice for Curing Concrete.

E. ACI 318 – Building Code Requirements for Reinforced Concrete.

F. ACI 347R – Guide to Formwork for Concrete.

G. ASTM A615 – Deformed and Plain Carbon - Steel Bars for Concrete Reinforcement.

H. ASTM C33 – Concrete Aggregates.

I. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens.

J. ASTM C42 – Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

K. ASTM C94 – Ready-Mixed Concrete.

L. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete

M. ASTM C150 – Portland Cement.

N. ASTM C172 – Practice for Sampling Freshly Mixed Concrete.

O. ASTM C231 – Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

P. ASTM C260 – Air-Entraining Admixtures for Concrete.

Q. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.

R. ASTM C494 – Chemical Admixtures for Concrete.

S. ASTM C618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

T. ASTM C920 – Elastomeric Joint Sealants.

U. ASTM D1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

V. ASTM D3740 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

W. ASTM E329 – Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.5 SUBMITTALS FOR REVIEW

A. Mix designs and test results as specified hereinafter.

B. Shop Drawings: Submit shop drawings for reinforcing steel and inserts to Engineer for review. Indicate sizes, spacing, and locations of reinforcing steel, supporting and spacing devices, bar bending details, and bar lists.

C. Submittals for admixtures and accessories, including product data and certifications, are to be provided for review and/or approval.

1.6 SUBMITTALS FOR INFORMATION

A. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain at least one copy of ACI 301 document on site at all times.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

1.8 TESTS

A. All sampling and testing services shall be performed by an independent testing agency in accordance to ASTM D3740 and ASTM E329 and accepted by the Engineer, at the Contractor's expense.

B. Contractor shall pay for and submit to the Engineer, the concrete materials and the concrete mix designs on each class of concrete proposed for use. This submittal shall include the results of all testing performed to qualify the materials and establish the mix designs. All mix designs shall be proportioned in accordance with Section 3.9 of ACI 301, Method 1 (trial batches) or Method 2 (field experience). The average strength used as the basis for selecting proportions shall be as specified in Paragraph 3.9.2 of ACI 301.

C. The testing laboratory shall conduct strength tests of the concrete during construction in accordance with Section of ACI 301, ASTM C39, and ASTM C172. At least one strength test (4 test cylinders) shall be made for each 50 cubic yards or fraction thereof, of each mix design placed each day.

D. Slump tests shall be conducted regularly during construction in accordance with ACI 301 and ASTM C143.

E. Air content of the concrete sample for each strength test shall be determined in accordance with ACI 301 and ASTM C231.

F. Results of all tests shall be submitted to the Engineer, with copies to the Contractor. The test reports shall include the exact location in the work at which the batch represented by a test was deposited.

G. Evaluation of test results and acceptance of concrete shall be in accordance with ACI 301.

1.9 ACCEPTANCE OF COMPLETED WORK:

A. Acceptance or rejection of completed concrete work shall be in accordance with ACI 301.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Shall conform to ACI 301 and ACI 347R.

B. Shall be wood, plywood, metal or other accepted material and of the grade or type suitable to obtain the finish specified.

C. Form Ties: Removable or snap-off type, galvanized metal, adjustable length, and free of defects that could leave holes larger than 1-inch in concrete surface.

D. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

2.2 REINFORCING

A. Reinforcing Steel: ASTM A615, Grade 60, deformed bars; uncoated finish.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II - Moderate.

B. Coarse and Fine Aggregates:

Course Aggregate: Clean, crushed stone or gravel conforming to ASTM C33. Unless otherwise approved by the Engineer, use size No. 57 or 89 stone; however, in no case shall coarse aggregate exceed ¾ of clear space between reinforcing bars. Minimum dry specific gravity shall be 2.6. Blend of two coarse aggregates shall be 75% by weight of No. 57 stone.

Fine Aggregate: Natural sand conforming to ASTM C33; free of injurious amounts of shale, alkali, organic matter, loam, or other deleterious substances. Fine aggregate shall not have more than 35% passing any sieve and retained on the next consecutive sieve as shown in 5.1 of ASTM C33.

2.4 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494 Type D - Water Reducing and Retarding; manufactured by Sika Corporation or equivalent.

C. Fly Ash: ASTM C618, Class C or F, LOI shall not exceed 3.5%.

D. Pozzolanic Admixtures: ASTM C618.

E. Calcium chloride or admixtures containing more than 0.1% chloride ions are <u>not</u> permitted.

F. Certification: Written certification of conformance to the above-mentioned requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.5 ACCESSORIES

A. Bonding Agent: Sikadur 32, Hi-Mod by Sika Corporation.

B. Concrete Repair Grout: For repair of defective areas of concrete.

1. For vertical and overhead surfaces, use one (1) of the following (or approved equal):

a. "Five Star Structural Concrete V/O"; Five Star Products, Inc.
b. "Euco Verticoat"; Euclid Chemical Co.
c. "Sikatop 122"; Sika Corp.

2. For horizontal surfaces, use one (1) of the following (or approved equal):
a. "Five Star Structural Concrete"; Five Star Products, Inc.
b. "Concrete Coat"; Euclid Chemical Co.
c. "Sikatop 122"; Sika Corp.

2.6 JOINT FILLER MATERIALS

A. Elastomeric Sealant: Joints shall be sealed per detail on project drawings, conforming to ASTM C920, Type S or M, Grade NS, Class 25, Use T.

B. Joint Filler: Preformed, non-extruding, resilient, bituminous; ½" to 1" joint width; ASTM D 1751

2.7 CURING MATERIALS

A. Membrane Curing Compound: ASTM C 309, clear with fugitive dye.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C171:

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

2.8 CONCRETE MIX

A. Concrete shall be batched, mixed, and transported from a supplier with sufficient facilities to deliver the concrete at the rate required and in accordance with ASTM C 94. The ready-mix concrete supplier shall furnish the Engineer a certified statement that the concrete furnished conforms to provisions of these specifications.

B. Compressive Strength: Minimum 4,000 psi in 28 days.

C. Slump: 4 to 5 inches.

D. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Use calcium chloride only when approved by Engineer.

F. Use set retarding admixtures during hot weather only when approved by Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

H. A total weight of cement shall consist of 80% Portland Cement and 20% fly ash. Fine aggregate weight shall not exceed 33% of total weight of fine and coarse aggregate combined.

PART 3 - EXECUTION

3.1 ON SITE OBSERVATIONS OF WORK

A. The Engineer will have the right to require any portion of the work be completed in his presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if the Contractor notifies the Engineer such work is scheduled, and the Engineer fails to appear within 48 hours, the Contractor may proceed without Engineer.

B. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. Improper work shall be reconstructed. All materials which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. Engineer shall have the right to mark rejected materials so as to distinguish them as such.

C. Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 EXAMINATION

A. Verify site conditions for conformance with requirements.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcements, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.3 FORM REMOVAL

A. Forms shall be removed carefully to avoid damage to green concrete. Ties shall be cut back 1-inch from the surface and all holes, stone pockets, voids, and minor defects shall be patched immediately upon removal of forms. Subject to approval by the Engineer, forms shall be removed according to the following table:

	Temperature (° F)				
	Over 95°	**70-95°**	**60-70°**	**50-60°**	**Below 50°**
Beams	10 Days	4 Days	5 Days	6 Days	50% of 28 Day
Slabs	10 Days	5 Days	6 Days	7 Days	Strength

Contractor shall keep all live loads off the concrete until it has sufficient strength to support applied loads. See Concrete Curing section for timing of permissible traffic loads.

B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Store removed forms so surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.4 REINFORCEMENT

A. All reinforcement shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.

B. Reinforcement shall be placed, supported, and secured against displacement by construction loads or the placing of concrete. Bar supports and spacers shall be made of concrete, metal, plastic, or other accepted material and subject to review by the Engineer. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2-inch of the concrete surface shall be noncorrosive or protected against corrosion.

C. Reinforcement shall be placed in accordance with ACI 301. Minimum concrete cover for reinforcement shall be as shown on the plans.

D. Field bending of bars partially embedded in concrete will not be permitted unless specifically accepted by the Engineer.

E. Locate reinforcing splices not indicated on the drawings at points of minimum stress.

3.5 PREPARATION FOR PLACING

A. Water shall be removed from excavations and/or formed areas before concrete is deposited. Hardened concrete debris and other foreign materials shall be removed from the interior of forms and inside of mixing and conveying equipment.

B. Unless noted otherwise, prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete and install epoxy adhesive system in accordance with manufacturer's recommendations.

D. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

E. Templates shall be used for the proper installation of anchor bolts. Templates and anchor bolts shall be in position prior to placing the concrete.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Concrete shall be placed only upon surfaces free from frost, ice, mud, standing water, and other detrimental substances or conditions. When concrete is to be placed on dry soil or other pervious material, polyethylene sheeting shall be laid over surfaces to receive the concrete.

C. Notify Engineer minimum 48 hours prior to commencement of operations.

D. Concrete shall be handled and deposited using equipment and methods which will prevent segregation or loss of ingredients. Equipment and methods for placing concrete shall be subject to review by the Engineer.

E. Concrete having attained its initial set or having contained water for more than 90 minutes shall not be used in the work.

F. Sufficient mixing and placing capacity shall be provided so concrete which is being integrated with fresh concrete is still plastic. Concrete shall be deposited continuously or in layers of such thickness so no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be placed subject to acceptance by the Engineer.

G. Concrete shall not be allowed or caused to flow horizontally or on slopes in the forms. Concrete placing on a slope shall begin at the lower end of the slope and progress upward.

H. Consolidate by mechanical vibration so concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms and around piling. Use of vibrators to transport concrete within forms shall not be allowed. A spare vibrator shall be kept on the job site during all concrete placing operations.

I. When the temperature of the surrounding air is expected to be below 40 degrees F. during placing or 24 hours thereafter, the temperature of the plastic concrete as placed, shall be no lower than 55 degrees for sections less than 12-inches in any dimension nor 50 degrees for any other sections. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and shall not exceed 90 degrees F.

J. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

L. Place concrete continuously between predetermined expansion, control, and construction joints.

M. Do not interrupt successive placement or permit unanticipated cold joints to occur.

3.7 CONCRETE FINISHING

A. Formed surfaces of concrete shall be given the finishes specified below unless the contract documents specify otherwise.

1. Smooth Form Finish - For all concrete surfaces exposed to public view. The form facing material shall produce a smooth, hard, uniform texture on the concrete. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. All fins shall be completely removed. No later than the day following form removal, the concrete surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced.

3.8 CONCRETE CURING

A. Curing of other cast in place concrete shall be provided by either a moisture cure or membrane cure, in accordance with ACI 308 and the following:

1. Unformed Surfaces shall be moisture cured for a minimum of 7 days. Following initial period, the use of membrane curing compounds may be used for subsequent curing.

2. Horizontal Formed Surfaces, including bridge topping slab, shall be moisture cured for a minimum of 7 days. Following initial period, the use of membrane curing compounds may be used for subsequent curing.

3. Vertical Formed Surfaces shall be either moisture cured for a minimum of seven (7) days or cured via membrane curing compound.

4. Non-Structural Concrete: Sidewalks, curbs & maintenance pads may be cured with a membrane curing compound in addition to any of the moisture curing methods listed herein. During hot weather concreting, if a curing compound is used, the non-structural slabs shall still be moist cured for 12 hours immediately following initial set.

B. For **moisture cure**: Immediately after placement and finishing, provide moisture curing by one (1) of the methods below. Forms shall be left in place for a minimum of seven (7) days during moisture curing:

1. Keep concrete surface continuously wet by covering with water.

2. Continuous water-fog spray.

3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place

absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

4. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches, and sealed by waterproof tape of adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   Hot Weather Curing: During hot weather concreting, keep forms moist and covered with plastic during the initial seven (7) day curing period. Hot weather curing shall be in accordance with ACI 305.

C. For **membrane cure**: Immediately after placement and finishing, concrete shall be protected from moisture loss for not less than seven (7) days. For surfaces not in contact with forms, curing compound shall be uniformly applied after water sheen disappears from the concrete. Formed surfaces shall receive an application of curing compound if forms are removed during the seven (7) day curing period. Curing compound shall not be applied during rainfall.

1. Apply one (1) coat of specified curing compound to concrete at the manufacturer's recommended rate. Apply uniformly in continuous operation by power-spray or roller. Care shall be taken to prevent application to joints where concrete bond is required, to reinforcement steel and to joints where joint sealer is to be placed. The compound shall form a uniform, continuous, coherent film which will not crack or peel and shall be free from pinholes and other imperfections. Concrete surfaces subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by above method and at the above coverage at no additional expense to Owner.

D. No pedestrian traffic shall be allowed over the surface for seven (7) days unless surface is protected by planks or plywood. The protection shall not be placed until at least 24 hours after application of curing materials (if applicable). No vehicular or equipment traffic shall be allowed over the surface for 30 days.

E. Protect concrete by suitable methods to prevent damage by mechanical injury or excessively hot or cold temperatures.

3.9 FIELD QUALITY CONTROL

A. Field sampling and testing shall be performed by an independent testing lab. Samples of concrete shall be taken at random locations from the work and at such times to represent the quality of the materials and work throughout the project. The laboratory shall provide the necessary labor, materials, equipment, and facilities for sampling the concrete and for casting, handling, and storing the concrete samples at the site of work. Sampling of plastic concrete will be in accordance with ASTM C172. Samples for pumped concrete shall be taken at the hose discharge point. Samples for other concrete shall be taken at the hopper of concreting equipment or transit mix truck.

B. Contractor shall pay for the following services when required:

1. All testing, test results, or certifications required to verify a proposed material item or mix design meets the requirements of the specifications.

2. Additional testing and inspection required because of changes in materials or proportions requested by the Contractor.

3. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements. For example, if compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure, or portion thereof, is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other load tests acceptable to the Engineer. Costs of such tests will be borne by the Contractor.

C. To facilitate testing and inspection, Contractor shall advise Owner and designated testing agency sufficiently in advance of operations to allow for the assignment of personnel and for completion of quality tests and inspection of forms.

D. Strength Tests -

1. General - The strength of the concrete will be verified by the testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site.

2. Frequency - As a minimum, one set of four standard cylinders shall be cast of each class of concrete based on the most stringent of the following requirements as applicable:

   - for each 50 cubic yards or less.

   - for each 4,000 square feet of surface area.

   - for each day a pour is made.

3. Lab Testing - Testing of specimens for compressive strength shall be made in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. One test cylinder from each group of four shall be tested at the end of 7 days and two shall be tested at the end of 28 days. Each strength test result shall be the average of the strengths of three test cylinders (cast from material taken from a single load of concrete) at 28 days.

4. Acceptance of Concrete Strength - The strength level of the concrete will be considered satisfactory so long as the average of all sets of three consecutive strength results equal or exceed the specified compressive strength and not more than 10% of the strength test results shall have

values less than the specified value. No individual strength test shall be less than the specified compressive strength by more than 500 psi.

E. Slump Tests - The slump shall be as specified when measured in accordance with ASTM C 143. Samples for slump determination shall be taken from the concrete during placing. Tests shall be made at the beginning of concrete placing operations and at subsequent intervals to insure the specification requirements are met. When concrete is pumped, slump tests shall be taken from the discharge end of the pump hose. Slump tests shall also be performed whenever standard cylinders are cast.

F. Temperature and Air Content Tests: Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Whenever standard cylinders are cast, temperature tests shall be performed. Air content tests shall be in accordance with ASTM C 231 and measured whenever standard cylinders are cast.

END OF SECTION

INDEX TO

SECTION 04220 – CONCRETE UNIT MASONRY

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):

a. 530.1/ASCE 6/TMS 602, Building Code Requirements for Masonry Structures and Specifications for Masonry Structures and Related Commentaries.

b. ACI SP-66, ACI Detailing Manual

2. ASTM International (ASTM):

a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

b. A153, Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

c. A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

d. A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

e. C33, Standard Specification for Concrete Aggregates.

f. C62, Building Brick (Solid Masonry Units Made from Clay or Shale)

g. C67, Sampling and Testing Brick and Structural Clay Tile

h. C90, Standard Specification for Loadbearing Concrete Masonry Units.

i. C91, Masonry Cement

j. C94, Ready Mixed Concrete

k. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

l. C144, Standard Specification for Aggregate for Masonry Mortar.

m. C150, Standard Specification for Portland Cement.

n. C270, Standard Specification for Mortar for Unit Masonry.

o. C476, Standard Specification for Grout for Masonry.

p. C494, Chemical Admixtures for Concrete

q. C578, Rigid, Cellular Polystyrene Thermal Insulation

r. C744, Standard Specification for refaced Concrete and Calcium Silicate Masonry Units.

s. C780, Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

t. C1019, Sampling and Testing Grout

u. C1072, Measurement of Masonry Flexural Bond Strength

v. C1142, Extended Life Mortar for Unit Masonry

w. C1289, Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

x. C1314, Standard Test Method for Compressive Strength of Masonry Prisms.

y. C2287, Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

z. E514, Standard Test Method for Water Penetration and Leakage through Masonry.

3. Brick Institute of America (BIA).

4. International Code Council (ICC):

a. International Building Code (IBC) Chapter 21.

b. ICC Evaluation Service (ICC-ES) Reports.

5. National Concrete Masonry Association (NCMA).

1.2 SUBMITTALS

A. Submittals for Review:

1. Product Data:

a. Accessories.

b. Concrete Masonry Units (CMU).

c. Mortar - include required environmental conditions, admixture limitations and manufacturer's instructions for packaged dry mortar installation.

d. Reinforcement.

2. Certificates:

a. Manufacturer letters of certification stating materials meet or exceed the specified requirements.

B. Informational Submittals:

1. Statement of Acknowledgement of Quality Assurance Plan in accordance with IBC Section 1705.3.

1.3 QUALITY ASSURANCE

A. Compliance: Comply with the requirements and criteria of the NCMA, BIA, ASTM C90, ASTM C216, and ACI 530.1 for masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances.

B. Spare Vibrator: Maintain at least one spare vibrator on site at all times.

C. Bracing and Scaffolding: Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not lay masonry when ambient temperature is below 32 degrees F on a rising temperature, or below 40 degrees F on a falling temperature, or when there is a probability of such conditions occurring within 48 hours, unless written approval of procedure for protection from freezing is obtained from Engineer. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

B. Moisture Protection: Protect masonry construction from loss of moisture during curing period of 7 days when ambient air temperature is 90 degrees F or greater and when relative humidity is less than 50 percent.

PART 2 – PRODUCTS

2.1 MASONRY UNITS

A. General:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.

2. Special units shall match properties of standard units.

3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.

4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.

5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with ACI 530.1, Table 7.

6. Masonry unit size and shape shall allow for all placement patterns to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

B. Concrete Masonry Units (CMU):

1. Load Bearing Units: ASTM C90: lightweight, hollow block, grouted as indicated.

2. Nominal Size: 16 inches long by 8 inches high by thickness shown on Drawings.

3. Minimum Compressive Strength, f'_m: 1,500 psi

4. Color of Units: Natural.

5. Surface Texture: Smooth.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM CI50, Type I.

B. Lime: ASTM C207, Type S hydrated.

C. Aggregates:

1. Mortar: ASTM C144, sand.

2. Grout: ASTM C404.

D. Water: Fresh, clean, and potable.

E. Mortar Mix:

1. Mortar for Unit Masonry, Type S in accordance with ASTM C270.

2. Minimum 28-day compressive strength of 2,000 psi.

F. Grout:

1. For bond beams, lintels and vertically reinforced cells.

2. Grout shall be in accordance with ASTM C476, premixed type in accordance with ASTM C94.

3. Consistency required to fill completely the volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

4. Minimum 28-day compressive strength of 3,000 psi. Slump: 8 inches to 11 inches.

2.3 REINFORCEMENT

A. Horizontal Joint Reinforcement:

1. Truss or ladder type, ASTM *A82,* 9ga, galvanized.

2. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.

3. Furnish special manufactured corner and wall intersection pieces.

4. Manufacturer: Dur-O-Wal, Inc., Aurora, IL.

B. Deformed Bars: As specified in Section 03300 Cast-In-Place Concrete.

2.4 PREFORMED CONTROL JOINTS

A. Solid rubber cross-shape extrusions as manufactured by:

1. Dur-O-Wal, Inc., Aurora, IL; Regular Rapid Control Joint.

2. Sonneborn-Contech Co., Oakland, CA; Sonneborn Control Joint.

3. Hohmann and Barnard, Inc; #RS-Standard.

PART 3 – EXECUTION

3.1 GENERAL

A. Protect masonry construction to prevent efflorescence. Provide measures to prevent moisture from entering incomplete walls.

3.2 PREPARATION

A. Prepare surface contact area of foundation concrete for initial mortar placement by one of following methods:

1. Sandblasting foundation and reinforcing dowels after concrete has fully cured to remove laitance and spillage and to expose sound aggregate.

2. Water blasting foundation and reinforcing dowels after concrete has partially cured to remove laitance and spillage and to expose sound aggregate.

B. Clean surfaces of loose material prior to initial mortar placement.

C. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

3.3 LAYING MASONRY UNITS

A. General:

1. Conform to building code applicable to this Project and as supplemented by these Specifications.

2. Do not start laying masonry units unless foundation wall is plumb within 1/4 inch in 10 feet or not straight within *5/16* inch in 10 feet.

3. Finish Tolerances (Measured on Interior surfaces):

a. Maximum permissible variation from plumb of masonry wall or line of joints in masonry wall: 1/16 inch per foot of height and *1/4* inch in total height of wall.

b. Maximum permissible variation from horizontal line along base of wall or for lines of horizontal joints: *1/16* inch per block and *1/4* inch per 50 feet of wall with proportionately greater tolerance for longer walls up to *1/2* inch in total length of wall.

4. Place units with chipped edges or corners such that chipped area is not exposed to view.

B. Wall Units:

1. General:

a. If necessary to move a unit after set in-place, remove from wall, clean, and set in fresh mortar.

b. Toothing of masonry units is not permitted.

2. Running Bond:

a. Unless otherwise shown, lay up walls in straight, level, and uniform courses using a running bond pattern.

b. Place units for continuous vertical cells and mortar joints to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

3. Corners: Lay standard masonry bond for overlapping units and grout solid.

4. Intersecting Walls: Bond with reinforcement, not with masonry bond.

C. Special Shapes:

1. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.

2. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

3.4 BUILT-IN ITEMS

A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them.

B. Install masonry anchors to secure items to wall.

C. Fill spaces around items with mortar or grout.

D. Do not place electrical, instrumentation, or water conduits in a cell containing reinforcement, unless approved in writing by Engineer. Pipes, sleeves, and conduits shall not be placed closer than three diameters, center-to-center, nor shall they impair strength of construction.

3.5 MORTAR JOINTS

A. General:

1. Straight, clean, with uniform thickness of 3/8 inch.

2. Horizontal and vertical mortar joints shall have full mortar coverage on face shells.

3. Vertical Head Joints:

   a. Butter well on each unit for a width equal to face shell of unit, shove tightly so mortar bonds well to both units.

   b. Solidly fill joints from face of block to at least depth of face shell.

4. As units are laid, remove excess mortar from grout space of cells to be filled.

5. Place mortar before initial setting of cement takes place. Do not retemper mortar that has started to set or is not used within one hour. Retempering of colored mortar is not allowed.

B. Exposed Joints:

1. Tool joints exposed to view after final construction, unless otherwise noted or shown.

2. Cut joints flush and as mortar takes its initial set tool to provide a concave joint.

3. Perform tooling when mortar is partially set but still sufficiently plastic to bond.

4. Perform tooling with tool that compacts mortar, pressing excess mortar out rather than dragging it out.

5. Rake out joints that are not tight at time of tooling, point, and then tool.

6. Rake and tool joints at split-face surfaces interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

3.6 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.

2. Place rubber control joint material as wall is built.

3. After wall is grouted, cured, and cleaned, install backing rod and sealant.

4. Place and tool sealant to match depth of typical joint.

5. Maximum spacing from all corners shall be 20 times wall thickness, maximum spacing between joints shall be 40 times wall thickness.

3.7 REINFORCING

A. Foundation Dowels:

1. Size, number, and location of foundation dowels shall match vertical wall reinforcing, unless otherwise noted.

2. When foundation dowel does not line up as intended, with vertical core, do not slope more than 1 horizontal to 6 vertical to bring it into alignment.

B. Vertical Reinforcing:

1. Use deformed bars.

2. Hold in position near the ends of bars by wire ties to dowels or by reinforcing positioners.

3. Lap reinforcing bars as shown, where spliced and wire tie together.

4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.

5. Hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.

C. Horizontal Reinforcing:

1. Use deformed bars.

2. Lay on webs of bond beam units and place as wall is built.

3. Lap reinforcing bars as shown, where spliced and wire tie together.

4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.

5. Terminate reinforcing bars 2 inches clear from control joints as shown.

D. Horizontal Joint Reinforcement:

1. Use for stack bond.

2. Provide in addition to typical wall reinforcing steel.

3. Space maximum 16 inches apart, vertically.

4. Lap ends 6 inches minimum.

5. At control joints make reinforcement discontinuous.

6. Use manufactured corner and other wall intersection pieces.

3.8 MORTAR PRODUCTION

A. General:

1. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use. Mix ingredients 3 minutes to 5 minutes after all ingredients are introduced.

2. Provide volumetric control by using batching box or similar measuring device. Do not use shovel to introduce materials directly into batch.

3. Maintain sand uniformly damp immediately before the mixing process.

4. Use cool mix water.

5. Do not use anti-freeze compounds to lower the freezing point of mortar.

6. If water is lost by evaporation, re-temper only within two hours of mixing.

3.9 GROUTING

A. General:

1. Do not mix, convey, or place with equipment constructed of aluminum.

2. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments in place; inspect and verify before placing grout.

3. Grout beams over openings in one continuous operation.

4. Maintain vertical alignment in ACI 530.1, Table 7.

5. Place grout as soon as possible after mortar has set to reduce shrinkage cracking of vertical joints.

6. Vertical Reinforcement:

a. First wire tie to foundation dowels, then build wall around it.

b. Provide reinforcing positioners or a proved cross bracing to secure top of steel in place.

c. Do not drop in vertical steel after block is laid, unless reinforcing positioners are provided in the course above previously grouted course.

B. Grouting Requirements:

1. Brace masonry to resist wet grout pressure.

2. Do not start grouting until wall has cured for 24 hours, minimum.

3. Partial Grouting Requirements:

   a. Walls Not Requiring Solid Grouting: Fill cells containing reinforcing steel, anchor bolts, and other embedded items as shown with grout.

   b. Construct cells to be filled to confine grout within cell.

   c. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.

4. Form horizontal construction joints between pours by stopping grout pour 1–1/2 inches below a mortar joint, except at a bond beam; stop pour 1/2 inch below top of masonry unit.

5. Partial Grouting with Insulation Fill:

   a. Where cells of masonry units are to receive masonry fill insulation in some cells and to receive grout in some cells, provide continuous mortar on block webs on each side of cells to be filled with grout to ensure insulation without enter grout cells.

   b. Where bond beams are required with masonry fill insulation and grout, limit pours to less than 6 feet in height.

6. Fully embed horizontal steel with grout in an uninterrupted pour.

7. Do not construct wall more than one course above top of grout pour prior to placing grout.

8. Vibration:

   a. Use internal "pencil" type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.

   b. After waiting sufficient time to permit grout to become plastic, but before it has taken any set, reconsolidate grout.

   c. Waiting period will vary depending upon weather conditions and block absorption rates, but under "normal" weather conditions with average masonry units the waiting period should be between 30 minutes to 60 minutes.

9. Cleanouts:

   a. Provide for grout pours over 5 feet in height.

   b. Provide for sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing.

c. Location: Concealed from view after final construction, unless otherwise approved by Contractor.

d. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout *leakage* and provide a flush finish.

3.10 FIELD QUALITY CONTROL

A. Masonry shall be tested by independent testing agency, retained by Owner, in accordance with ASTM C1314, Method B, as modified by ACI 530.1/ASCE 6.

B. Masonry test samples, when required, shall be constructed onsite with same materials and workmanship to be used for Project.

C. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

D. Masonry Testing:

1. Unit Strength Method:

a. Method and frequency for mortar, grout, and masonry unit sampling and testing in accordance with IBC 2105.2.2.1.

b. Provide masonry units for test samples required.

E. Corrective Action:

1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength. Masonry units shall also be tested to verify compliance to requirements of ASTM C90, Type 1.

2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with IBC 2105.3.

3.11 CLEANING

A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.

3.12 PROTECTION OF INSTALLED WORK

A. Do not allow grout and mortar stains to dry on face of exposed masonry.

B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

C. Adequately brace walls until walls and roof are completed.

D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

E. Protect masonry against freezing for minimum 2 hours after being laid.

F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

END OF SECTION 04220

INDEX TO

SECTION 05100 – MISCELLANEOUS METALS

SECTION 05100 – MISCELLANEOUS METALS

PART 1 – GENERAL

1.1 DESCRIPTION: The work covered by this section includes the grating, pipe supports and other miscellaneous items used in structures on the project.

1.2 RELATED WORK SPECIFIED ELSEWHERE: Other items of work required for the completed structures for which miscellaneous metals are required are specified in the following sections:

A. Section 02667 – Water Distribution System

B. Section 09900 – Painting

C. Section 02668 – Prefabricated Booster Pump Station

1.3 MEASUREMENT AND PAYMENT: The work covered by this section will not be measured for direct payment. Payment will be included in the contract lump sum price for the item which it is associated.

PART 2 – PRODUCTS

2.1 ALUMINUM: Unless otherwise specified, aluminum items shall be in standard mill finish.

A. Extrusions: Shall be alloy 6063–T–4.

B. Plate: Shall be heat treatable alloy 6061–T–4.

C. Structural: Shall be alloy 6061–T–4 with the sizes shown on the drawings.

2.2 EXPANSION SHIELD: Shall conform to Federal Specification FF–S–325.

2.3 ANCHOR BOLTS AND CONNECTING BOLTS: Shall conform to Federal Specification FF–B–588, hot dipped galvanized or cadmium plated. Where specified, located on the drawings or submerged locations, stainless steel bolts and accessories shall be used.

2.4 GRATING: Shall be aluminum, grating shall be designed to support a uniform live load of 300 pounds per square foot for the spans shown on the drawings. They shall be I–Bar or Extruded. Bearing bars shall be alloy 6061–T–6. Extruded grating shall be 6–inches wide extruded planks welded to each other and to end bars. Extruded grating shall be alloy 6063–T–6.

2.5 STRUCTURAL STEEL: Shall conform to ASTM A–36 (Structural).

2.6 ACCESS DOORS (HATCH COVERS): (If indicated on Plans) Shall be of the size and dimensions as shown on the drawings and similar to those manufactured by Bilco, Halliday Products, Washington Aluminum or accepted equivalent. Door shall be 1/4" aluminum diamond pattern plate, alloy 6061–T6, reinforced to withstand a live load of

300 pounds per square foot (min). Frame shall be an extrusion, alloy 6063–T6. Door shall be equipped with a minimum of two heavy duty stainless steel hinges with stainless steel pins and an automatic hold–open device.

All material shall have a standard mil finish. The embedded portion of the frame shall have a heavy shop coat of bituminous paint.

2.7 UNI–STRUT: Shall be hot–dipped galvanized steel appropriately sized to support the control panel and electrical equipment for the pump station.

PART 3 – EXECUTION

3.1 GENERAL: Miscellaneous metal work required shall be as herein specified. See drawings, schedules, and details for items and location of miscellaneous metals required. Supplementary materials and parts necessary to complete each item, through such work is not definitely shown or specified, shall be included. Miscellaneous bolts and anchors, supports, braces and connections necessary for completion of the work shall be provided, including bolts, anchors, sockets, and other fastenings required by other trades for securing miscellaneous metalwork to other construction. Standard products, generally meeting such requirements, will be accepted if details of construction and installation are approved by the Engineer. Gauges of nonferrous metals are Brown and Sharpe. Items specified to be galvanized, when practical and not indicated otherwise, shall be hot–dipped processed after fabrication. Galvanizing shall be in accordance with ASTM Specification A–123, A–163, A–386, or A–525 as applicable. All steel shall be cleaned of rust and scale.

3.2 WORKMANSHIP: All miscellaneous metal work shall be well formed to shape and size with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Corner joints shall be coped or mitered, well formed and in true alignment. All work shall be accurately set to establish lines and elevations and securely fastened in place. This work shall be executed and finished in accordance with approved drawings, cuts, details, and samples.

A. Fastenings: Shall be exposed. Thickness of metal and details of assembly and supports shall give ample strength and stiffness.

B. Delivery to Site and Installation: At the proper time, deliver and set in place items of metal work to be built to adjoining construction.

3.3 SHOP DRAWINGS: Shop drawings of materials shall be submitted to the Engineer for approval before fabrication.

3.4 STRUCTURAL SHAPES: Furnish miscellaneous structural items for lintels and other structural sections as required by the drawings.

3.5 HANDRAIL AND GRATING: Furnish and install railing and grating on existing and proposed structures as required by the drawings.

A. Handrails: Shall be installed with posts plumb and rails true to line. Anchorages shall be rigid.

B. Grating and Frames: Exterior edges of grating shall be banded with bars of the same size and bearing bars. Where openings have been cut in grating, the edges around the openings and removable section shall also be banded as specified for exterior edges. Frames of shapes and all welded construction finished to match grating shall be provided as indicated. Frames shall be provided with welded–on anchors. Support angles, beams, and other items shall be provided as required. Steel grating and frames shall be galvanized.

3.6 ANCHORAGE: Anchorage shall be provided for fastening miscellaneous metal items in place. Anchorage shall be provided as indicated and specified herein. Secure anchors and bolts in place as work progresses.

3.7 SHOP PAINTING: Surfaces of ferrous metal, except galvanized surfaces, shall be cleaned and shop coated with manufacturer's standard protective coating. Items to be finished painted shall not be given a bituminous protective coating. Surfaces shall be cleaned with solvents to remove grease and oil and with power wire–brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Surfaces of items embedded in concrete shall not be painted.

END OF SECTION

SECTION 06130

TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lumber and timber framing.

B. Hardware.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

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

1. ASTM A 153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.

2. ASTM A 307 – Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

B. American Wood Preserves Association (AWPA) Standards:

1. AWPA Standard U1.

2. AWPA M4 – Standard for the Care of Pressure Treated Wood Products.

C. U. S. Department of Commerce:

1. PS 20 – American Softwood Lumber Standard.

D. Southern Pine Inspection Bureau (SPIB) Publication:

1. Grading Rules, Current Edition.

1.4 QUALITY ASSURANCE

A. A certificate from the wood preserving company attesting that all lumber and timber has been treated in accordance with these specifications shall be delivered to the Engineer prior to delivery of any timber to the site.

1.5 DELIVERY, STORAGE, HANDLING

A. Store materials on site in Contractor's staging area if provided by the Owner or on material barge. Lumber and timber shall be stored in stacks and shall be close stacked so as to prevent warping. Maintain storage area and store materials in accordance with AWPA M4.

B. Handle treated lumber and timber in accordance with AWPA M4 and in such a manner as to prevent sudden dropping, breaking of outer fibers, bruising, or

penetration of the surface. Cant hooks, peavies, pikes, hooks, or wire rope shall not be used.

C. Repair damage to treated lumber and timber in accordance with AWPA M4.

1.6 MEASUREMENT AND PAYMENT

A. Lumber and timber shall not be measured for direct payment. Payment for all lumber and timber, hardware, and accessories specified herein shall be included in the contract lump sum for the project.

PART 2 - PRODUCTS

2.1 LUMBER & TIMBER

A. Structural lumber and timber shall contain only sound wood free from any form of decay. All lumber and timber shall be Southern Yellow Pine, and its Association grading rules shall conform to the basic provisions of PS 20.

B. All lumber and timber used on the project shall be Southern Pine No. 2 Grade, as set forth in the SPIB Grading Rules, except where noted otherwise on plans.

2.2 PRESERVATIVE TREATMENT

A. all lumber and timber shall be pressure treated with Copper Azole type C (CAC) with a retention of 0.15 pcf, in accordance with AWPA Standard U1, commodity Specification A, to the requirements of use category UC4B.

B. A certificate from the wood preserving company attesting that the lumber and timber products have been treated in accordance with these specifications shall be submitted to the Engineer prior to installation of any lumber.

2.3 ACCESSORIES

A. Hardware other than deck screws shall be hot dipped galvanized G-90 in accordance with ASTM A-153 or Stainless Steel, as specified on the drawings. Mechanical and electroplated/electro galvanized coatings shall not be allowed.

B. Washers shall be used under all nuts which would otherwise come in contact with wood.

C. Pipe hangers and attachment devices shall be stainless steel or galvanized.

2.4 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered by Contractor.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall be responsible for making all field measurements required to layout lines and elevations to accurately construct the timber systems as shown on the drawings.

3.2 PROTECTION OF TREATED TIMBER PRODUCTS

A. Prior to and following erection, ensure conformance with AWPA M4, except as modified hereinafter.

B. Cuts and Abrasions: All field cuts and abrasions, including end grain of all expose vertical timbers, shall be brushed with three (3) coats of the preservative, each coat being allowed to soak in before application of succeeding coats.

C. Bolt Holes: All bolt holes bored after treatment shall be poured full of the preservative. Horizontal holes may be filled by pouring the preservative through a bent funnel. When filling holes, temporarily plug the outlet. Any unfilled holes, after being treated with preservative, shall be plugged at each end with tight-fitting treated wooden plugs.

3.3 FRAMING AND BORING

A. All lumber shall be accurately cut and framed to a close fit in such a manner that the joints will have even bearing over the entire contact surfaces.

B. Use only full length timbers, unless noted otherwise. Joints shall not be permitted in split caps and bracing. Joints in stringers shall be permitted if construction detail is provided. No shimming will be permitted in making joints, nor will open joints be accepted.

C. Drill all holes straight and perpendicular to the bearing surface. Counterbore holes for bolts for countersinking bolts and washers.

D. Holes for machine bolts shall be bored with a bit the same diameter as the bolt, or up to 1/16 inches larger than the bolt diameter. Holes for drift bolts or pins shall be bored with a bit 1/8-inch less in diameter than the drift bolt to be driven. Holes for lag bolts shall be bored with a bit equal to shank diameter for the treated portion.

3.4 WORKMANSHIP

A. All workmanship shall be first class. Only competent and experienced carpenters shall be employed in the work.

B. All framing shall be true and exact.

C. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood. Deep hammer marks in wood surfaces shall be considered evidence of poor workmanship and sufficient cause for replacement of the member in question, at the Contractor's expense.

D. Hot-dip galvanized and stainless steel components shall not be placed in contact with each other.

E. Complete fabrication of treated items prior to treatment where possible. If cut after treatment, coat cut surfaces with three heavy brush coats of copper nephthenate and to comply with AWPA M4. After each brush coat, allow time for the coating to soak in before application of succeeding coats. This process applies to abrasions as well.

F. All decking and deck boards shall be installed with bark side up.

END OF SECTION

INDEX TO
SECTION 08332 – OVERHEAD COILING ALUMINUM DOORS

SECTION 08 33 23 – OVERHEAD COILING ALUMINUM DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor to provide one aluminum overhead door as specified herein and on plans for pump house building.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated.

1. Wind Loads: As indicated on Drawings

1.3 MEASUREMENT AND PAYMENT

A. The work covered will not be measured for direct payment. Payment will be included in the contract lump sum price for "CMU Building – Complete, in service".

1.4 SUBMITTAL

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Show locations of replaceable fusible links.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance Data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling–door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Metal Interior Curtain–Slat Facing: Match metal of exterior curtain–slat face.

B. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1–1/2 by 1–1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from metal to match curtain slats and finish.

C. Curtain Jamb Guides: Manufacturer's standard aluminum angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

2.2 HOOD

A. General: Form sheet metal aluminum hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface–mounted hoods and fascia for any portion of between–jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.3 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring–loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Provide cylinders for locking mechanism on each door.
2. Keys: Provide three for each cylinder.

B. Safety Interlock Switch: Equip power–operated doors with safety interlock switch to disengage power supply when door is locked.

2.4 CURTAIN ACCESSORIES

A. Weather Seals: Equip each exterior door with weather–stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

B. Push/Pull Handles: Equip each push–up–operated or emergency–operated door with lifting handles on each side of door, finished to match door. Provide pull–down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable–tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease–sealed bearings or self–lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets with 3/16 thick S.S. plates with permanently sealed ball bearings.

2.6 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation–cycles requirement specified, with electric motor and factory–prewired motor controls, starter, gear–reduction unit, solenoid–operated brake, clutch, remote–control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:

    a. Phase: single phase.
    b. Volts: 115/230 V.
    c. Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

D. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

E. Remote–Control Station: Momentary–contact, three–button control station with push–button controls labeled "Open," "Close," and "Stop."

1. Interior units, full–guarded, surface–mounted, heavy–duty type, with general–purpose NEMA ICS 6, Type 1 enclosure.

F. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lb./f.

G. Emergency Operation Disconnect Device: Equip operator with hand–operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

H. Motor Removal: Design operator so motor may be removed without disturbing limit–switch adjustment and without affecting emergency manual operation.

I. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.7 DOOR ASSEMBLY

A. Basis of Design for Coiling Doors: The doors are based on Overhead Door Corporation 620 Series door.

B. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cookson Company.
b. Overhead Door Corporation.
c. Raynor.
d. Wayne–Dalton Corp.
e. Windsor Door.

C. Operation Cycles: Not less than 20,000

D. Door Curtain Material: Aluminum

E. Door Curtain Slats: Flat profile slats of 2–5/8–inch nominal center–to–center height.

F. Door Curtain Slat Gauge: Minimum 14 Gauge Aluminum

G. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal–to–metal contact and to minimize operational noise.

H. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: Face of wall.

I. Electric Door Operator:

1. Usage Classification: Standard duty, up to 60 cycles per hour.
2. Motor Exposure: Interior.
3. Emergency Manual Operation: Chain type.
4. Obstruction–Detection Device: Automatic photoelectric sensor.
5. Remote–Control Station: Interior

J. Door Finish:

1. Baked–Enamel or Powder–Coated Finish: Color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer. Adjust seals to provide weathertight fit around entire perimeter.

3.2 DEMONSTRATION

A. Engage a factory–authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

INDEX TO

SECTION 08342 – FIBERGLASS REINFORCED PLASTIC DOORS

SECTION 08342

FIBERGLASS REINFORCED PLASTIC DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fiberglass reinforced plastic door and frame at all rooms, including chlorine room and Pump room.

1.2 RELATED SECTIONS

A. Section 08712 – Door Hardware.

1.3 SYSTEM DESCRIPTION

A. Design door opening assemblies to resist failure from corrosion.

1.4 SUBMITTALS

A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, cut–outs for glazing, and finish.

B. Product Data: Indicate door configurations, location of cut–outs for hardware reinforcement.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept doors on site in manufacturer's packaging. Inspect for damage.

B. Break seal on–site to permit ventilation.

C. Store door assemblies in manufacturer’s packaging. Store on end in a dry area and protect from damage.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 COORDINATION

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.9 MEASUREMENT AND PAYMENT

A. Fiberglass Reinforced Plastic Doors: The work covered will not be measured for direct payment. Payment will be included in the contract lump sum price for "CMU Building – Complete, in service".

1.10 WARRANTY

A. Manufacturer's 10–year warranty against failure due to corrosion from chlorine gas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Mat: Random Glass Fiber Mat, minimum 4.5 ounces per square foot weight of glass material.

B. Polyurethane Foam: Minimum density of 4 pounds per cubic foot.

C. Roving: Unidirectional Glass Fiber Mat, minimum 16 ounces per square yard weight.

D. Resins: Formulated for chlorine gas environment.

E. Anchors and Fasteners: Stainless steel.

2.2 MANUFACTURED UNITS

A. Fiberglass Reinforced Plastic (FRP) Door

1. Thickness: 1–3/4 inches.
2. Thermal Insulating Valve: "R" Factor 12.
3. Stile and Rail Structure: One–piece molded U–shaped cross–section, 20 mil gel coat, minimum three (3) layers random fiberglass mat, saturated with resins.
4. Core: Polyurethane foam.
5. Face Sheets: 20 mil gel coat, with minimum two (2) layers random fiberglass mat and one (1) layer roving, saturated with resins.
6. Finish: Semi–gloss surface.
7. Color: To be determined by the Owner.
8. Glazing: Safety glass with wire.

B. Fiberglass RTM Door Frame

1. One–piece molded cross–section with molded stop, 20 mil gel coat,

minimum two (2) layers random fiberglass mat, saturated with resins.
2. Finish: Semi–gloss surface.
3. Color: To be determined by the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's latest written instructions.

B. Anchor components securely to wall construction without distortion or stress.

C. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.

D. Door closer furnished under Section 08712 Door Hardware.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement.

3.5 PROTECTION

A. Protect door assemblies and door hardware from damage by subsequent construction activities until final acceptance.

END OF SECTION

INDEX TO

SECTION 08712 – DOOR HARDWARE

SECTION 08712

DOOR HARDWARE

PART 1 GENERAL

1.1 WORK INCLUDED

A. Hardware for fiberglass reinforced plastic doors.

B. Thresholds.

C. Gaskets.

D. Closers

1.2 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.3 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three years experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with three years documented experience.

C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

1.4 SUBMITTALS

A. Submit schedule, shop drawings, and product data.

B. Indicate locations and mounting heights of each type of hardware.

C. Submit manufacturer's parts lists, templates, and installation instructions.

D. Submit manufacturer's certificate that hardware meets or exceeds specified requirements.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products.

B. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

C. Deliver keys to Owner by security shipment direct from hardware supplier.

D. Protect hardware from theft by cataloging and storing in secure area.

1.7 WARRANTY

A. Provide five year warranty.

1.8 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.9 MEASUREMENT AND PAYMENT

A. Door Hardware: The work covered will not be measured for direct payment. Payment will be included in the contract lump sum price for "CMU Building – Complete, in service".

PART 2 PRODUCTS

2.1 KEYING

A. Door locks and keys shall be reviewed and approved by County.

2.2 FINISHES

A. For fiberglass reinforced plastic doors, butts, locksets, flushbolts, closers and threshold shall be **stainless steel**.

2.3 LOCK SETS:

A. Contractor to provide heavy duty industrial grade hasp for use with Facility supplied pad lock. Provide stainless steel face and back plates at hasp as necessary for reinforcement to prevent damage to fiberglass doors.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use the templates provided by hardware item manufacturer.

C. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.3 SCHEDULE

A. Pair of fiberglass doors to have the following:

6 Hinges	4–1/2 x 4–1/2 NRP
1 Lockset	6 Pin, Storage Room Function
2 Flush Bolts	Provide 16" chain for top bolt
2 Kickplates	8" x 34"
2 Closers	
1 Threshold	
1 Set	Weatherstripping

END OF SECTION

INDEX TO

SECTION 09900 – PAINTING

SECTION 09900

PAINTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work covered by this section includes surface preparation and coatings on structural steel, pumps, equipment, interior and exterior of building, floor (all rooms), piping, and other places or items listed in the painting schedule herein or shown on drawings.

1.2 RELATED WORK

A. Section 02667 – Water Distribution System

B. Section 02668 – Prefabricated Booster Pump

C. Section 05110 – Miscellaneous Metal – Bulkhead

1.3 REFERENCES (LATEST REVISIONS)

A. SSPC–SP6 – Commercial Blast Cleaning.

B. SSPC–SP7 – Brush–Off Blast Cleaning.

C. SSPC–SP10 – Near–White Blast Cleaning.

D. SSPC–SP13 – Surface Preparation of Concrete.

1.4 QUALITY CONTROL

A. Paint Manufacturer: Paint shall be a product of a manufacturer with a record of at least 5 years of producing paint of the type specified.

B. Applicators: Paint shall be applied by skilled painters with experience in painting structures similar to those specified and with the use of coating type described. If a painting contractor is used, they shall furnish Engineer with a list of similar projects completed and the names of Owners and Engineers who are familiar with their capabilities.

1.5 ALLOWABLE TOLERANCES

A. Thickness of coatings shall be at least 90% of specified for any coat and shall be at least 100% of specified for the total thickness.

1.6 CERTIFICATE

A. Manufacturer shall furnish the Engineer with a certificate showing composition and physical properties of paint proposed for use. Proprietary formula will not be required but information must include at least the following:

Binder	Pot Life
Resin	Theoretical Coverage per Mil Thickness
Pigment	Solvent
Solids by Weight	Solids by Volume

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material must be brought to the job site in original sealed and labeled containers. It shall be stored in a protected manner to preserve the labels and seals.

1.8 JOB CONDITIONS

A. No paint shall be applied when surrounding air temperature, as measured in the shade, is below 40° F. No paint shall be applied when temperature of the surface to be painted is below 35° F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist. No paint shall be applied when it is expected the air temperature will drop below 40° F. within 18 hours after application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain the surfaces are dry. Further, a days painting should be completed well in advance of probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to formation of moisture.

All paint should be applied in strict accordance with the paint manufacturer's instructions.

1.9 PROTECTION

A. Painted surfaces shall be protected until thoroughly dry and cured. Any damage to painted surfaces that mar or abrade the surface shall be repaired. Contractor shall sand to a sound surface and repaint with the same paint used on surrounding surfaces. Where a repainted surface does not blend completely with surrounding surface, Contractor shall repaint entire area, or part or segment of the surface to make repair not discernable.

1.10 SEQUENCING AND SCHEDULING

A. Contractor shall arrange work so the finish paint coat is completed after all equipment has been installed and other work finished.

1.11 ALTERNATIVES

A. The intention of these specifications is to produce the best protective coating for the Owner. If Contractor suggests alternate material or methods which will improve results at no additional cost, Engineer will examine the suggestion and if it is accepted, it may be used. The basis upon which acceptance of an alternate will be given will be its value to Owner and not for conveniences of Contractor.

1.12 GUARANTEE

A. Contractor shall guarantee the quality and performance of material and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

1.13 COLOR

A. Contractor shall provide the Owner with a color selection chart and obtain Owner's choice on color prior to ordering.

1.14 MEASUREMENT AND PAYMENTS

A. Painting: No separate payment will be made for work included in this Section. All costs and charges in connection therewith shall be included and reflected in the payment for particular item of work to which it pertains.

PART 2 – PRODUCTS

2.1 PAINT QUALITY

A. Paint manufacturer shall have a record of at least 5 years producing the type paint specified. The quality of paint shall be equivalent to those manufactured by Tnemec Company or Induron Coatings.

Products of other manufacturers comparable in quality and type will be acceptable, if offered by the Contractor with satisfactory data on past performance in similar installations and if accepted by Engineer.

2.2 PRODUCT NAMES

A. Product names of certain manufacturers are used in the following paint schedules to indicate type, thickness, color, and method of application. Products of other manufacturers will be acceptable, if in the opinion of Engineer, they are equivalent to those named.

2.3 PAINT MATERIALS

A. Painting materials used shall be similar and equivalent to the following products of Tnemec Company or Induron Coatings. Painting materials used for various surfaces and conditions of service shall be similar and equivalent to the following:

	Tnemec Company	**Induron Coatings**
Exterior Structural Steel and Miscellaneous Ferrous Metal Surface Prep: SSPC–SP6 Commercial Blast	Shop Primer: One coat Series 66 Hi–build Epoxoline, 3.0 dry film mils.	Shop Primer: One coat Armorguard P–14 Epoxy Primer, 3.0 dry film mils.
	Field Spot Primer: Series 66 Hi–build Epoxoline.	Field Spot Primer: Armorguard P–14 Epoxy Primer.
	Intermediate Coat: One coat Series 66 Hi–build Epoxoline, 3.0 dry film mils	Intermediate Coat: One coat Armorguard Epoxy, 3.0 dry film mils.
	Finish Coat: One coat Series 73 Endura–Shield, 3.0 dry film mils.	Finish Coat: One coat Indurethane 6600, 2.0 dry film mils.
Interior Structural Steel and Miscellaneous Ferrous Metal Surface Prep: SSPC–SP6 Commercial Blast	Shop Primer: One coat Series 66 Hi–build Epoxoline, 3.0 dry film mils.	Shop Primer: One coat Armorguard P–14 Epoxy Primer, 3.0 dry film mils.
	Field Spot Primer: Series 66 Hi–build Epoxoline.	Field Spot Primer: Armorguard P–14 Epoxy Primer.
	Finish Coat: One coat Series 66 Hi–build Epoxoline, 4.0 dry film mils.	Finish Coat: Two coats Armorguard Epoxy, 3.0 dry film mils per coat.
Structural Steel and Miscellaneous Ferrous Metals (Submerged Potable Water) Surface Prep: SSPC–SP10 Near White Blast	Shop Primer: One coat Series 20 Pota–Pox, 3.0 dry film mils.	Shop Primer: One coat PE–70 Epoxy, 3.0 dry film mils.
	Field Spot Primer: Series 20 Pota–Pox.	Field Spot Primer: PE–70 Epoxy.
	Finish Coat: Two coats Series 20 Pota–Pox, 4.0 dry film mils per coat.	Finish Coat: Two coats PE–70 Epoxy, 4.0 dry film mils per coat.
Structural Steel and Miscellaneous Ferrous Metals (Submerged Non–Potable Water)	Shop Primer: One coat Series 66 Hi–build Epoxoline, 3.0 dry film mils.	Shop Primer: One coat PE–70 Epoxy, 3.0 dry film mils.
Surface Prep: SSPC–SP10 Near White Blast	Field Primer: Series 66 Hi–build Epoxoline.	Field Primer: PE–70 Epoxy.
	Intermediate Coat: One coat Series 104 H.S. Epoxy, 8.0 dry film mils.	Intermediate Coat: One coat PE–70 Epoxy, 5.0 dry film mils.

	Tnemec Company	**Induron Coatings**
	Finish Coat: One coat Series 104 H.S. Epoxy, 8.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
Interior Concrete Surface Prep: SSPC–SP7 Brush–Off Blast	Primer Coat: One coat Series 66 Hi–build Epoxoline, 5.0 dry film mils.	Primer Coat: One coat Armorguard Epoxy, 5.0 dry film mils.
	Finish Coat: One coat Series 66 Hi–build Epoxoline, 5.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 5.0 dry film mils.
Exterior Concrete Surface Prep: SSPC–SP13 Surface Preparation of Concrete	Primer Coat: One coat Series 180 W.B. Tneme–Crete, 6.0 dry film mils.	Primer Coat: Two coats AC 402 Acrylic Masonry Sealer, 0.5 dry film mils per coat.
	Finish Coat: One coat Series 180 W.B. Tneme–Crete, 6.0 dry film mils.	Finish Coat: Two coats AC 403 Acrylic Elastomeric Coating, 6.0 dry film mils per coat.
Exterior Concrete Masonry Units Surface Prep: SSPC–SP13 Surface Preparation of Concrete	Primer Coat: One coat Series 130 Envirofill. 60 – 80 sq. ft./gal.	Primer Coat: One coat AC 220 Acrylic Block Filler, 60 – 80 sq. ft./gal.
	Finish Coat: Two coats Series 180 W.B. Tneme–crete, 6.0 dry film mils per coat.	Finish Coat: Two coats AC 403 Acrylic Elastomeric Coating, 6.0 dry film mils per coat.
Interior Concrete Masonry Units Surface Prep: SSPC–SP13 Surface Preparation of Concrete	Primer Coat: One coat Series 130 Envirofill. 60 – 80 sq. ft./gal.	Primer Coat: One coat Polyfill Epoxy Block Filler to fill voids.
	Intermediate Coat: One coat Series 180 W.B. Tneme–crete, 6.0 dry film mils.	Intermediate Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
	Finish Coat: One coat Series 180 W.B. Tneme–crete, 6.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
Concrete Floor Surface Prep: SSPC–SP13 Surface Preparation of Concrete	Primer Coat: One coat Series 201 Epoxoprime 6.0 dry film mils.	Primer Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
	Intermediate Coat: One coat Series 280 Tneme–glaze, 6.0 dry film mils.	Intermediate Coat: One coat Armorguard Epoxy, 6.0 dry film mils.

	Tnemec Company	**Induron Coatings**
	Finish Coat: One coat Series 280 Tneme–glaze, 6.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
Interior and Exterior Ductile or Cast Iron Pipe, Pumps and Valves Surface Prep: Per Manufacturer's Instructions	Primer Coat: One coat Series 66 Hi–build Epoxoline, 5.0 dry film mils.	Primer Coat: One coat PE–70 Epoxy, 5.0 dry film mils.
	Finish Coat: One coat Series 66 Hi–build Epoxoline, 6.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 5.0 dry film mils.
Ductile or Cast Iron Pipe, Pumps and Valves (Submerged Potable Water) Surface Prep: Per Manufacturer's Instructions	Primer Coat: One coat Series 20 Pota–Pox, 5.0 dry film mils.	Primer Coat: One coat PE–70 Epoxy, 5.0 dry film mils.
	Finish Coat: One coat Series 20 Pota–Pox, 6.0 dry film mils.	Finish Coat: Two coats PE–70 Epoxy, 3.0 dry film mils per coat.
Ductile or Cast Iron Pipe, Pumps and Valves (Submerged Non–Potable Water) Surface Prep: Per Manufacturer's Instructions	Primer Coat: One coat Series 66 Hi–build Epoxoline, 5.0 dry film mils.	Primer Coat: One coat PE–70 Epoxy, 5.0 dry film mils.
	Finish Coat: One coat Series 66 Hi–build Epoxoline, 6.0 dry film mils.	Finish Coat: One coat Armorguard Epoxy, 6.0 dry film mils.
Interior or Exterior Wood Surface Prep: Clean and Dry	Primer Coat: One coat Series 10–99W Tnemec Primer, 3.0 dry film mils.	Primer Coat: One coat AC 301 Wood Primer, 2.5 dry film mils.
	Finish Coat: One coat Series 113 H.B. Tneme–Tufcoat, 6.0 dry film mils.	Finish Coat: Two coats Armorlux 2500, 2.5 dry film mils per coat.

2.4 PRODUCT REVIEW

A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 3 – EXECUTION

3.1 ON SITE OBSERVATION OF WORK

A. Surfaces shall be checked by the Engineer after cleaning. After each coat has been applied and allowed to dry, the dry film thickness will be measured by Engineer using a dry film thickness gauge. Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

3.2 SURFACE PREPARATION

A. All surfaces shall be clean, dry and in suitable condition to receive the finish. Incidental or necessary minor cleaning, sanding and dusting of surfaces shall be made so they are in proper condition to receive the finish. All dirt, grease, and rust shall be removed from metal work with benzine, sandpaper, or wire brush. All abrasions shall be rubbed smooth and edges of all paint feathered and then touched up with paint specified for finish, in such a manner the patch will not show on completion. All metal surfaces shall be clean, free from dirt, scale, loose paint, oil, and grease. In general, metal surfaces will have a priming coat before shipment. The abraded portions shall be touched up prior to applying final coats.

All surfaces to be painted shall be free from cracks, holes, or other defects that will prevent obtaining a smooth unbroken paint film.

1. Steel surfaces must be prepared by sand blasting.

   a. Sand Blasting: As a minimum, all unprimed metal surfaces shall be field sandblasted in accordance with NACE No. 2 (SSPC–SP10), near white blast. A NACE No. 3 (SSPC–SP6), commercial blast, shall be required on any metal surface to be subsequently finished with coal tar epoxy. All weld areas shall be smooth.

      Blast cleaning shall not develop an anchor pattern exceeding 1/3 total thickness of the film used and may be obtained with a 16–30 mesh sand. All dust or grit remaining on the surfaces after blasting shall be removed by brush or vacuum.

   b. Shop Primed Coats: Certain shop coats are to be furnished for some items as specified under other parts of these specifications. Consequently, field prime coats will not be required on surfaces shop primed, except for touch–up and repair of any damage to same as the result of shipping, erecting or construction operations. Such touch–up and repair shall be with a field primer recommended by the paint manufacturer.

      It shall be the responsibility of Contractor to ensure all field applied painting materials are compatible with shop applied painting materials over which they will be used.

2. Concrete surfaces shall be prepared according to SSPC–SP 13. Allow concrete to cure for a minimum of 28 days before painting. Surfaces shall be clean, dry, and free of oil, crease, chalk, form release agents and other contaminants.

3. Concrete masonry units shall be prepared according to SSPC–SP 13. Allow mortar to cure for a minimum of 28 days before painting. Surfaces shall be clean, dry, and free of oil, grease, dirt, dust and other contaminants.

4. Ductile and cast iron surfaces shall be prepared according to manufacturer's instructions. Surfaces shall be clean, dry, and free of oil, grease, dirt, dust and other contaminants.

5. Wood surfaces shall be prepared according to manufacturer's instructions. Surfaces shall be clean, dry, and free of oil, grease, dirt, dust sap and other contaminants. Seal knots and sand rough spots with the grain. Lightly sand between coats.

3.3 APPLICATION

A. Painter shall apply each coating at rate specified by the manufacturer. If materials have thickened or must be diluted for application by spray guns, the coating shall be built up to same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer must not cover a greater square foot area when applied by spray gun than when applied by brush unthinned.

Sufficient time shall elapse between successive coats to permit proper drying. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish.

Paint coats on metal may be either brushed or sprayed on. If sprayed, the gun shall be operated by mechanics, nozzle held perpendicular to surface being painted and coats applied uniformly and in a manner which will bond paint properly to surface. Air spray application of paint shall be followed immediately with a paint brush applied along vertical and lower horizontal edges of members and along all abutting surfaces, edges of connections, between rivet heads and the like points to remove all surplus paint and to smooth out all runs. All sags in paint films wherever located shall be brushed out immediately.

For submerged metal surfaces, all or part including below or above grade surfaces constantly wet or exposed to moisture and condensation must be dry, clean and free of oil and grease. Proper cleaning is essential. Sandblast to a near white blast in accordance with Steel Structures Painting Council recommended methods outlined in Specification SP10. Surfaces shall be primed immediately after sandblasting with the primers as outlined in these specifications.

3.4 PAINTING SCHEDULE

A. The following paint schedule indicates surfaces to be painted using painting materials previously specified for type of surface and conditions of service as directed by Owner and Engineer. Colors will be selected by the Owner from manufacturer's standard color charts and, where required to match existing or other colors provided, manufacturer shall obtain same by mixing and/or tinting of its particular products. Colors are subject to final acceptance by the Owner at time of construction.

Surfaces to be painted shall include the following:

1. Withing the work area, new pumps, piping, valves, electrical conduits, panels and miscellaneous steel which will remain in service upon completion of the work.

2. Pump building, chlorine room, electrical room, concrete wall (interior & exterior), Concrete floor, and ceiling (all rooms), unpainted and primed metal.

3. Pumps, piping, valves, electrical conduits and miscellaneous metal.

4. The painting of all doors and windows, pipe supports and hangers.

If any of the above items are furnished in aluminum, bronze, or stainless steel, no painting is required.

END OF SECTION

DIVISION 16 - ELECTRICAL

16010 - BASIC ELECTRICAL REQUIREMENTS

1.1 QUALITY ASSURANCE

A. All electrical work shall be in accordance with the following codes and agencies:

1. The National Electrical Code (NFPA-70), 2017 Edition.
2. The International Building Code, 2018 Edition, with 2020 Georgia amendments.
3. Regulations of the local utility company concerning metering and service entrance.
4. State and local ordinances governing electrical work.

B. All materials shall be new and shall conform to standards where such have been established for the particular material. All UL listed equipment shall bear the UL label.

1.2 PERMITS

A. Obtain all permits and inspections required for the work involved. Deliver to the owner all certificates of inspection.

1.3 WARRANTY

A. The contractor shall warrant to the owner that all work shall be free from defects and will conform to the contract documents. This warranty shall extend not less than one year from the date of beneficial use.

1.4 DRAWINGS

A. The drawings indicate the general arrangement of electrical equipment, based on one manufacturer's product. Coordinate installation of equipment with all other trades. Do not scale drawings for connection locations. Bring all discrepancies to the immediate attention of the engineer.

B. Contractor shall install and circuit all electrical work as indicated on drawings unless specific building construction requires a change or rerouting of this work. He shall keep a record of the location of all concealed work, including the underground utility lines. He shall document all changes in the manner specified by the General Conditions, Special Conditions and Supplementary General Conditions to the Electrical Work.

1.5 RECORD DRAWINGS

A. At the time of final inspection, provide three (3) sets of data on electrical equipment used in the project. This data shall be in bound form and shall include the following items:

1. Shop drawings on equipment listed above.
2. Data sheets indicating electrical characteristics of all devices.

3. Data sheets on all lighting fixtures indicating voltage, lamp, and ballast used in each fixture.
4. Test results required by “Electrical Systems Operation Test.”

1.6 ELECTRICAL SYSTEMS OPERATIONAL TEST

A. Prior to final inspection, the following systems or equipment shall be tested and reported as herein specified.

1. Each ground rod installation shall be tested after all connection to ground rods are made. Ground rod installations shall be tested by “fall of potential” measuring method using ground resistance test meter and two auxiliary electrodes driven into the earth, interconnected through the meter with the ground rod installation being tested. Placement of auxiliary electrodes shall be in accordance with operating instructions of test meter, but in no case shall auxiliary current electrodes be placed within seventy feet of the grounding system being tested. Test data shall indicate placement of auxiliary electrodes with respect to system being tested, data readings were taken and lowest resistance recorded.
2. Three (3) typewritten copies of the test shall be submitted to the Engineer for approval.

1.7 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment.

B. Drawings are based on design loads of one manufacturer. If equipment actually furnished have loads, numbers of connections, or voltages other than those indicated on the drawings, then control equipment, feeders, and overcurrent devices shall be adjusted as required, at no additional cost to the owner. Such adjustments are subject to review by the engineer.

C. Catalog numbers indicated with equipment, devices and lighting fixtures are for convenience only. Errors or obsolescence shall not relieve the furnishing of items which meet the technical description given in specifications, noted, or required by function designated.

1.8 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Provide a dry, weathertight space for storing materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Handle and store material in accordance with standards to prevent damage. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable. Replace damaged materials.

1.9 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all equipment to provide a clean surface. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, and equipment enclosures with paint

manufactured specifically for that purpose. All other painting shall be done under the "Painting" section of these specifications.

1.10 SUBMITTALS

A. The Contractor shall submit for review by the Engineer a complete schedule and data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, such as catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer, to show conformance to specification and drawing requirements; model numbers alone will not be acceptable. Complete electrical characteristics shall be provided for all equipment.

B. Submittals shall be made for each of the following items:

1. Circuit Breakers
2. Lighting Fixtures
3. Devices
4. Panelboards
5. SCADA System
6. Generator
7. Automatic Transfer Switch
8. Photocell
9. Transformer

1.11 SERVICE

A. Electrical service shall be 3 phase, 4W, 480/277 wye. Service shall be aerial originating in weatherhead installed adjacent to a utility furnished secondary service drop. Coordinate transformer location with local utility.

B. Complete metering systems shall be provided. Install the system in accordance with the utility standards. Coordinate meter location with local utility and provide channel rack for mounting of meter.

16100 BASIC MATERIALS

2.1 RACEWAYS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratory, Inc. Publications 1, 6, 467, 651, 797, 1242.
2. American National Standards Institute C-80.1, C-80.3.

B. Raceway is required for all wiring, unless specifically indicated or specified otherwise. The minimum size of conduit shall be ¾", but shall not be less than size indicated on the drawings or required by the NEC.

C. Conduits shall be provided for the following conditions:

1. Conduits above grade shall be rigid aluminum conduit.
2. Conduits installed within concrete slabs shall be schedule 80 heavy wall PVC. Where transition is made from raceway in slab to any type of raceway out of slab, make transition with a rigid aluminum elbow.

3. Conduits installed in direct contact with earth shall be schedule 80, heavy wall PVC.

D. Rigid aluminum fittings shall be standard threaded couplings, threaded hubs, bushings, and elbows. All fittings shall be rigid aluminum; set screw or non-threaded fittings are not permitted. Non-metallic conduit fittings shall be of the same material as the conduit furnished and shall be the product of the same manufacturer.

E. All conduit support parts and hardware shall be stainless steel. Conduit clamps shall be two piece 304 stainless steel type. Conduit support channels shall be 1 1/2" x 1 1/2" - 14 gauge channel. Wire or chain is not acceptable for conduit hangers. Individual conduit hangers shall be stainless steel specifically designed for the purpose.

F. Leave all empty conduits with a 200 lb. test nylon cord pull line. Complete raceway runs prior to installation of wires or cables. Deformed conduits shall be replaced. Protect conduits against dirt, plaster, and foreign debris with conduit plugs.

G. Fasten conduit support devices to structure with toggle bolts on hollow masonry, expansion anchors on solid masonry or concrete, and machine bolts or clamps on steel. Nails are not acceptable.

H. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members. Support branch circuit conduits at intervals not exceeding 10 feet, and within 3 feet of each box or change of direction.

2.2 WIRES AND CABLES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 486, 493.
2. Insulated Cable Engineers Association Standards S-61-402, S-66-524.
3. National Electrical Manufacturer's Standards WC-5, WC-7.

B. Conductors shall be electrically continuous and free from short circuits or grounds. All open, shorted, or grounded conductors and any with damaged insulation shall be removed and replaced with new material free from defects.

C. Conductor size shall be minimum of No. 12 AWG, unless larger size is required by the drawings or the NEC. Insulation voltage level rating shall be 600 volts. All wire and cable shall bear the UL label. Communication conductors are not included in this specification; they shall comply with NEC requirements.

D. Conductors No. 10 and smaller shall be solid copper, 90 degrees C. type THWN/THHN. Conductors larger than No. 10 shall be stranded copper, 90 degrees C. type THWN/THHN, or XHHW. Fixture wire shall be No. 16 AWG silicone rubber insulated, stranded fixture wire type SFF-2 or No. 16 thermoplastic nylon jacketed stranded fixture wire type TFFN.

E. Color code all conductors. No. 6 and smaller shall have solid color compound or coating. No. 4 and larger shall have solid color compound or colored phase tape; tape shall be installed on conductors in every box, termination point, cabinet, or enclosure. Coding shall be as follows:

1. 480Y/277 volt three phase four wire wye system: Phase A – Brown, Phase B – Orange, Phase C – Yellow, neutral - grey
2. 240/120 volt single phase three wire system: Phase A-black, Phase B-red, Phase C-blue, neutral-white.
3. Grounding conductors shall be green or green traced.

F. Maintain phase rotation established per N.E.C. at service equipment throughout entire project.

G. Group and lace with nylon tie straps all conductors within enclosures. Make splices in conductors only within junction boxes, wiring troughs, or other NEC approved enclosures. Do not splice conductors in pull boxes, enclosed breakers or panelboards. Identify each conductor as to circuit connection in all boxes and enclosures.

H. Terminate stranded conductors No. 10 AWG and smaller with crimp-type lug or stud. Crimp terminal shall be the configuration type suitable for terminal point.

I. Torque each terminal connection to the manufacturer's recommended torque value. A calibrated torquing tool shall be used to insure proper torque application.

2.3 BOXES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50, 467, 514.

B. Outlet boxes for switches and receptacles in exposed wiring systems shall be cast FS type with matching device plate. For exterior installations, use in-use type extra duty hinged covers. Provide larger boxes as required for special purpose devices.

2.4 WIRING DEVICES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. National Electrical Manufacturer's Association Publications WD-1, WD-5.

B. Ground fault interrupter (GFI) receptacles shall be Hubbell GFTWRST83. Equivalent receptacles manufactured by Arrow Hart, Cooper, Legrand, or Leviton are acceptable.

C. All devices installed in areas exposed to the weather shall be provided with a weatherproof in-use extra-duty device plate/cover. Exposed conduit system outlets and switches shall have 4” square outlet boxes and raised steel covers.

2.5 SUPPORTING DEVICES

A. Provide and install supporting devices that comply with manufacturer's standard materials, design, and construction in accordance with published standards and as required for complete installation.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices. Install hangars, supports, clamps, and attachments to support piping properly from building structure only.

2.6 ELECTRICAL IDENTIFICATION

A. Provide engraved nameplates for all electrical equipment such as:

1. Enclosed Circuit Breakers
2. Panelboards
3. Chlorine Analyzer Panel
4. SCADA Cabinet
5. Automatic Transfer Switch
6. Transformer

B. Mark cover of all junction boxes with circuit number or system use of box.

C. Provide typed panel directories for all panels.

16400 DISTRIBUTION EQUIPMENT

3.1 GROUNDING SYSTEMS

A. Equipment grounding system shall be established with equipment ground conductors. The use of metallic raceways for equipment grounding is not acceptable. Unless indicated otherwise, provide equipment ground the same size as phase conductors.

B. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 467, 486, 493.
2. National Electrical Manufacturer's Association Standards WC-5, WC-7.

C. Grounding electrode conductors shall be bare or green insulated copper sized as indicated on the drawings. Connect service grounding system to ground rods, building steel, grounding ring. Equipment grounding conductors shall be green insulated type THW, THWN, or XHHW sized as indicated on the drawings. Where sizes are not indicated, grounding conductor shall be sized in accordance with NEC Article 250.

D. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame. Provide a conductor termination grounding lug bonded to the enclosure of each enclosed breaker.

E. Ground all non-current carrying parts of the electrical system, i.e., wireways, equipment enclosures and frames, junction and outlet boxes, machine frames,

and other conductive items in close proximity with electrical circuits. Grounding connections to structural steel shall be made with a chemical exothermic weld.

F. Grounding conductors for branch circuits are not shown on the drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables, including flexible conduit. Grounding conductors shall be the same AWG size as branch circuit conductors.

G. The equipment grounding conductor shall be terminated with a screw or bolt used for no other purpose. Equipment grounding conductors shall terminate on panelboard, grounding bus only. Do not terminate on neutral bus.

3.2 TRANSFORMERS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 506.
2. National Electrical Manufacturer's Association Publication ST-20.
3. American National Standards Institute Publications C-57, C-89.2.

B. Products of GE/ABB, Eaton or Square D which comply with these specifications are acceptable.

C. Transformers shall be self-cooled, rated for continuous operation at rated KVA, 24 hours per day, 365 days per year with normal life expectancy. Transformers shall be rated for average temperature rise by resistance of 150 degrees C. in 40 degrees C. maximum ambient, 30 degrees C. average ambient unless otherwise indicated. Transformer insulation system shall be UL rated as 220 degrees C. system. Sound rating shall not exceed NEMA and ANSI standards for the KVA rating. Internal vibration dampening shall be provided on all transformers.

D. Transformer enclosures shall be open, ventilated, drip-proof with removable front and rear cover panels, suitable for floor mounting, for transformers rated 30 KVA and up. For transformers up to 25 KVA, transformers shall be totally enclosed, non-ventilated with a resin encapsulated core and coil and drip-proof housing.

E. Primary ratings shall be 480 volts, 1 phase, 2 wire. Secondary service shall be 240/120 volts, 1 phase, 3 wire. Nominal impedance shall be 4.5 percent minimum.

F. Core assemblies and the center ground connection point of the coil secondaries shall be grounded to their enclosures by adequate, flexible ground straps. Provide grounding lug at the strap to enclosure bonding location for connection of three conductors.

G. Dry type transformers larger than 15 kva shall be floor mounted; 15 KVA and below shall be wall mounted. Installation shall meet the requirements of the N.E.C. Article 450. Transformers shall be mounted on neoprene, waffle type vibration pads 5/8” thick minimum. Primary and secondary connections shall be made with flexible conduit. The secondary windings of each transformer shall be grounded in accordance with the NEC requirements for separately derived systems.

H. Do not install equipment over transformers, unless indicated on the drawings. Install secondary over current protective device within 10 feet horizontally from the transformer. Where none is indicated on the plans, provide an enclosed circuit breaker within 10 feet rated 125 percent of the transformer full load ampacity but not greater than the secondary conductor ampacity. Provide full working clearances as required by the NEC.

3.3 PANELBOARDS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50,67,489.
2. National Electrical Manufacturer's Association Publications PB-1, AB-3.

B. Products of GE/ABB, Eaton or Square D which comply with these specifications are acceptable.

C. All panels and circuit breakers shall be UL listed and bear a UL label. Panels shall be of the dead front safety type. Provide panels complete with factory assembled circuit breakers connected to the bus bars. Number all panelboards in the following sequence: Circuits 1 and 2 - Phase A; circuits 3 and 4 - Phase B; circuits 5 and 6 – Phase C.

D. All bus bars shall be copper. Main lugs and main breaker shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus and, when required, a full size insulated neutral bus. The neutral and ground busses shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection. The ground bus shall be bolted to the panel enclosure, but not attached to the panel interior. Where designated, each "space' shall include all bussing, device supports and connections for future breaker installation.

E. Circuit breakers shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Multi-pole breakers shall be common trip and common reset type; tie handle connections are not acceptable. Interrupting ratings on 240 volt systems shall be 10,000 RMS symmetrical amps minimum, and on 480 volt systems shall be 14,000 RMS symmetrical amps minimum, provide higher ratings when indicated on the drawings.

F. Provide in each panelboard a typewritten circuit directory mounted under clear plastic in metal holder in the door of the panel reflecting all field changes and additions. Install push-in knock-out closure plugs in any unused knock-out openings.

3.4 GUARANTEE AND TEST

A. Upon completion of the project all systems shall be tested for proper operation as directed by the Engineer or his representative. Equipment covers, i.e., panelboard, motor controls, etc., shall be removed where required for inspection of internal wiring. The Contractor shall furnish the personnel, tools and necessary equipment to inspect and test the system.

B. Where ground readings are required, the Contractor shall provide a typewritten copy of certification of ground reading. Data shall indicate date readings were taken and lowest resistance recorded.

C. All systems and component parts shall be guaranteed for one year from date of final acceptance of the completed project. Defects found during this guarantee period shall be promptly corrected at no additional cost to the Owner.

END OF SECTION

SECTION 16600

ENGINE DRIVEN EMERGENCY POWER SUPPLY SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work required under this section of the specifications consists of the installation of the complete Engine Driven Emergency Power Supply System. All materials and devices which are an integral part of this system shall be provided under this section of the specifications.

B. Definition: The Emergency Power Supply System (EPSS) shall consist of one fixed mounted engine driven generator set which contains an engine directly coupled to an electric generator, together with the necessary switchgear, controls, accessories, transfer devices, and fuel supply to provide electric power for the duration of any failure of the normal power supply.

1. Automatic Transfer Switch (ATS): An automatic transfer switch is self-acting equipment for transferring one or more load conductor connections from one power source to another.

1.3 SCOPE OF WORK

A. Provide a diesel generator with a 700 gallon sub-base tank and 150mph rated aluminum sound attenuated enclosure level II. The generator shall have a PMG type alternator. Provide a 1000A four-pole automatic transfer switch. The basis of design is a Cummins Power Generation 500kW/625kVA, 480Y/277V, 3 phase, 4 wire DFEK series generator with a Cummins Power Generation OTPC series 1000A/4 Pole automatic transfer switch. Equivalent equipment by Caterpillar, Kohler or MTU will be considered acceptable. Provide computer generated sizing report as part of the submittals, utilizing the parameters outlined in this specification, demonstrating the submitted generator is capable of operating and supporting the electrical system show on the drawings.

1.4 QUALITY ASSURANCE

A. The following specifications and standards are incorporated into and become a part of this specification by reference.

1. National Fire Protection Association (NFPA):
   a. NFPA-37 Combustion Engines
   b. NFPA-70 National Electrical Code
   c. NFPA-110 Emergency and Stand-By Power Systems

2. Diesel Engine Manufacturers Association (DEMA) Standard: Standard Practices for low and medium speed stationary diesel and gas engines.
3. Electrical Generating Systems Association (EGSA) Standards:
   a. EGSA CEP2 Codes for Emergency Power by States and Major Cities
   b. EGSA GTD3 Glossary of Standard Industry Terminology and Definitions
   c. EGSA ECB1 Performance Standard for Engine Cranking Batteries
   d. EGSA TSS1 Performance Standard for Transfer Switches for use with Engine Generator Sets
   e. EGSA BCES1 Performance Standard for Battery Chargers
   f. EGSA ICAE1 Performance Standard for Electric Generator Set Instrument Control and Auxiliary Equipment
4. Institute of Electrical and Electronics Engineers (IEEE) Standards:
   a. IEEE 446 IEEE Recommended Practices for Emergency and Standby Power Systems
   b. IEEE 472 Voltage Surge Withstand Capabilities
5. National Electric Manufacturers Association (NEMA) Standards:
   a. MG-1 Motors and Generators
   b. ICS1-109 Test and Test Procedures for Automatic Transfer Switches
   c. ICS2-447 A.C. Automatic Transfer Switch
6. Underwriters Laboratories Inc. (UL) Publications:
   a. UL 1008 Automatic and Non-Automatic Transfer Switches
7. American National Standards Institute (ANSI):
   a. C37.90a Voltage Surge Withstand Capability

B. Acceptable Manufacturers: Products of the following manufacturers, which comply with these specifications, are acceptable:

1. Engine Driven Generator Sets:
   a. Cummins
   b. Caterpillar
   c. MTU
   d. Kohler
2. Transfer Switches:
   a. Cummins OTPC
   b. Caterpillar ATC-300
   c. Kohler KCP Series
3. Sub-Base Fuel Tanks
   a. JRS
   b. Globel
   c. Generator manufacturer

C. Coordination:

1. Review shop drawings submitted under this and other sections, as well as other divisions, to insure coordination between work required among different trades. Coordinate the installation sequence with other contractors to avoid conflicts and to provide the fastest overall installation schedule. Coordinate installation with architectural and structural features, equipment installed under other sections of the specifications,

and electrical equipment to insure access and to insure clearance minimums are provided.

1.5 SUBMITTALS

A. Manufacturer's Product Data:

1. Submit material specifications and installations data for products specified under Part 2 - Products to include:
   a. Engine driven generator set
   b. Transfer switches

B. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract drawings. Submittals containing less than the information listed below will be rejected.

1. Shop drawings for the engine driven generator sets shall contain not less than the information listed as follows:
   a. Certification that the engine driven generator set(s) furnished will serve electrical loads indicated including motor starting loads with type(s) of starting indicated.
   b. Continuous and stand-by rating of engine driven generator set(s) including voltage and phase.
   c. Frequency and voltage regulation with maximum instantaneous voltage dip and time of recovery to stable operation.
   d. Output voltage adjustment range in percentage of rated plant voltage.
   e. Alternator type and method of connection to prime mover.
   f. Components contained in alternator instrument panel.
   g. Rating of engine at operating speed, engine cycle and number of cylinders.
   h. Type of engine lubrication system and verification of components specified.
   i. Type of engine governor.
   j. Components contained in engine instrument panel.
   k. Fuel consumption at rated load.
   l. Starting batteries including ampere hour rating.
   m. Verification that all accessories specified are to be provided. This includes cold weather starting aid with rating and voltage indicated, exhaust system with muffler type indicated, and outdoor housing with verification of space available within housing for batteries.
   n. Line and machinery constants of the generator furnished.
2. Shop drawings for the transfer switch shall contain not less than the information listed as follows:
   a. List of accessories contained in the control panel.
   b. Withstand rating in RMS symmetrical amperes.

C. Quality and Service:

1. All materials and parts of the EPSS shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. Units and components offered under these specifications shall be covered by the manufacturer's

comprehensive warranty for a minimum of five years from date of Owner acceptance of the project on a new machine, a copy of which shall be included in the shop drawings submittal. Warranty shall be complete parts and labor warranty for time specified.

2. Submittals will be accepted only on engine driven generator sets and transfer switches which can be properly maintained and serviced without requiring the Owner to stock spare parts or wait longer than twenty-four hours for service. Submittals shall include the nearest location of permanent parts outlet from which parts may be obtained and written assurance that trained service personnel will be available on twenty-four hour's notice. Units with service centers more than 100 miles from project site will not be accepted.

D. Record Drawings

1. Include in each set three sets of operating, maintenance, and parts manuals covering all components for the EPSS. Each supplier shall provide instructions to the Owner in operation and maintenance of his equipment, both in written form and with on-site personnel for a minimum of four hours.

PART 2 - PRODUCTS

2.1 ENGINE DRIVEN EMERGENCY POWER SUPPLY (EPS)

A. Engine

1. The engine driven emergency power supply (EPS) shall be an internal combustion diesel driven prime mover. The generator set shall have the following characteristics:
   a. 500 KW Capacity minimum *
   b. 625 KVA Capacity minimum *
   c. 480/277 Volts
   d. 60 Hertz
   e. 0.8 Power Factor
   f. 3 Phase
   g. 4 Wire

   *The generator shall be capable of starting and running the following loads within the operating parameters specified. The maximum one-step load at 0.8PF is 103.6kW (step 2). The load to be served by this generator set consists of 30 KVA non-inductive load, five ton HVAC load plus one 435 total motor HP. The unit provided shall be sized for the loads actually provided and shall be started as shown in the following table. Submit sizing calculations with shop drawings.

Step No.	Load Name	HP/KVA/Tons	Starting Method
1	Initial Load	30KVA	
	HVAC	5 tons	
	Jockey Pump	60 Hp	VFD
2	HSP No. 1	125 Hp	VFD
3	HSP No. 2	125 Hp	VFD
4	HSP No. 3	125 Hp	VFD

Size generator for 20% maximum voltage dip on starting.

2. The rated net horsepower of the engine at the generator synchronous speed, with all accessories, shall not be less than that required to product the KW specified in paragraph 1 above. The horsepower rating shall take into account generator efficiency and all accessory losses such as fans, battery charger, etc. The generator set shall be capable of producing the specified KW (without overload) for the duration of the power outage, under the following ambient conditions:
   a. Altitude: 50 feet above mean sea level.
   b. Air temperature at engine intake: 104 degrees F.
   c. Humidity Range: 5 - 95 %.
3. Included with the shop drawing submittal shall be the manufacturer's estimate of supply fuel and oil consumption for the engine. The engine shall have an oil filter with replaceable elements and a lube oil cooler.
4. The engine shall be equipped with a suitable governor (engine speed control) to maintain frequency within limit specified below by controlling engine and generator speed. Manufacturer shall indicate in submittal data whether mechanical, hydraulic, electrical, or hybrid governors are provided.
   a. Type: Isochronous
   b. Stability: ±1/4% maximum steady state frequency variation at any constant load from no load to full load.
   c. Regulation: 5% maximum frequency deviation between no-load steady state and full load steady state.
5. The engine shall be electric start, provided with a solenoid energized motor with either positive engagement or clutch drive to the engine. The engine starting batteries shall be sealed lead-acid recombination type. Batteries shall be rack mounted adjacent to the engine set inside the weatherproof plant housing to minimize the distance from the batteries to the starter. Mount on channel rack. Provide battery straps and heater.
6. A float type battery charger, compatible with the batteries selected, shall be furnished at the engine which shall maintain the starting batteries at full charge. The charging system shall permit charging from either the normal or the emergency power source. It shall have an equalize rate and a float rate charging system. An ammeter and voltmeter shall indicate the charge rate and the circuit shall be protected by either fuses or circuit breakers. The charger or charging circuit shall be so designed that it will not be damaged during the engine cranking cycle, for example, by a current limiting charger or a crank disconnect relay. It shall also be capable of recharging a discharged battery in 12 hours while carrying normal loads. The charger shall be equipped with alarm relays as required for annunciation equipment.
   a. Provide battery straps and heater per NFPA 110.
7. The engine shall be liquid cooled. The type of liquid cooling system shall be unit mounted radiator - consideration shall be given for air temperature rise across the engine in addition to ambient. Minimum capacity shall be rated for 104°F. minimum engine ambient temperature plus air temperature rise across the engine.

a. Provide an electric heater, thermostatically controlled, in the engine coolant system as a cold weather starting aid. Heater shall be for operation on 120 volt single phase A.C. 1500 watt units.
b. Provide shutoff valves or quick connect couplings to allow isolation of heater. Heater shall maintain 70°F. to 90°F.
c. Provide 120 volt condensation heater in generator windings.

8. Air Supply/Exhaust System
   a. Cleaner: An air cleaner and silencer shall be furnished, located and mounted as recommended by the engine manufacturer.
   b. Exhaust: An exhaust system of suitable size, configuration, and material in accordance with engine manufacturer's recommendations shall connect the exhaust outlet of the engine to a silencer. The type of silencer shall meet the requirements of engine manufacturers and shall be critical. The silencer shall be located on top of the outdoor enclosure. Exhaust pipe to turn up through rain cap.
   c. The exhaust system including silencer shall be of such size that back pressure on the system will not exceed the back pressure permitted by the engine manufacturer's recommendation. A flexible connection shall be mounted at the engine exhaust outlet and the discharge end shall be protected against entry of precipitation.. Piping and silencer within reach of personnel or with 8'-0" of finished floor or grade shall be protected by screening and shall be insulated with two inches of calcium silicate insulation with aluminum jacket. All exhaust piping shall be gas tight.
9. The engine instrument panel shall be mounted at the engine and shall contain the following:
   a. Oil pressure gauge to indicate lubricating oil pressure.
   b. Temperature gauge to indicate cooling medium temperature.
   c. Hour meter to indicate total actual running time.
   d. Battery charging meter to indicate satisfactory performance of battery charging means.
   e. Other instruments as recommended by the manufacturer for proper maintenance.

B. Generator

1. The generator shall be an engine-driven single or two bearings type, synchronous, brushless, PMG type conforming to applicable standards. It shall be connected to the engine flywheel by means of a flexible type coupling for single bearing generators and elastic coupling for two bearing generators.
2. The generator shall be rated for 40°C. ambient. Class of insulation shall be NEMA Class F. The voltage regulation shall be plus or minus 2% from no load to full load with plus or minus 5% speed change and a 15°C. rise in ambient. The generator voltage dip from no load to full load shall not exceed 22%.
3. The generator shall be capable of sustaining at least 250% of rated current for at least ten (10) seconds under a three phase symmetrical short by inherent design or by the addition of an optional current boost system. A re-settable line sensing circuit breaker shall be furnished which protects the generator from damage due to its own high current

capability. This breaker shall not trip within the ten seconds specified above to allow selective tripping of downstream fuses or circuit breakers under a fault condition.

C. Voltage Regulation

1. The generator shall be equipped with a volts-per-hertz type voltage regulator to maintain voltage within limits specified below:
   a. Stability: 2% maximum voltage variation at any constant load from no load to full load.
   b. Regulation: 4% maximum voltage deviation between no load steady state and full load steady state.
   c. Transient: 20% voltage dip or overshoot on one-step application or removal of 0.8 power factor full load.

D. Generator full main line circuit breaker.

1. Main line circuit breaker shall be supplied to protect the generator and controls from overloads and/or short circuits in the load. They shall be rated as indicated on the drawings. Interrupting current shall be 25,000 amps RMS. Breakers shall comply with UL 489 and NEMA AB-3.

E. Start and Stop Controls

1. Automatic starting and stopping controls shall be furnished to start the engine automatically when the normal electrical power fails or falls below specific limits and to stop the engine automatically after the normal power supply resumes. The signal for starting or stopping the engine shall be sensed through an auxiliary contact in the automatic transfer switch. The controls shall be capable of operating at 50% of normal DC system supplied voltage.
2. The cranking cycle shall be initiated by manual start, loss of normal power at any transfer switch clock exerciser, or the manually operated test switch at each ATS.
3. Crank control and the time delay relays shall provide a minimum of 4 crank attempts of at least 7 seconds each, separated by appropriate rest periods. A sensing device shall automatically disconnect the starting circuit when the engine has started. If the engine has not started at the completion of the starting program, the overcrank signal shall indicate. The engine starting controls shall be locked out and no further starting attempts shall take place until the overcranking device has been manually reset.
4. A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine; a "manual" position that permits the engine to be started manually by the pushbutton on the control cabinet and run unloaded; an "automatic" position that readies the system for automatic start or stop on demand or the automatic load transfer switches or of the programmed exerciser.

F. Instrumentation

1. Local engine control and safety panel shall be provided, containing the following:
   a. Automatic remote start capability.

b. "Manual-Off-Auto" switch.

c. Controls to shut down and lock out the prime mover under the following conditions: failure to start after specified cranking time, overspeed, low lubricating oil pressure, high engine temperature, operation of remote manual stop station.

d. Battery powered individual alarm indication to annunciate visually at the control and safety panel the occurrence of any condition itemized below; contacts or circuits for a common audible alarm signaling locally the occurrence of any itemized conditions listed below. Test switch shall be provided to test the operation of all lamps.

Indicator Function (At Battery Voltage)		Level 1 C.V.	S
a.	Overcrank	X	X
b.	Low Water Temp. < 70°F (21°C)	X	X
c.	High Engine Temp. Pre-alarm	X	
d.	High Engine Temp.	X	X
e.	Low Lube Oil Pressure Pre-alarm	X	
f.	Low Lube Oil Pressure	X	X
g.	Overspeed	X	X
h.	Low Fuel Main Tank	X	
i.	EPS Supplying Load	X	
j.	Control Switch Not In Auto Pos.	X	
k.	Battery Charger Malfunctioning	X	
l.	Low Voltage in Battery	X	
m.	Lamp Test	X	
n.	Contacts for Local & Remote Common Alarm	X	
o.	Audible Alarm Silencing Switch	X	
p.	Remote Emergency Stop	X	X
q.	Fuel in Containment	X	

Key:
C.V. -- Control Panel-Mounted Visual Indication
S -- Shutdown of EPS
X -- Required

e. Controls to shutdown the prime mover upon removal of initiating signal or manual emergency shutdown.

f. A.C. voltmeter with selector switch off position and positions for phase to phase and phase to neutral.

g. A.C. ammeter with selector switch with positions for each phase.

h. Frequency meter -- digital electronic type.

i. Voltage adjusting rheostat to allow plus or minus 5% voltage adjustment.

j. Manual reset circuit breaker.
k. Manual stop/start control.
l. Elapsed time meter.
m. Panel lights.
n. Indicator lights for signals from engine instrument panel.
o. Light to indicate switch has been left in the "off" position.

2. All instruments, controls, and indicating lights shall be properly identified. All wires shall be individually identified and must agree with the wiring diagram provided. All wiring shall be harnessed or flexibly enclosed. Terminals on all terminal blocks shall be individually identified. All instrumentation must be isolated from engine generator set vibration.
3. Provide the following auxiliary contacts for connection to dialer:
   a. Generator ‘Run’ through transfer switch
   b. Generator ‘Pre-Alarm’, including low fuel
   c. Generator ‘Fail’
4. Connect to fuel monitoring system as required for points shown.

G. Enclosures and Connections:

1. All electrical enclosures, i.e, terminal cabinets, wireways, circuit breaker enclosures, etc., shall be of adequate size to provide minimum bending radii as required by the NEC for the size conductor actually terminated within or passing through the enclosure.
2. All factory provided enclosures shall have gasketing and finish appropriate for the environment in which the unit is to be mounted. All wiring, wiring harness, etc., shall be protected from the elements, such as direct sunlight, moisture, etc. or shall be UL listed for direct exposure to the applicable elements. Include written documentation of the above with the shop drawing submittal.

H. Provide flexible fuel connections at supply at return piping. Flexible hoses shall be steel reinforced type. Provide solenoid valve in series with gate valve in supply line. Solenoid valve shall be powered from generator batteries and shall be open only when generator is running.

I. Provide 700 gallon double wall UL listed sub base fuel tank. Fuel tank shall include emergency vent, low fuel alarm, fuel gauge, lockable fill cap, and vent. Provide gate valve and steel flexible hose from tank to engine and flexible hose from engine return to tank. Provide auxiliary contacts for low fuel connected to annunciator. Provide high level fuel alarm system so that if fuel is above 90% full an audible and visual alarm panel located outside generator enclosure alarms. Provide silence and reset button. Provide engraved nameplate reading “DISCONTINUE FILLING IF ALARM SOUNDS.” Provide “fuel in rupture basin” alarm. The tank shall be capable of withstanding 5 PSIG internal pressure without distortion. The tank top shall be capped to allow water to run off.

J. Connect receptacles for battery charger and circuit for generator condensation heater and jacket water heater to circuits shown.

2.2 TRANSFER SWITCH

A. Transfer switch shall be rated at not less than as indicated on the drawings at rated voltage. Transfer switch shall be rated and marked for total system load.

B. Transfer switch shall be the automatic contactor type, open transition. In phase transition will not be accepted. Provide Cummins OTPC type or approved equal.

C. Transfer switch shall be wall mounted in a NEMA 1 painted steel enclosure. Enclosure shall have hinged door with three point latching and factory installed key locking enclosure door.

D. All switch and contacts, coils, springs and control elements shall be removable from the front of the transfer switch without removal of the switch panel from the enclosure and without disconnecting power conductors or drive linkages. Control and sensing relays shall be continuous duty industrial type with minimum contact rating of ten amps.

E. Transfer switch shall be rated to withstand in RMS symmetrical amperes not less than the available symmetrical RMS amperes when protected by the circuit protective device.

F. The control panel for each automatic transfer switch shall contain the following accessories:

1. Adjustable 0.5 to 6 second time delay on starting of EPS to override momentary power dips and interruptions of the normal services. Time delay shall be factory set at 1 second.
2. Time delay on transfer to emergency adjustable from 0 to 60 seconds, factory set at 0 seconds.
3. Test switch on enclosure door to simulate failure of the normal power source. ATS shall transfer load to the EPS.
4. Push button to bypass time delay on re-transfer to normal.
5. Close differential voltage sensing shall be provided on all phases of the normal power supply. The pickup voltage shall be adjustable from 85% to 100% of nominal and the dropout voltage shall be adjustable from 75% to 98% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and re-transfer to normal shall occur when normal source restores to 95% of nominals.
6. Independent single phase voltage and frequency sensing of the emergency source. The pickup voltage shall be adjustable from 85% to 100% of nominal. Pickup frequency shall be adjustable from 90% to 100% of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90% or more of nominal and frequency is 95% or more of nominal.
7. A time delay on re-transfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0 to 25 minutes and factory set at 15 minutes.
8. An unloaded running time delay for emergency generator cool-down, factory set at 5 minutes.

9. Transfer switch shall have intermediate position. Provide adjustable time delays 0-3 min. to set time delay on transfer in both directions.
10. Pilot light for indicating switch in normal position (include fuses and auxiliary contact).
11. Pilot light for indicating switch in emergency position (include fuses and auxiliary contact).
12. An exerciser for exercising standby power plant on a weekly basis shall be provided in the transfer switch. Exerciser shall be set to exercise standby plant for one half hour per week under load. Time of plant exercise shall be set in field. Exerciser timer shall have reserve power back-up, either by battery or spring-wound clock, to ride through power outages to the switch.
13. Auxiliary contact (gold plated) which closes when normal source fails. (Closed after override delay of 0.5 to 6 seconds).
14. Auxiliary contact (gold plated) which opens when normal source fails. (Opens after override delay of 0.5 to 6 seconds).
15. Auxiliary contacts on same shaft as main contacts (closed on normal.)
16. Auxiliary contacts on same shaft as main contacts (closed on emergency). (2)
17. Provide pre-transfer and post-transfer signals for load step control.

PART 3 - EXECUTION

3.1 EPS INSTALLATION

A. The plant shall be on a welded steel base with a minimum of four spring vibration isolators attached. Isolators shall consist of steel springs designed specifically for this application, mounted on rubber plates to block high frequency vibrations.

B. Provide concrete pad which extends 12” on all sides of generator housing.

C. The EPS shall be provided in outdoor aluminum, sound attenuated (Level II), weatherproof housing rated for 150 mph with removable panels for access to equipment. The starting batteries and charger shall be rack mounted within the housing.

D. Extend 120 and 240 volt emergency power circuits for charger and cold weather starting aids from the building wiring system. Connect to generator with receptacles as shown on the drawings.

3.2 TRANSFER SWITCH INSTALLATION

A. Locate transfer switch(es) to provide working clearance and full accessibility as required by the National Electrical Code.

B. Lace and group conductors installed in transfer switch with nylon tie straps. Only one conductor shall be installed under terminals. Form and train conductors in enclosure neatly parallel and at right angles to sides of box. Uninsulated conductor shall not extend beyond one-eights inch from terminal lug. Conductors shall be installed such that no stresses are transferred to terminal lugs.

C. Mounting and Support

1. Mounting

a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Transfer switches 400 amps and larger shall be secured by a minimum of eight (8) devices. A 1.5 inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.

b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified.

c. Attach enclosure directly to masonry, concrete, or wood surfaces.

d. Mount enclosure on metal channel (strut), which is connected to structure with fastening device specified, for installations on steel structure, sheet metal equipment enclosure, or sheet rock walls.

e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.

f. Do not splice conductors in enclosure. Where required, install junction box or wireway adjacent to transfer switch and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the WIRES AND CABLES section of the specifications and do not exceed.

g. Conductors not terminating in transfer switch shall not extend through or enter transfer switch enclosure.

h. Install push-in knock-out closure plugs in any unused knock-out openings.

i. Cleaning and Adjustment

1) After completion, clean the interior and exterior of dirt, paint and construction debris.

2) Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

3.3 TESTING

A. Submit verification letter to Engineer indicating successful completion of sequence of operations testing and certification that all functions are operational. Letter to request load testing approval and schedule of proposed test. Prior to load test, written approval must be provided by Engineer. Representatives of the generator and transfer switch shall be present. The local authority having jurisdiction shall be given advance notification of the time of the final test in order that he may witness the tests.

B. A failure of any test or any component during a test will require a complete retest program at no additional cost to the Owner.

C. Provide all fuel, lubricants, and other consumables for testing. Provide 300 gallons of fuel for testing.

D. An on-site acceptance test shall be conducted as a final approval test for all Emergency Power Supply Systems.

1. The test shall be conducted after completion of the installation with all EPSS accessory and support equipment in place and operating.
2. Test Results. The EPSS shall perform within the limits specified in the standard NFPA-110 for a Level I installation.
3. The on-site installation test shall be conducted as required by NFPA 110.

3.4 O & M MANUALS

A. At least three sets of an instruction manual(s) for all major components of the EPS shall be supplied by the Manufacturer(s) of the EPS and shall contain:

1. A detailed explanation of the operation of the system.
2. Instruction for routine maintenance.
3. Detailed instructions for repair of the EPS and other major components of the EPS.
4. Pictorial parts list and part numbers.
5. Pictorial and schematic electrical drawings of wiring systems, including operation and safety devices, control panels, instrumentation and annunciators.
6. Startup and testing reports.

END OF SECTION