INDEX TO

SECTION 31 00 00 – EARTHWORK

SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Grading.

B. Excavation.

C. Backfilling.

D. Compaction.

E. Remove and Replace Topsoil.

F. Dressing of Shoulders and Banks.

G. Water Control.

H. Testing.

1.02 RELATED SECTIONS

A. Section 01 45 00 – Quality Control.

B. Section 01 45 23 – Testing and Inspecting Services.

C. Section 31 10 00 – Site Clearing.

1.03 REFERENCES (LATEST REVISION)

A. ASTM D 448 – Sizes of Aggregate for Road and Bridge Construction.

B. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. ASTM D 2487 – Classification of Soils for Engineering Purposes (Unified Soil Classification System).

D. ASTM D 6938 – In–Place Density and Water Content of Soil and Soil–Aggregate by Nuclear Methods (Shallow Depth).

E. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and Inspection of Soil and Rock as Used in Engineering Design and Construction.

F. ASTM E 329 – Agencies Engaged in Construction Inspection and Testing.

1.04 SUBMITTALS

A. Section 01 00 00 – General Requirements: Procedures for submittals.

B. Materials Source: Submit gradation analysis, proctor results, and soil classification for all borrow material.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with Federal, State of Georgia, and City of Savannah standards.

1.06 TESTING

A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).

B. In place density tests in accordance with ASTM D 6938.

C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.

D. The testing laboratory and Project Engineer or Project Representative shall be given a minimum of 48 hours notice prior to taking any of the tests.

E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

F. Acceptable test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Controlled fill shall consist of sand or sand–clay soils capable of being readily shaped and compacted to the required densities, and shall be reasonably free of roots, trash, rocks larger than two inches, and other deleterious material.

B. All soils used for structural fills shall have a PI (plastic index) of less than ten, and a LL (liquid limit) of less than 30. Fill soils shall be dried or wetted to appropriate moisture contents prior to compaction. Additionally, fill soils used for the top two feet of fill beneath roads and parking lots shall have no more than twelve percent passing the # 200 sieve.

C. Controlled fill material should be cohesion-less soil containing no more than twelve percent fines (material passing the No. 200 sieve) by weight, having a maximum dry density of at least 100 pcf as determined by a laboratory modified Proctor compaction test (ASTM D 1557). The soil should be relatively free of organics, deleterious matter, and elongated or flat particles susceptible to

degradation. All fill should be placed in uniform lifts of ten inches or less (loose measure) and compacted to at least 95% of the modified Proctor maximum dry density. (ASTM D-1557).

Fill placement should be observed by a qualified Engineering Technician working under the direction of the Geotechnical Engineer. In addition to this visual evaluation, the Technician should perform a sufficient number of in-place field density tests to confirm the contractor's equipment and methods are capable of achieving the required degree of compaction.

D. Contractor shall furnish all fill material.

E. Contractor shall be responsible for and bear all expenses in developing borrow sources including securing necessary permits, drying the material, haul roads, clearing, grubbing, excavating the pits, placing, compaction, and restoration of pits and haul roads to a condition satisfactory to property owners, and in compliance with applicable federal, state, and local laws and regulations.

2.02 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest.

B. Provide materials of each type from same source throughout the Work.

PART 3 – EXECUTION

3.01 TOPSOIL

A. Contractor shall strip topsoil and stockpile on site at a location determined by the Owner at the Contractor's expense.

B. Topsoil shall be placed to a depth of four inches over all disturbed or proposed landscaped areas.

C. Topsoil shall be provided at Contractor's expense if it is not available from site.

D. Any remaining topsoil will be hauled off site at the Contractors expense.

E. Do not excavate wet topsoil.

3.02 EXCAVATION

A. Suitable excavation material shall be transported to and placed in fill areas within limits of the work.

B. Unsuitable material encountered in areas to be paved and under building pads, shall be excavated two feet below final grade and replaced with suitable material from site or borrow excavations. Contractor shall notify Engineer if more than two feet of excavation is needed to replace unsuitable material.

C. Unsuitable and surplus excavation material not required for fill shall be disposed of off site.

D. Proper drainage, including sediment and erosion control, shall be maintained at all times. Methods shall be in accordance with the National Pollutant Discharge Elimination System standards and other local, state, and federal regulations.

E. Unsuitable materials as stated herein are defined as highly plastic clay soils, of the CH and MH designation, border line soils of the SC–CH description, and organic soils of the OL and OH description based on the Unified Soils Classification System. Further, any soils for the top two feet of pavement subbase shall have no more than 15 percent passing the # 200 sieve.

3.03 GROUND SURFACE PREPARATION FOR FILL

A. All vegetation, roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material within the areas to be filled shall be stripped and removed prior to beginning the fill operation.

B. Sloped ground surfaces steeper than one vertical to four horizontal, on which fill is to be placed shall be plowed, stepped, or benched, or broken up as directed, in such a manner where fill material will bond with the existing surface.

C. Surfaces on which fill is to be placed and compacted shall be wetted or dried as may be required to obtain the specified compaction.

3.04 FILL

A. Shall be placed in successive horizontal layers eight inches to ten inches in loose depth for the full width of the cross–section and compacted as required.

3.05 FINISHED GRADING

A. All areas covered by the project including excavated and filled sections and adjacent transition areas shall be smooth graded and free from irregular surface changes.

B. Degree of finish shall be that ordinarily obtainable from either blade–grader or scraper operations, supplemented with hand raking and finishing, except as otherwise specified.

C. Unpaved areas to within 0.1 feet of elevations shown on the drawings provided such deviation does not create low spots that do not drain.

D. Paved Areas – Subgrade to within 0.05 feet of the drawing elevations less the compacted thickness of the base and paving.

E. Building Pads – Subgrade to within 0.05 feet of the drawing elevations [less the thickness of the concrete slab].

F. Ditches and lagoon banks shall be finished graded, dressed, and seeded within fourteen calendar days of work to reduce erosion and permit adequate drainage.

3.06 DISPOSAL OF WASTE MATERIAL

A. All vegetation, roots, brush, sod, broken pavements, curb and gutter, rubbish, and other unsuitable or surplus material stripped or removed from limits of construction shall be disposed of by the Contractor.

3.07 PROTECTION

A. Graded areas shall be protected from traffic, erosion, settlement, or any washing away occurring from any cause prior to acceptance.

B. Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated by the Owner at all times during earthwork operations.

C. Repair or re–establishment of graded areas prior to final acceptance shall be at the Contractors expense.

D. Site drainage shall be provided and maintained by Contractor during construction until final acceptance of the project. Drainage may be by supplemental ditching, or pumping if necessary, prior to completion of permanent site drainage.

3.08 DRAINAGE

A. Contractor shall be responsible for providing surface drainage away from all construction areas. This shall include maintenance of any existing ditches or those constructed in the immediate vicinity of the work. Contractor shall provide proper and effective measures to prevent siltation of wetlands, streams, and ditches on both the Owner's property, and those properties downstream.

3.09 FIELD QUALITY CONTROL

A. Compaction testing shall be performed in accordance with ASTM D 6938. Where tests indicate the backfill does not meet specified requirements, the backfill shall be reworked or removed and replaced, and then retested at the Contractor's expense.

B. Unpaved areas – at least 90 percent of maximum laboratory density within two percent optimum moisture content unless otherwise approved by the Engineer.

C. Paved Areas and Under Structures – top six inches layer of subbase to at least 98 percent of maximum laboratory density within two percent optimum moisture content. Layers below top 6 inches shall be compacted to 95 percent of maximum laboratory density within two percent optimum moisture content.

D. Rolling and compaction equipment and methods shall be subject to acceptance by the Engineer. Acceptance in no way relieves Contractor of the responsibility to perform in correct and timely means.

E. Number of Tests – Under paved areas, no less than one density test per horizontal layer per 5,000 square feet of subbase shall be made. In unpaved areas, no less than one density test per horizontal layer per 10,000 square feet of fill area shall be made. [On building pads, no less than one density test per horizontal layer per 1,500 square feet of fill area shall be made.]

3.10 PROOF ROLLING

A. Shall be required on the subbase of all concrete and paved areas and on the base of all paved areas where designated by the Engineer. Proof rolling shall take place after all underground utilities are installed and backfilled. The operation shall consist of rolling the subbase or base with a fully loaded ten–wheeled dump truck. A full load shall consist of ten to twelve cubic yards of soil or rock. The dump truck shall be capable of traveling at a speed of two to five miles per hour and be in sound mechanical shape with no exhaust leaks or smoking from burning oil. The Engineer shall determine number of passes and areas rolled.

END OF SECTION

INDEX TO

SECTION 31 10 00 – SITE CLEARING

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of surface debris.

B. Removal of paving, curbs, and concrete, etc.

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

D. Topsoil excavation.

1.02 RELATED SECTIONS

A. Section 01 56 39 – Temporary Tree and Plant Protection.

B. Section 02 41 13 – Selective Site Demolition.

C. Section 31 00 00 - Earthwork.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for environmental requirements and the City of Savannah ordinances.

B. Coordinate clearing Work with utility companies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide tree protection materials as detailed on the construction drawings. Provide protection of existing structures during site clearing operations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain is clearly identified and protected.

B. Contractor shall coordinate with Owner to identify a salvage area for placing removed materials.

3.02 PROTECTION

A. Protect all trees on site that are not identified in the Construction Drawings for removal. Refer to Section 01 56 39 Temporary Tree and Plant Protection for additional requirements regarding protection of trees.

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

C. Protect all existing utilities unless noted otherwise.

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

3.03 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 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 accepted tree wound 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 paragraph 3.2). Clearing shall also include removal and disposal of structures obtruding, encroaching upon, or otherwise obstructing the work.

3.04 GRUBBING

A. Grubbing shall consist of the removal and disposal of stumps, roots larger than one inch in diameter, and matted roots from the 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 the original surface level of the ground in embankment areas and not less than two feet below the finished earth surface in excavated areas. Depressions made by grubbing shall be filled with well-compacted controlled fill, as defined in Section 31 23 13 Subgrade Preparation.

3.05 REMOVAL

A. Additional Removals: Where indicated or directed, trees and stumps shall be removed from areas outside those areas designated for clearing and grubbing. The work shall include the felling of such trees and the removal of their stumps and roots. Trees shall be disposed of as hereinafter specified. Remove debris,

rock, and other extracted plant life from site. Partially remove paving, curbs, and concrete, as indicated. Neatly saw cut edges at right angle to surface.

B. Following all clearing, grubbing and removal, any resulting voids created shall be backfilled with well-compacted controlled fill, as defined in Section 31 23 13 Subgrade Preparation. The existing fill soils may remain in place if they are deemed sufficiently stable by the Geotechnical Engineer at the time of Construction.

3.06 DISPOSAL

A. Disposal of trees, branches, snags, brush, stumps, etc., resulting from the clearing and grubbing shall be removed from the site and is the responsibility of the Contractor. All costs in connection with disposing of the material shall be borne by the Contractor. All liability associated with the disposal of the cleared and grubbed material shall be the responsibility of the Contractor. The disposal of all materials cleared and grubbed shall be in accordance with the state and local regulations.

3.07 GEOTECHNICAL RECOMMENDATIONS

A. All site clearing activity shall be in conformance with the Geotechnical Recommendations provided by Terracon for this project.

3.08 COUNTY REQUIREMENTS

A. Adhere to all County requirements.

END OF SECTION

INDEX TO

SECTION 31 23 13 – SUBGRADE PREPARATION

SECTION 31 23 13

SUBGRADE PREPARATION

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM): D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m1m3)).

B. Georgia Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition (GADOT Standard Specifications).

1.02 DEFINITIONS

A. Optimum Moisture Content: As defined in Section 31 23 23, Fill and Backfill.

B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

C. Relative Compaction: As defined in Section 31 23 23, Fill and Backfill.

D. Subgrade: Layer of existing soil after completion of clearing, grubbing, and scalping of topsoil, prior to placement of fill, roadway structure, or base for floor slab.

E. Proof-Rolling: Testing of subgrade by compaction methods to identify areas that will not support the future loading without intolerable settlement.

1.03 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Sections 31 10 00 Site Clearing and Section 31 23 16 Excavation, prior to subgrade preparation.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

A. Under and Adjacent to Structures, Slabs, Pavements, Footings and Sidewalks: The area under and ten feet beyond the footprint of proposed facilities shall be proof-rolled after removal of topsoil and before placement of fill. Proof-roll shall be with a minimum of ten overlapping passes using a fifteen ton or heavier vibratory roller. The upper twelve inches of the bottom shall be compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by ASTM D1557. Any soft areas that cannot be compacted shall be over-excavated and replaced with compacted sand, silty sand, or other material, as determined by the Geotechnical Engineer. Subgrade compaction under pavement areas shall be in accordance with the GADOT standard specifications.

B. All compacted subgrade in footprint of new structures shall be inspected by Geotechnical Engineer and accepted prior to placing fill or other material.

C. Under Earthfill: Compact upper twelve inches to a minimum of 95 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557.

3.03 MOISTURE CONDITIONING

A. Dry Sub grade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, harrowing, or other methods, to hasten drying process.

3.04 TESTING

A. Testing methods and frequencies shall be per Section 31 23 23 "Fill & Backfill" , 1.04 Quality Assurance.

3.05 CORRECTION

A. Soft or Loose Sub grade:

1. Adjust moisture content and re-compact; or

2. Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23, Fill and Backfill.

B. Unsuitable Material: Over excavate as specified in Section 31 23 16 Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23 Fill and Backfill.

END OF SECTION

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SECTION 31 23 16 – EXCAVATION

SECTION 31 23 16

EXCAVATION

PART 1 – GENERAL

1.01 DEFINITIONS

A. Common Excavation: Removal of material not classified as rock excavation.

1.02 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized over-excavation.

B. Excavation Support: When performing trench excavation in excess of five feet in depth, comply with Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 CFR, s. 1926.650, Subpart P, and all subsequent revisions or updates adopted by the Department of Labor and Employment Security. Ensure that trench boxes are wide enough to accommodate compaction and density testing. The excavation support system shall be designed by a professional Engineer registered in the State of South Carolina.

1.03 WEATHER LIMITATIONS

A. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction. If this occurs, Geotechnical Engineer shall approve material prior to use.

1.04 SEQUENCING AND SCHEDULING

A. Clearing, Grubbing, and Stripping: Complete applicable Work specified in Section 31 10 00 Site Clearing, prior to excavating.

B. Dewatering: Conform to applicable requirements of Section 31 23 19.01 Dewatering, prior to initiating excavation.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for

forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

B. An unbraced temporary excavation with side slope inclined at one and a half Hertz to 1 Volt or flatter is expected to remain stable if not subject to surcharge load or vibration. Excavation deeper than five feet shall comply with OSHA trench safety standards, 29 CFR, s. 1926.650,

C. Surface water runoff should be prevented from entering trenches by temporary berms, swales, or other diversion methods.

D. Do not over–excavate without written authorization of Engineer.

E. Maintain subsurface with a minimum of twelve inches below excavations.

3.02 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.03 EXCAVATION AROUND PILES

A. Excavation of areas where piles are to be installed shall be performed with acceptable equipment to six to twelve inches above the base of the footing or pile cap. This will occur prior to installation of piles.

B. Following installation of piles, excavation of remaining area around and between piles shall be performed by hand and shall not damage or dislocate piles.

3.04 TRENCH WIDTH

A. Minimum Width of Trenches: Excavate trenches for pipes to the elevation of the bottom of the pipe or sub-base as specified on the Drawings. The width should be sufficient to provide adequate working room for pipe installation and connections.

3.05 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceed three-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a six-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.06 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

C. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

D. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.07 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.

B. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 10 00, Site Clearing, for clearing and grubbing debris.

END OF SECTION

INDEX TO

SECTION 31 23 19 – SLUDGE DE-WATERING SYSTEM

SECTION 31 23 19

SLUDGE DE-WATERING SYSTEM

1.0 WORK INCLUDED

1.1 The contractor shall install one (1) Klampress 2.0-meter Type B5 belt filter press (furnished by owner) complete with sludge conditioning unit, hydraulic power unit, belt wash water booster pump, and one PLC/HMI touchscreen panel (furnished by owner). In addition, the contractor shall furnish and install dry sludge feed pump, raw polymer tank and pump, neat polymer tank and pump, and all necessary valves, inter-connecting piping and wiring, instrumentation, anchor bolts and other necessary appurtenances as shown on plans and the manufacturer installation manual for a complete and operating installation.

2.0 GENERAL

2.1 A belt press and belt press control cabinet will be provided by the City and installed by the general contractor.

2.3 All other wiring, controls, starters, disconnects, shall be the responsibility of the installing Contractor.

3.0 PERFORMANCE REQUIREMENTS

3.1 Each belt filter press shall be capable of operating satisfactorily under the following performance conditions:

3.2 Type of sludge: WAS from Aerobic Digester process.

3.3 Sludge feed concentration: Range 4 % dry solids.

3.4 Hydraulic throughput, solids throughput, cake solids concentration, solids capture (combined filtrate and washwater) and polymer use requirements:

Feed Solids %	Hydraulic Throughput GPM	Solids Throughput Lbs DS/hr	Cake Solids %	Solids Capture %	Polymer Use, Lbs Active Polymer/ Ton DS
4	200	1000	18	95	8

4.0 GENERAL SYSTEM REQUIREMENTS

4.1 After proper flocculation of the sludge with polymer, initial dewatering shall occur by gravity drainage through a relatively porous gravity section filter belt traveling

horizontally along the press. Further dewatering shall occur by squeezing the sludge between two tensioned pressure belts of heavier construction, first through a wedge zone then over and under a minimum of eight rollers forcing entrained water from the sludge through both pressure and shear action. Dry cake discharge shall be assisted by blades at each pressure belt. Each belt shall be subsequently washed with high pressure, low volume water from spray headers before it returns to the head of its section of the press. Wash water and filtrate shall be collected in drain pans for direction to a curbed concrete drainage basin surrounding the press.

4.2 The overall dimensions of each fully assembled belt filter press shall be as shown on the plans.

4.3 The equipment furnished shall be designed and constructed in accordance with the best practices and methods and for continuous service at maximum conditions. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be fully suitable for the intended conditions of service. Provisions shall be made for easy lubrication, adjustment or replacement of all parts. Corresponding parts of multiple units shall be interchangeable. All materials used shall be of the best quality and fully suitable in every respect for the service intended. Unless otherwise specified, all materials in direct contact with sludge, polymer or filtrate shall be type 316 stainless steel or plastic. All fasteners shall be type 316 stainless steel.

5.0 SLUDGE CONDITIONING SYSTEM

5.1 Each sludge conditioning system shall consist of an in-line polymer injection ring, a variable orifice venturi type mixing valve and a press mounted flooded bottom distribution system for final flocculation as well as even distribution of sludge across the full width of the press.

5.2 The polymer injection ring shall be of the multiport type to assure optimum polymer usage, shall be of polyethylene construction and shall be supplied with a polyethylene injection manifold complete with tubing and fittings for distributing polymer to the injection points on the ring. The mixing valve shall be of cast type 316 stainless steel construction and shall include provisions to vary the throat area through an external adjustably weighted lever arm for most effective instantaneous polymer/sludge mixing. The mixing valve shall also include a removable inspection cover.

5.3 Each injection ring and mixing valve shall form a sludge/polymer mixing assembly which shall be located directly in the sludge feed line. The contractor shall provide spool pieces to simulate the mixing assembly at two additional locations in each sludge feed line to allow for repositioning the mixing assembly for most effective floc formation. The contractor shall also provide the necessary polymer piping and valving to accommodate the alternate mixing assembly locations.

5.4 The flooded bottom distribution system shall be mounted on the feed end of the press and shall be sized to provide an adequate residence time for effective floc formation. The distribution system shall consist of a lower inlet section or feed hopper and an upper distribution and exit section. All parts of the system shall be constructed of type 316 stainless steel. Sludge shall directly overflow the hopper

onto the full width of the distribution section. The sludge inlet line to the tank shall incorporate a means of draining the feed hopper. The hopper shall also be provided with a plugged drain connection. No mechanical or static mixing devices shall be included in the hopper or distributor as such devices become fouled and require frequent cleaning.

6.0 MISCELLANEOUS

6.1 Each press shall be provided with two yellow safety trip cords at each side of the press, one at a lower elevation and one at a higher elevation. Each cord shall be connected to a NEMA 4X lever operated emergency stop switch which shall immediately stop the belt drives and shut down the entire system upon actuation of the switch. These switches shall be independent of the gross belt misalignment switches and shall require resetting at the press before the equipment can be restarted.

6.2 Each press shall be complete with all intra-unit power and control wiring terminating in a single press mounted NEMA 4X stainless steel junction box. All wiring shall be run in PVC coated rigid conduit for added corrosion resistance.

6.3 Each press shall be complete with all intra-unit hydraulic system and washwater piping as well as all filtrate and washwater drain lines directed to the collection basin beneath the press, all washwater supply piping terminating at a single washwater inlet connection and all hydraulic piping and tubing.

6.4 For maximum corrosion resistance all miscellaneous parts such as brackets, spacers, etc. shall be fabricated from type 304 stainless steel or plastic and all guards shall be fabricated from type 304 stainless steel.

6.5 **The Contractor Shall provide a washwater booster pump** for the belt press unit to raise the system water pressure to the required operating level. The pump shall be a horizontal end suction centrifugal pump in type 316L stainless steel construction with mechanical shaft sealing. The pump shall be driven by a direct coupled **7-1/2 HP**, 3600 RPM, TEFC motor and shall be furnished with a common steel channel base for the motor and pump and a coupling guard.

7.0 BELT PRES CONTROL PANEL (Provided by City)

7.1 A control panel shall be furnished by the City for the belt filter press to control the belt press functions and those of the related auxiliary equipment specified herein. The panel shall be preassembled and prewired and shall include all controls necessary for semi-automatic system operation with provisions for manual control of individual items when desired. The panel shall be suitably wired for connection to a 480-volt, 3 phase, 60 Hertz power sources.

7.2 The enclosure shall be fabricated from 14-gauge type 304 stainless steel, shall be floor stand mounted and shall be constructed to NEMA 4X standards. Instruments and control devices mounted on the enclosure door shall be rated for or installed in such a manner as to maintain the NEMA 4X integrity. Nameplates shall be engraved laminated phenolic with black background and white letters to identify

each component mounted on the panel face. Letter height shall not be less than 3/16 inch. Additionally, the complete panel, as an assembly, shall be built in accordance with UL 508 and shall have a UL serialized label.

7.3 Wiring shall be accomplished in a neat workmanlike manner and run in PVC wiring duct where practical. Where not practical it shall be supported and tied in position with nylon cable ties. All wiring shall be identified with a number code and all wiring for external connection shall be brought to a numbered terminal strip. Wiring shall comply with the applicable requirements of the latest edition of the National Electrical Code. Interconnecting wiring between this panel and the press and other related equipment shall be the responsibility of the contractor.

7.4 The enclosure shall house a flange mounted dead front main disconnect, all motor starters, variable frequency controls, a programmable logic controller, interlocks, alarms, indicating lights and operator controls required for the operation of the belt filter press and auxiliary equipment described in this specification section. Each AC motor, contactor and wiring shall be protected by a properly sized motor starter protector and overload relays. Variable frequency drives shall be protected by properly sized fuses. Indicating lights and operator controls only as required shall be included in this panel for other system auxiliary equipment items described in other sections of the specifications. Starters, variable speed drives, controllers, etc. for such other items shall be furnished by the contractor and shall be located elsewhere. The following control interfaces shall be provided for this auxiliary equipment: (including sludge feed pump, dry sludge cake pump, polymer feed pump, and the wash water booster pump) dry contacts rated at 10A 125V for start/stop control, PLC inputs to accept dry contact 'on' status and motor overload/fail signals, 4-20 madc signals or high/low speed switch contact closures as required for speed command signals. System interlocking, and logic shall be provided by an industrial grade programmable logic controller meeting the following minimum requirements:

1. Total input/output: As required, expandable to 184 flexible I/O.
2. Memory size and type (16-bit words): 3.7K words EEPROM.
3. Scan rate: 0.87 ms for 1K words.
4. Internal functions: 196 internal coils, 192 data registers, 64 timers/counters and RS232C port.
5. Program language: Boolean based relay logic.
6. Programming: Hand held programmer, plant CPU or PC interface.
7. Acceptable PLC: Allen Bradly, DL305 by PLC Direct or equal.

Components shall be selected, and the enclosure sized to limit the enclosure internal heat rise to 10° C while operating in a 40°C ambient. Calculations or method of determining compliance shall be submitted to the Engineer with the initial drawing submittal. A minimum of 20% spare terminal blocks shall be provided. The control panel shall be completely tested under simulated field conditions by the press manufacturer prior to shipment. The Operation and Maintenance Manual shall contain complete as-built drawings including schematics, physical layout and terminal connections. It shall also contain tabulated maintenance procedures.

7.5 The control panel face shall include the following controls and indicators. All start/stop controls shall be of the illuminated pull-to-start push-to-stop type with status lights indicating steady on for run and flashing for fail or overtemperature.

1. Main disconnect switch.
2. System automatic cycle start/stop control with on status light.
3. Hydraulic power unit start/stop control with on status/motor fail light.
4. Belt washwater booster pump start/stop control with on status/motor fail light and/or washwater solenoid valve to open/close appropriately.
5. Gravity belt drive start/stop control with on status/motor overtemperature light, speed control potentiometer and speed indicator.
6. Pressure belt drive start/stop control with on status/motor overtemperature light, speed control potentiometer and speed indicator.
7. Sludge feed pump start/stop control with on status/motor fail light, speed control and speed indicator as required.
8. Polymer feed pump start/stop control with on status/motor fail light, speed control and speed indicator as required.
9. Sludge cake pump start/stop control with on status/motor fail light.
10. Start/stop controls with on status/motor fail lights for raw polymer mixing pump.
11. Belt prewet and post wash cycle indicator lights.
12. Motor run/jog selector switch.
13. Emergency stop pushbutton with alarm/emergency trip light.
14. Gravity belt gross misalignment alarm light.
15. Pressure belt gross misalignment alarm light.
16. Gravity belt broken belt/belt drive fail alarm light.
17. Pressure belt broken belt/belt drive fail alarm light.
18. Low system hydraulic pressure alarm light.
19. Low system washwater pressure alarm light.
20. Alarm lights as required for other specified alarm conditions.
21. Audible alarm horn.
22. Alarm acknowledges pushbutton.
23. Alarm reset/lamp test pushbutton.
24. Sludge Pump Control Switch – HOA.

7.6 Semi-automatic operation of the entire system shall be controlled by a single start/stop cycle control. This control along with status and alarm contacts shall provide inputs to the programmable controller (PLC). The controller shall continuously scan the inputs and according to a logic program stored in its memory shall develop the appropriate run, stop, status or alarm signals for devices connected to its output. The PLC shall cause specific functions to be interlocked, timed, started or stopped as required during the start up, run and shutdown modes of operation. These modes of operation may be operator initiated or caused by one of the inputs. Essentially, the PLC shall initiate and monitor each step of the cycle, check that all interlocks are satisfied and drive start-ups are confirmed before proceeding to the next step, provide for prewetting the belts before sludge is introduced to the press on start-up and provide for the proper timed intervals for complete discharge of sludge cake and thorough belt washdown during the shutdown cycle. The control system shall allow unattended operation in the semi-automatic mode. In the manual mode of operation, the system shall be started and stopped by the actuation of each individual component control.

7.7 During operation in either mode, any of the following alarm conditions shall activate the alarm horn and respective alarm light or motor status indicator light causing the entire system to shut down either instantaneously or in the normal programmed

sequence as appropriate: gross misalignment of any belt, low system hydraulic pressure, low washwater pressure, emergency stop at the press, either belt drive fails, any broken belt, either belt drive motor overheats, auxiliary DC motors overheated, auxiliary AC motors overloaded or emergency stop at the control panel. Alarm annunciation shall follow ISA sequence AM. The motor status light shall serve as the alarm light, flashing for motor fault conditions or, in the case of remotely located starters, for overload trip or power off. If the operator can correct an alarm condition during programmed shutdown, the PLC shall allow continuation of full operation by reactivation of the cycle control.

7.8 For either semi-automatic system operation where the programmable logic controller assumes control or manual control where an operator assumes control, the sequence of operation shall be as follows:

1. **Start-up Sequence:**
   a) Start the hydraulic power unit.
   b) Start the belt washwater booster pump and/or open the washwater solenoid valve.
   c) Start the gravity belt drive.
   d) Start the pressure belt drive.
   e) Start the sludge cake pump (conveyor) after receiving signals from the sludge level sensor.
   f) After allowing the belts to become wet, start the polymer feed pump and the sludge feed pump.
   g) Start any other auxiliary equipment item at the appropriate time during the sequence (in-line sludge grinder).
   h) Adjust belt speed and/or sludge and polymer feed rates.

2. **Shutdown Sequence:**
   a) Stop the sludge and polymer pumps.
   b) After allowing sludge to discharge completely from the belts and allowing for complete belt washdown, stop the washwater booster pump and/or close the solenoid valve.
   c) Stop the belt drives.
   d) Stop the hydraulic power unit.
   e) Stop the conveyor.
   f) Stop any other auxiliary equipment at the appropriate time during the sequence.

8.0 WARRANTY

8.1 The equipment provided by the General Contractor shall be guaranteed against defects in material and workmanship under normal use and service for a period of one year after start-up not to exceed eighteen months after shipment during which time repairs or replacements shall be made without charge.

9.0 MANUFACTURER'S SUPERVISORY SERVICES

9.1 The belt press manufacturer shall furnish the services of a competent and experienced person for a period of 10 days to be covered in 2 trips to job site to check the installation, supervise the start-up, supervise the performance testing and

provide operator instruction for the equipment furnished. Additional service, if requested, shall be available at the manufacturer's portal to portal per diem rate in effect at the time of service delivery, plus all travel and living expenses.

10.0 LIQUID POLYMER ACTIVATION / DILUTION / FEED SYSTEM

10.1 GENERAL

Polymer Unit

The polymer dilution/feed unit shall be capable of automatically metering, diluting, activating and feeding a liquid polymer with water.

10.2 WARRANTY

The system shall be covered by a two (2) year limited warranty against defects in materials and workmanship. The mixing chamber shall be covered by a lifetime warranty covering the repair and replacement of any part of the mixing chamber that fails for any reason, provided unit has received reasonable use and care. The mixing chamber shall be guaranteed not to plug for the life of the system. The warranty shall not be de-rated as a result of using non-potable water.

If purchaser is dissatisfied with unit's performance within 30 days of start-up, unit may be returned for full refund, or credit against another unit, provided unit has received reasonable use and care.

10.3 EQUIPMENT

A. Multi-Zone Mixing Chamber

A non-mechanical hydrodynamic blending device specifically designed to dilute and activate emulsion, dispersion and solution type polymer with viscosities up to 75,000 cps. and active contents up to 75%, shall be provided. Systems without a proven track record with all types of polymers described above will not be considered.

The liquid polymer activation chamber's mixing energy shall be staged such that it provides for high, non-damaging mixing energy over the full operating range of the system which then dissipates through concentric chambers. The integral water control device, which shall also produce mixing energy by creating a pressure drop across its orifice, shall be constructed of stainless steel and brass and shall be designed to allow orifice replacement without disassembly of any other part of the system. The system shall be designed for use with either potable or non-potable dilution water.

A mixing chamber drain valve with 1/2" fitting shall be provided. The mixing chamber shall have a maximum rated pressure of 150 psi.

Provide a brass, adjustable range pressure relief valve on mixing chamber with a range of 25 to 75 psi.

At no time shall polymer be exposed to excessive shear. All components that require periodic maintenance shall be readily accessible.

Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. The valve body shall be constructed of Teflon. The ball shall be stainless steel. The spring shall be covered with a PVC boot, to prevent polymer from passing through the spring. The valve shall be readily accessible for cleaning and shall be easily disassembled. Conventional check valves, and or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.

B. Dilution Water Control

The dilution water flow rate shall be monitored by a Rotameter type flow meter Unions shall be provided on the inlet and outlet of the Rotameter to allow easy removal for cleaning.

Unit shall have an electric solenoid valve for on/off control of total dilution water flow.

C. Open Top Polymer Tank:

1. One (1) Polyprocessing 700 Gallon 1.9SG XLPE Natural Open Top Vertical Cylindrical Tank with Three (3) 1" 150# Flanged Connections

D. Pump

Unit shall have a neat polymer metering pump with the following;

1-	Fluid	1.25 % polymer
2-	Viscosity	1000cPs
3-	Flow, Min/Max.	0.03 / 0.3 gpm
4-	Pressure	300 psi
5-	Drawdown Cylinder	500 ML

6- One (1) MOYNO Progressive Cavity metering pump

-	Model # B4100D-SSF-AAA	
-	Motor	1HP/230VAC/3 PH/60 Hz/1750
-	Pump housing:	S.S.
-	Internal material:	S.S. chrome plated
-	Stator material:	Viton
-	Seal:	Viton
-	Gearbox	NORD SK172/2.49:1 Ratio
	Drive	1 hp, 1 Ph 120VAC Input / AC Tech Drive Model No. ESV751N01SXE

E. Controls

A control panel integral to the systems frame shall be provided, rated NEMA 4X and constructed of FRP. The control panel shall consist of all

switches, relays, indicator lights, digital displays, as required. The control panel and all components shall be industrial duty. Switches and indicator lights shall be equal to Allen Bradley series 800E. "Mini" LED indicator lights, toggle switches and residential light switches shall not be acceptable as control devices or indicators. All skid mounted electrical components interconnected to control panel shall terminate on terminal block. Terminal blocks sized for 14 ga. wire with terminal block numbers and legend, as manufactured by Entrelec or equal. Wires shall be neatly run through wire race-way and numbered with adhesive type labels. Control Enclosure shall be Vynkier or equal.

Control Devices:

ON - OFF - REMOTE switch with contacts to receive remote start / stop signal (maintained contact) and provide "remote" mode output indication (dry contact)
Tactile membrane type stroke frequency control (located on the metering pump).

Indicators:

LCD display of pump rate
Power ON indicator

Inputs signals:

External mode shall allow for automatic polymer pump pacing based on a 4-20 mA analog input signal.
In the remote mode, the unit shall accept a run signal (maintained contact).

Outputs:

System in "Remote mode" status output, dry contact
System "Running" status output, dry contact

10.4 MAINTENANCE

A. Unit shall be open frame design to allow easy access to all components.

Mixing chamber shall be easily disassembled and reassembled to allow access to all parts exposed to neat polymer.

Polymer check valve shall be readily accessible. Check valves installed inside mixing chamber shall not be acceptable.

10.5 MATERIAL SPECIFICATIONS

A. The Polymer mixing pump shall have the following:

1. Dilution water inlet, 1" FNPT
2. Neat polymer inlet, 1.5" barbed hose fitting or sch. 80 PVC

3. Solution discharge, 1" FNPT

4. Required Utilities
   - Power Supply: 120VAC, 15A, 60Hz
   - Water Supply: 30 GPM @ 30 - 70 psi

5. Unit Electrical Components
   - 1 hp / 3 ph / 1800 RPM / 230-460V / 60 Hz / TEFC
   - 1 hp, 1 Ph 120VAC Input / 3 Ph 230V Output AC Tech Drive Model No. ESV751N01SXE
   - 0.5" vane type water flow meter with low flow set point
   - 10-foot power supply cord with male connector

- SS Base Connections - Electrical
  - Standard, grounded male plug - 120/1/60, 20 amps max.
  - Terminal blocks - 4-20 mA signal input
  - Terminal blocks - dry contact input for remote start
  - Terminal blocks - dry contact run output
  - Terminal blocks for interconnecting all skid mounted electrical devices
  - Isolators to isolate analog and discrete signals connected to terminal block.

- Dilution water plumbing shall be schedule 80 PVC. Hose shall be braided vinyl. Hose fittings shall be schedule 80 PVC. No nylon fittings shall be used.

  Mixing chamber – 304 stainless steel.

11.0 POLYMER MIX CONDITIONING TANK AND MIXER

2. One (1) Polyprocessing 1,050 Gallon 1.9SG XLPE Natural Dome Top Vertical Cylindrical Tank:
   - 5'-1" Diameter
   - 8'-6" Height
   - 19" Safe-Surge Manway Lid
   - One (1) "Suction" 1" flanged outlet 3" off bottom
   - One (1) "Fill" 1 ½" flanged as close to top as possible
   - One (1) "Overflow" 2" flanged, 1" lower than fill
   - One (1) "Low Level" 1" flanged, 6" from bottom
   - One (1) "Level" 1" flanged 3" from bottom

3. One (1) CHEMINEER Model 50DTC-1.5, Clamp-On Style Mixer with 316SS wetted parts and 1.5HP, 175RPM, Standard Duty, TEFC, 120/230V/1PH/60Hz Motor

4. The CHEMINEER Mixer will be mounted to a 304SS bracket that will be installed on/thru the raceways on the tank using 304SS hardware

5. One (1) NEMA 4X 304SS Mixer Start/Stop Panel Supplied Loose for Field Mounting/Wiring:

   - One (1) RITTAL NEMA 4X 304SS Electrical Enclosure 20" X 16" X 8" Model #WM201608N4
   - One (1) EATON 30 Amp Quick Disconnect Switch Model #R5A3030U
   - One (1) EATON Disconnect Switch Pistol Handle Model #SHR00N12
   - One (1) EATON Disconnect Switch 5MM Shaft Model #SF320SH5X5
   - One (1) EATON 1.5HP Manual Motor Starter with 120VAC Coils Model #XTSC025BCA
   - One (1) EATON 30mm 3-Position Corrosion Resistant Switches (CAM#3) Model #E34VHBL1
   - Two (2) EATON 30mm 2-"NO" Contact Blocks (Finger Safe) Model #10250T2P
   - One (1) EATON 30mm Corrosion Resistant Red LED Pilot Light 120VAC Model #E34FB197LRP2A
   - One (1) EATON 30mm Corrosion Resistant Green LED Pilot Light 120VAC Model #E34FB197LGP2A
   - One (1) EATON 30mm Corrosion Resistant Amber LED Pilot Light 120VAC Model #E34FB197LAP2A
   - TYTON-HELLERMAN Wire Track will be used to secure all wiring inside the cabinet
   - EATON 5.2MM Spring Cage Terminal Strip with well labeled terminals for all customer field connections
   - All necessary general wiring materials required such as wire tags, grounds, etc.
   - An as built electrical schematic sealed to prevent moisture damage will be included

Polymer Metering Pumps with Primary / Spare Control Panel:

Fluid:	1.25% Polymer solution
Viscosity:	1000cPs
Flow:	7gpm
Pressure:	50psi

6. One (1) MOYNO Compact C Progressive Cavity Metering Pumps:

   - Model #C23AS81RPA/E412
   - Pump Housing: Stainless Steel
   - Internal Material: Stainless Steel chrome plated
   - Stator Material: Viton
   - Seal: Packing
   - MOYNO Stator Temp Sensor with 115V Controller - Run Dry Protection

7. 1 (1) NORD Gear Reducers:

   - Model #SK172.1F-140TC

- Output Ratio: 2.92:1
- AGMA: Class II

8. 1 (1) BALDOR Inverter Duty Motors:

   - Power: 2HP
   - Speed: 1755 RPM
   - Voltage: 230/460 X 3Phase
   - Enclosure: TEFC
   - Insulation: F1

9. 1 (1) LENZE 2HP 400-480V (3PH) NEMA 4X Variable Frequency Drives Model #ESV152N04TMC

10. One (1) NEMA 4X 304SS Electrical Cabinet mounted on the frame and wired to the components to contain but is not limited to the following:

    - One (1) RITTAL NEMA 4X 304SS Electrical Enclosure 30" X 24" X 12" Model #WM302408N4
    - One (1) EATON 30 Amp Quick Disconnect Switch Model #R5A3030U
    - One (1) EATON Disconnect Switch Pistol Handle Model #SHR00N12
    - One (1) EATON Disconnect Switch 5MM Shaft Model #SF320SH5X5
    - One (1) EATON 3-Amp / 2-Phase Circuit Breaker Model #FAZ-C5/2-NA-SP
    - One (1) EATON 4-Amp / 1-Phase Circuit Breaker Model #FAZ-C7/1-NA-SP
    - One (1) EATON 200vA 460X120V CPT with Finger Safe Covers Model #C0200E2A
    - Two (2) EATON 30mm 3-Position Corrosion Resistant Switches (CAM#3) Model #E34VHBL1
    - Four (4) EATON 30mm 2-"NO" Contact Blocks (Finger Safe) Model #10250T2P
    - Two (2) EATON 30mm Corrosion Resistant Red LED Pilot Lights 120VAC Model #E34FB197LRP2A
    - Two (2) EATON 30mm Corrosion Resistant Green LED Pilot Lights 120VAC Model #E34FB197LGP2A
    - Two (2) EATON 30mm Corrosion Resistant Amber LED Pilot Light 120VAC Model #E34FB197LAP2A
    - TYTON-HELLERMAN Wire Track will be used to secure all wiring inside the cabinet
    - EATON 5.2MM Spring Cage Terminal Strip with well labeled terminals for all customer field connections
    - HUBBELL Flexible Conduit and Fittings to be used
    - All necessary general wiring materials required such as wire tags, grounds, etc.
    - An as built electrical schematic sealed to prevent moisture damage shall be provided

11. All components listed above to be mounted on a 304SS square tube frame with the Control Panel and VFD wired to motors.

12. Submittal Package shall include AutoDesk Inventor 3D Model in STP or STEP format of the entire packaged containers. Additional component drawings and electrical drawings/schematics shall be in 2D DWG or DXF format.

12.0 SLUDGE FEED PUMP TO BELT PRESS (Progressing Cavity Pump)

12.1 QUALITY ASSURANCE

A. The pump to be furnished under this Section shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The manufacturer will be considered qualified upon examination of credentials and confirmation of satisfactory operation of similar installations over the past five years.

B. The progressing cavity pump to be furnished under this Section shall be as manufactured by Moyno, Model Z3AAC11RMB/E with Vulcan single mechanical seal, no substitutions.

C. Should equipment which differs from the Specifications be offered and determined to be equal to that specified, such equipment shall be acceptable only on the basis that any revisions in the layout and construction of the structures, piping and appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

D. Pumps, drive units and motors shall be furnished by the pump manufacturer and be factory-mounted on a common base plate of cast iron or fabricated steel.

12.2 SYSTEM DESCRIPTION

A. Pumps shall be positive displacement, progressing cavity pumps. The liquid to be pumped is Municipal sludge with a concentration of 3-4 percent solids.

B. The pumps shall have a capacity as follows:

Tag No.	Max.,Capacity (gpm)	Total Dynamic Head (psig)	Max. Speed (rpm)	Min. Motor Size (HP)
*	250	30	302	20

C. Pump shall be interlock with the by belt press control panel.

12.3 MAINTENANCE

A. Tools and Spare Parts

1. One set of all special tools required for normal operation and maintenance shall be provided.

2. The following spare parts shall be provided as a minimum:

   a. One mechanical seal.

   b. One set of gaskets.

   c. One stator

12.4 MATERIALS AND EQUIPMENT

A. General

1. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed and any other pertinent data shall be attached to each pump.

2. The manufacturer shall supply all motors. The manufacturer shall factory-mount motors, pumps, gear reduction units, couplings and guards on a common base plate.

3. The nameplate rating of the motors and drives shall not be exceeded, nor shall the motor design service factor be reduced when its pump is operating at any point on its characteristic curve.

4. These Specifications call attention to certain features, but do not purport to cover all details of construction of the units.

12.5 PUMPS

A. Pumps shall be heavy duty, positive displacement, progressing cavity type. The pump body shall be of thick-walled cast iron. Suction and discharge connections shall be 125 pound raised faced ANSI cast iron flanged. All wetted internal components shall be alloy steel unless otherwise stated in this specification.

B. The pump rotor shall be manufactured in **one piece** from an alloy steel conforming to BS970, grade 708M40T/709M40T (ASTM A 322, grade 4140/4145) or equivalent. The rotor surface should be coated with hard chrome plate to a nominal thickness of 0.25mm (.010") at the scroll peaks (major diameter). The surface should be polished to a minimum of Ra 1.6 um (63uin) to maximize stator wear life.

C. The rotor shall rotate relative to a one-piece, medium-high acrylonitrile Buna "N" rubber stator of approximate 70 Durometer hardness (Shore A) securely bonded to its steel tube housing. The stator shall be arranged to prevent the pumped material from contacting the bonding or the tube.

D. The rotor shall be joined to the drive shaft by a heavy duty, oil lubricated, pin type universal joint.

A **two-piece** design connecting rod is required which allows the rotor and stator to be removed without disturbing/dismantling the pump pin-joint drive connections.

E. The rotor and stator shall be capable of being removed and replaced without disturbing or removing the suction and delivery pipe work pump connections. This should also apply to the removal/replacement of the connecting rod, driveshaft and gland seal.

F. Suction chamber area should be easily and quickly accessible with unrestricted 360-degree access.

G. Unless otherwise specified or dictated by duty conditions, the gland seal shall consist of a single internally mounted bi-directional mechanical seal. Metallic parts should be manufactured from 316 stainless steel. Face materials should be Silicon Carbide.

12.6 MOTORS

A. Each pump's motor shall be a horizontal, totally enclosed fan-cooled, induction motor rated for 460VAC, constant speed, inverter duty, 1800 RPM and manufactured by WEG or approved equal.

12.7 GEAR REDUCTION UNIT

A. Gear reduction shall be oil-immersed helical or worm gears running on anti-friction bearings.

12.8 COUPLINGS

A. The pump shaft shall be connected with a close coupled flange mounted gear motor with cross drilled shaft.

12.9 BASE

A. Motor, drive and pump shall be mounted in-line, on a carbon steel brake bent base.

12.10 INSTRUMENTATION AND CONTROLS

A. The control of the progressive cavity pumps shall be accomplished locally through a NEMA 4X manufacturer supplied control panel.

B. The control mode of motor shall be made through the operation of a local selector switch.

C. The equipment manufacturer shall be responsible for sizing the NEMA 4X control panel. The pre-wired control panel shall house all control components. The control panel shall contain run, stop and power on indicator lights, standard start and stop pushbuttons and all miscellaneous appurtenances required for a complete and fully operational system.

12.11 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. All surfaces shall be prepared, and shop primed as part of the work under this Section. Surface preparation and shop priming shall be as specified in the painting specifications.

12.12 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include **contractor** furnished required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set by the Contractor in accordance with the manufacturer's recommendations.

B. Base plate shall be grouted in place by Contractor using an approved non-shrink grout.

12.13 INSPECTION AND TESTING

A. Furnish the services of a factory representative for one (1) normal eight (8) hour day who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment. These services may be combined with those provided under Paragraph 1.03.C.

B. After installation is complete and approved by the manufacturer's representative, contractor and engineer a completed start-up report shall be provided.

C. If the pump performance does not meet the Specifications, corrective measures shall be taken by the supplier.

D. Operation and Maintenance Manuals

Supplier shall provide five (5) hard copies and one PDF copy of the Operation and Maintenance Manuals. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

13.0 DRY SLUDGE CAKE TRANSFER PUMP

General Description:

13.1 The thickened sludge discharge pump shall be of the Moyno 2000 Ultra-Pro 1:2 design, Model 4H065G3M20CDA5AAA with stator Temperature Probe Kit. The pumps shall be of the heavy duty, positive displacement, progressing cavity type with a gear joint drive train. The drive train shall be firmly supported by heavy duty bearings integral to pump.

13.2 Standard suction housing shall be thick walled cast iron. Suction housing shall

incorporate two rectangular inspection ports, 180 deg. apart, to permit access to suction housing interior without disconnecting piping or feed chute. Bearing housing of pump shall be thick-walled cast iron. All cast parts shall be free of sand holes, blow holes and other defects.

13.3 Bearings must be integral to pump and of grease lubricated, tapered roller type with diverging pressure angles for maximum shaft stability. Close-coupled pumps, which do not utilize bearings integral to pump will not be accepted. Bearings are to be designed for minimum B-10 life of 100,000 hours under maximum operating conditions and will not require periodic lubrication. Bearings shall be protected from contaminants by means of bearing cover plate bolted to bearing housing. Bearings shall be enclosed in a separate housing, incorporating a bearing spacer and bolted bearing cover, which eliminates the need to shim bearings. Inferior methods of positioning bearing, i.e., snap rings, will not be accepted.

13.4 Discharge connection shall be a raised face, 8" 300 lb. ANSI Flange with bolt dimensions and spacing to ANSI standards. Suction opening shall be 16" wide x 88.88" long to mate with two (2) meter press.

13.5 Moyno Ultra-Shield rotor shall be of one-piece construction with integrally machined rotor head. Rotors made in long lengths and cut to size, with welded rotor heads, will not be accepted.

13.6 Moyno Ultra-Shield rotor shall be machined from alloy steel and shall be ASTM A331-90, grade 4150 cold finish with a yield strength greater than 55,000 psi. Moyno Ultra-Shield rotor shall be of single helix design with a Moyno Ultra-Shield 05 hard chrome plate thickness of .010 inches coating for maximum abrasion resistance.

13.7 Moyno Ultra-Flex stators shall be of double helix design and chemically bonded to inside of a carbon steel tube. Opening of stator, on suction side of pump, shall be beveled to at least a 30-degree angle from vertical. Beveled inlet is important to eliminate entrance losses due to flow of high solids sludges or viscous products.

13.8 Shore A durometer of Nitrile stator shall be 71 plus/minus 4. Stator shall be machined with groves to accept a 720-deg. retaining ring. Stator shall be rigidly fastened to suction housing and discharge flange with removable clamp rings to facilitate stator removal. Stators held in place with inferior methods, such as tie rods that are prone to uneven tensioning and stator misalignment, will not be accepted.

13.9 Stators for progressing cavity pumps shall be manufactured to size. Stators made in long lengths and cut to size will not be accepted.

13.10 Stator tensioning or adjusting devices, which distort rotor/stator compression and seal lines will not be accepted.

13.11 The replaceable stator gaskets shall be designed to prevent the material being pumped from contacting the stator bonding and tube. Stators manufactured with seals integrally molded to the stator elastomer, that are not replaceable and can be damaged during handling and installation, will not be accepted.

13.12 The Moyno Ultra-Drive shall also consist of gear joints of the grease lubricated, crowned gear type. The gear joint shall be totally enclosed and protected by a

wire reinforced elastomeric seal. Mechanical components of the gear joints shall be designed to operate for 10,000 hours at the manufacturer's published maximum speed and pressures.

13.13 The gear joints shall be machined of alloy steel, ASTM 331-90, grade A8620. The ball gear shall have an internal spline machined to American Standard 30 deg. pressure angle involute spline. Stub tooth gears must have a 30-degree pressure angle.

13.14 Joints utilized in the progressing cavity pump must have separate components handling the thrust forces and rotational forces. In the gear joint, the ball and ring gears handle rotational forces. The thrust plates handle thrust forces. Pin joints, on the other hand, are subjected to both rotational and thrust forces resulting in reduced wear life.

13.15 Light duty universal joint designs, such as flexishafts, cardan joints, and bushed pin joints, with forces concentrated on line contact will not be accepted.

13.16 The Moyno Ultra-Drive shall consist of a connecting rod that shall be of the rigid, splined design, connecting the gear joints of the drive shaft and eccentrically moving rotor. The connecting rod shall also serve as a conveyor assembly, moving the pumpage from the suction housing to the pumping elements.

13.17 The connecting rod shall be machined of alloy steel and shall be ASTM 331-90, grade A8620. The connecting rod shall be splined to accept a ball gear. All diameters of the connecting rod are to be concentric to within plus/minus .003" TIR. Total angularity of the connecting rod shall not exceed 1.5 deg.

13.18 The drive shaft shall be of two-piece construction through the bearings and shaft seal area. This design shall permit quick disassembly of the universal joints without affecting the alignment and setting of the pump bearings.

13.19 Carbon steel shafts shall be coated with Moyno Ultra-Shield hard chrome plating with a nominal chrome plate thickness of .010 inches for maximum abrasion resistance, to prevent scoring of shaft in packing area. Progressing cavity designs that do not protect drive shaft from abrasive wear with chrome plating will not be accepted.

13.20 Stuffing box shall be equipped with a split packing gland and split Teflon lantern ring to permit repacking of pump without removing bearings or drive shaft components. Fittings will be provided for grease lubrication of packing.

13.21 TYPE G3 Bridge Breaker:

A. Bridge breaker shall be an integral part of suction housing. It shall consist of two counter-rotating shafts, each with a series of wide paddles, and positioned in close proximity to pump's conveyor assembly. Bridge breaker shafts shall be sealed from pumped material by adjustable packing.

B. Bridge breaker shafts shall be supported at each end by heavy duty bearing blocks and ball bearings. Shafts shall be driven off a separate 7.5 HP right angle gearmotor drive, which will allow bridge breaker to operate at different speeds than pump. Single drive shall turn both shafts in a counter

rotating direction through a set of grease lubricated timing gears. Bearing blocks, ball bearings, and timing gears shall be protected from contamination by pumped material through a wide atmospheric break between drive components and sealing arrangement.

C. For ease of pump maintenance, bridge breaker paddles shall be designed for easy access to pump's drive components without disturbing bridge breaker drive assembly and timing gears. Each shaft shall be a three-piece design with two end shafts and a paddle shaft. The end shafts shall be made of 416 SS, and the paddle shaft shall be made of 4140 alloy steel. Paddle shaft shall be fully removable from top of suction housing without disturbing bridge breaker bearings, timing gears, gearmotor, packing, and end shafts. Designs requiring disassembly of bridge breaker drive components to access pump drive train will not be accepted.

13.22 PERFORMANCE SPECIFICATION:

The belt press discharge pump shall be capable of pumping 15 - 25 gpm of maximum 20 – 24% sludge cake against estimated 175 psi of total discharge head at a maximum of 107 rpm. The pump shall have minimum four (4) stage rotor and stator. A stage is equal to a minimum of one complete seal line between discharge and suction pressure. The maximum rpm is based on the motor operating at 60 Hz. **The minimum pump driver horsepower shall be 20. Bridge Breaker minimum HP shall be 7.5 HP.**

NOTE:

1. Ancillary item to be supplied is Process Controls supplied ABB laser level transmitter Model LM80.AP801-FM-P804-LCD2 including NEMA 4X control.

2. Contractor to provide transition hopper. Chute design from press to pump inlet should be no more than 10 degrees from vertical. Any angularity will encourage creation of bridge. Convex design at pump inlet on long chutes is preferred.

14.0 PERFORMANCE TESTING

14.1 The equipment manufacturer shall conduct a performance test to demonstrate that the installed equipment can meet the specified performance requirements. One press shall be selected for testing. The test shall occur as soon as possible after successful equipment start-up and process and system stabilization has been accomplished.

14.2 The test period shall consist of two five-hour steady state test runs on two consecutive days with sludge feed, sludge cake and effluent (combined filtrate and washwater) samples taken at the start of each run and every hour thereafter resulting in a total of twelve samples of each type. The sludge feed and effluent samples shall be analyzed for total suspended solids content; the cake samples shall be analyzed for total solids content. The resulting solids contents shall be averaged, and the average value of each type shall be used to judge satisfactory performance. Polymer solution strength and flow rate shall be recorded. Sludge feed rate shall be recorded.

14.3 The press manufacturer's representative shall operate the equipment during the test. The owner shall furnish personnel to assist in the operation and to take samples. The owner shall also furnish sludge, water, polymer, utilities, sludge cake disposal, routine test equipment, and laboratory services for analyzing the samples. The belt press manufacturer shall recommend the most suitable polymer for furnish by the owner. The contractor shall provide any special instrumentation for measuring sludge feed or polymer feed rates.

14.4 The equipment shall have passed the performance test if the specified cake solids, solids capture, and polymer use requirements are met with the press operating at the specified hydraulic and solids loading rates.

14.5 Should the installed equipment fail to meet the specified performance requirements, the manufacturer shall within 30 days make changes in the equipment or method of operation as necessary and the equipment shall be retested. If after a second 30-day period the equipment still does not meet the performance criteria, the equipment shall have failed the performance test and the owner shall require its removal and replacement with the specified equipment at no additional cost to the owner.

END OF SECTION

INDEX TO

SECTION 31 23 19.01 – DEWATERING

SECTION 31 23 19.01

DEWATERING

PART 1 – GENERAL

1.01 SUBMITTALS

A. Informational Submittals: Copies of any authorization and permits required to perform dewatering activities.

1. Water control plan.

2. Well permits.

3. Discharge permits.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for design, installation, and operation of a dewatering system to keep excavation free of water.

3.02 SURFACE WATER CONTROL

A. Remove surface runoff controls when no longer needed.

3.03 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in the dry and to lower and maintain groundwater level a minimum of two feet below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Dewatering systems shall include wells or well points and other equipment and appurtenances necessary to maintain specified groundwater elevation. Systems shall be installed outside structural limits and sufficiently below lowest point of excavation.

C. Design and Operate Dewatering Systems:
1. To prevent loss of ground as water is removed.

2. To avoid inducing settlement or damage to existing facilities completed Work, or adjacent property.

3. To relieve artesian pressures and resultant uplift of excavation bottom.

D. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

3.04 DISPOSAL OF WATER

A. Obtain discharge permit for water disposal from authorities having jurisdiction.

B. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.

END OF SECTION

INDEX TO

SECTION 31 23 23 – FILL AND BACKFILL

SECTION 31 23 23

FILL AND BACKFILL

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. C117, Standard Test Method for Materials Finer Than 75–Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.

b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

c. D75, Standard Practice for Sampling Aggregates.

d. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand–Cone Method.

e. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.–lbf/ft^3 (2,700 kN–m/m3).

f. D2922, Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as–compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.

2. Apply corrections for oversize material to either as–compacted field dry density or maximum dry density, as determined by Geotechnical Engineer.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4–inch sieve.

C. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and sub grade preparation.

D. Completed Course: A course or layer that is ready for next layer or next phase of Work.

E. Lift: Loose (uncompacted) layer of material.

F. Geosynthetics: Geotextiles, geogrids, or geo–membranes.

G. Well–Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.

2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

H. Influence Area: Area within planes sloped downward and outward at 60–degree angle from horizontal measured from:

1. One foot outside outermost edge at base of foundations or slabs.

2. One foot outside outermost edge at surface of roadways or shoulder.

3. One-half foot outside exterior at spring line of pipes or culverts.

I. Borrow Material: Material from required excavations or from designated borrow areas on or near Site. Material to be provided by Contractor.

J. Selected Backfill Material: Materials available onsite that geotechnical Engineer determines to be suitable for specific use.

K. Imported Material: Materials obtained from sources offsite, suitable for specified use.

L. Granular Fill: Fill materials as required under structures, pavements, and other facilities.

M. Embankment Material: Fill materials required to raise existing grade in areas other than under structures, pavements, and other facilities.

N. Standard Specifications: When referenced in this section, shall mean South Carolina Department of Transportation Standard Specification for Road and Bridge Construction, latest edition.

O. Controlled Fill: Fill materials as required under structures, around pipes, in trenches, and backfill for structures. As defined herein, in accordance with the Geotechnical Report.

1.03 SUBMITTALS

A. Informational Submittals: Certified test results from independent testing agency.

1.04 QUALITY ASSURANCE

A. Notify Engineer when:

1. Structure, tank, or area is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.

2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.

3. Fill material appears to be deviating from Specifications.

B. Testing and Inspection Services:

1. An independent geotechnical testing agency, qualified in accordance with ASTM E 329, shall, at a minimum, conduct soil materials and properties and compaction testing. The geotechnical testing agency shall designate, from within, a Geotechnical Engineer, registered in the state of Georgia, to serve as the main point of contact and geotechnical advisor on the project during construction.

2. The Owner shall approve of the testing agency.

3. The testing agency will be paid for by the Contractor.

4. At a minimum, in-place field density tests shall be conducted at the following locations. Exact locations are to be determined by the Geotechnical Engineer.

   a. One test within the Building footprints.
   b. Two tests shall be conducted within the main Basin footprint.
   c. One test shall be conducted on the south end of the main Basin structure where the equipment pads are located.
   d. One test shall be conducted within the Primary Influent Screen footprint.
   e. Other locations as designated by the Geotechnical Engineer.

5. Contractor shall provide access for testing agency to perform soil testing and inspection services for quality control during earthwork operations.

6. Fill and Backfill placement shall be observed by a qualified Engineering Technician working under the direction of the designated Geotechnical Engineer.

1.05 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 02 41 13 Selective Site Demolition, Section 31 10 00 Site Clearing, Section 31 23 16 Excavation, and Section 31 23 13 Subgrade Preparation, prior to placing fill or backfill.

B. Backfill against concrete structures only after concrete has attained compressive strength, as specified in Section 03 30 00 Cast-in-Place Concrete. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill.

C. Backfill around water-holding structures only after completion of satisfactory leakage tests as specified in Section 03 30 00 Cast-in-Place Concrete.

D. Backfill around buried tanks only after tank is set in position and anchored and exterior pipes and other equipment are in place and securely anchored.

E. Do not place granular base, sub-base, or surfacing until after subgrade has been prepared as specified in Section 31 23 13, Subgrade Preparation.

PART 2 – PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.

2. During production of imported material, test as follows:

a. Granular Fill: One Test per 2,000 CY.

B. Samples: Collected in accordance with ASTM D75:

1. During production of imported material, provide Samples as follows:

a. Granular Fill: One sample for every 2,000 CY.

2.02 EARTH FILL

A. Excavated material from required excavations free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

B. Provide imported material of equivalent quality, if required, to accomplish Work.

2.03 GRANULAR FILL

A. One-inch minus crushed gravel, sand, or crushed rock.

B. Free from dirt, clay balls, and organic material.

C. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 12 percent by weight passing No. 200 sieve.

2.04 CONTROLLED FILL

A. Cohesion-less soil containing a maximum of 12 percent by weight passing No. 200 sieve.

B. The soil shall be free of organics, deleterious material and elongated or flat particles susceptible to degradation.

C. A maximum dry density of at least 100 pcf as determined by a laboratory modified Proctor compaction test (ASTM D1557).

D. Uses classifications SP, SM, SP-SM, GP, GW, and SW.

2.05 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

2.06 BASE COURSE

A. As specified in Section 32 11 23, Aggregate Base Courses.

PART 3 – EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. All fill and backfill placement shall be observed by a qualified Engineering Technician working under the direction of the Geotechnical Engineer.

C. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation. Compact each lift to specified density prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water. Place in maximum thickness of loose fill layers of ten inches (use maximum thickness of two to four inches if hand-guided equipment (jumping jack or plate compactor) is used).

D. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

E. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

F. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:

1. Fill or backfill to an elevation two feet above top of item to be laid.

2. Excavate trench for installation of item.

3. Install bedding, if applicable, as specified in Section 31 23 23.15 Trench Backfill.

4. Install item.

5. Backfill envelope zone and remaining trench, as specified in Section 31 23 23.15 Trench Backfill, before resuming filling or backfilling specified in this section.

G. Tolerances:

1. Final Lines and Grades: Within a tolerance of one-tenth of a foot unless dimensions or grades are shown or specified otherwise.

2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

H. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

I. Use of granular and controlled fill material shall be approved by the Geotechnical Engineer. Alternate material may be designated by Geotechnical Engineer to replace soft yielding soil if deemed necessary.

3.02 BACKFILL

A. Under Site Features: Within influence area beneath sidewalks, pavements, curbs, piping, conduits, duct banks, and other site facilities, backfill with Granular Fill, unless otherwise shown. Place in lifts of 10–inch maximum thickness and compact each lift to minimum of 97 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557.

B. Under Structural Features: Within influence area beneath structural slabs and foundations, backfill with Controlled Fill, unless otherwise shown. Place in lifts of 10–inch maximum thickness and compact each lift to minimum of 97 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557.

C. Around Tanks and against Basin walls: Install Controlled Fill and place in lifts of 10–inch maximum thickness and compact each lift to minimum of 97 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557. Geotechnical Engineer shall provide allowable methods of compaction in these areas.

D. Other Areas: Backfill with earth fill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 10–inch maximum thickness and compact each lift to minimum 97 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557.

3.03 FILL

A. Outside Influence Areas and not Beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earth fills as follows:

1. Allow for four–inch thickness of topsoil where required.

2. Maximum 10–inch thick lifts.

3. Place and compact fill across full width of embankment.

4. Compact to minimum 97 percent of the modified Proctor maximum dry density, as determined in accordance with ASTM D1557.

5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

3.04 SITE TESTING

A. Gradation:

1. Frequency shall be determined by Geotechnical Engineer. At a minimum, one sample from each 1,500 tons of finished product. If variation in gradation is occurring or if material appears to depart from Specifications, more frequent sampling may be required.

2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.

3. Remove material that does not meet Specification requirements.

B. At a minimum, both in-place field density (ASTM D1556 or D2922) and compaction (ASTM D1557 or other permitted by Geotechnical Engineer) tests shall be conducted during placement of materials in accordance with the following list (except where noted otherwise). Exact locations are to be determined by the Geotechnical Engineer.

1. Two tests within the Building footprint.
2. Six tests shall be conducted within the main Basin footprint.
3. Two tests shall be conducted on the south end of the main Basin structure where the equipment pads are located.
4. Two tests shall be conducted within the Primary Influent Screen footprint.
5. One density test for every 2,000 square feet of each lift or one test per lift, whichever is greater.
6. Other locations as designated by the Geotechnical Engineer.

C. Contractor shall provide access for testing agency to perform soil testing and inspection services for quality control during earthwork operations.

3.05 GRANULAR BASE, SUBBASE, AND SURFACING

A. Place and Compact as specified in Section 32 11 23 Aggregate Base Courses and the Standard Specifications.

3.06 REPLACING OVEREXCAVATED MATERIAL

A. Replace excavation carried below grade lines shown or established by Engineer as follows:

1. Beneath footings: Controlled Fill.

2. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.

3. Beneath Slabs–On–Grade: Controlled Fill.

4. Trenches:

   a. Unauthorized Over–excavation: Granular Fill.

   b. Authorized Over–excavation: Granular Fill.

5. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):

   a. Flat to Moderate Steep Slopes (3: 1, Horizontal Run: Vertical Rise or Flatter): Earth fill.

   b. Steep Slopes (Steeper than 3:1):

      1. Correct over–excavation by transitioning between overcut areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right–of–ways, or adversely impacts existing facilities, adjacent property, or completed Work.

      2. Backfilling over–excavated areas are prohibited, unless in Engineer's opinion, backfill will remain stable, and over–excavated material is replaced as compacted earth fill.

3.07 ACCESS ROAD SURFACING

A. Place and compact as specified in Section 32 11 2, Aggregate Base Courses and the Standard Specifications.

END OF SECTION

INDEX TO

SECTION 31 23 23.15 – TRENCH BACKFILL

SECTION 31 23 23.15

TRENCH BACKFILL

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Fort Pierce Utility Authority Design and Construction Standards for Water and Wastewater System, latest edition.

2. American Public Works Association (APWA): Uniform Color Code for Temporary Marking of Underground Utility Locations.

3. ASTM International (ASTM):

   a. C33, Standard Specification for Concrete Aggregates.
   b. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   c. C 117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   d. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   e. C150, Standard Specification for Portland Cement.
   f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   g. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
   h. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft.-lbf/ft^3 (2,700 kN-mlm^3)).

4. National Electrical Manufacturers Association (NEMA): Z535.1, Safety Color Code.

1.02 DEFINITIONS

A. Base Rock: Granular material upon which manhole bases and other structures are placed.

B. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.

C. Imported Material: Material obtained by Contractor from source(s) offsite.

D. Lift: Loose (uncompacted) layer of material.

E. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.

F. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.

G. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversize material may be applied to either as compacted field dry density or maximum dry density, as determined by Engineer.

H. Selected Backfill Material: Material available onsite that Geotechnical Engineer determines to be suitable for a specific use.

I. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Manufacturer's descriptive literature for marking tapes.

B. Informational Submittals:

1. Catalog and manufacturer's data sheets for compaction equipment.

2. Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for excavated materials, except for trench stabilization material that will be submitted prior to material delivery to Site.

PART 2 – PRODUCTS

2.01 MARKING TAPE

A. Plastic:

1. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.

2. Thickness: Minimum 4 mils.

3. Width: 3 inches.

4. Identifying Lettering: Minimum one-inch high, permanent black lettering imprinted continuously over entire length.

5. Manufacturers and Products:

   a. Reef Industries; Terra Tape.
   b. Allen; Markline.

B. Metallic:

1. Solid aluminum foil, visible on unprinted side, encased in a protective high visibility, inert polyethylene plastic jacket.

2. Foil Thickness: Minimum 5.5 mils.

3. Width: 3 inches.
4. Identifying Lettering: Minimum one-inch high, permanent black lettering imprinted continuously over entire length.

5. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.

6. Manufacturers and Products:

   a. Reef Industries; Terra "D."
   b. Allen; Detectatape.

C. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities.

Color*	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable water
Purple	Reclaimed water, effluent water, irrigation, and slurry lines
*As specified in NEMA Z535.1, Safety Color Code.	

2.02 TRENCH STABILIZATION MATERIAL

A. No 57 stone (granite).

2.03 BEDDING MATERIAL AND PIPE ZONE MATERIAL

A. Granular fill as specified in Section 31 23 23 Fill and Backfill.

2.04 EARTH BACKFILL

A. Earth fills as specified in Section 31 23 23 Fill and Backfill.

B. Free from roots or organic matter, refuse, boulders and material larger than 112 cubic feet, or other deleterious materials.

2.05 GRAVEL SURFACING ROCK

A. As specified in Section 32 11 23 Aggregate Base Courses.

2.06 SOURCE QUALITY CONTROL

A. Perform gradation analysis, as specified by Geotechnical Engineer, in accordance with ASTM C136 for:

1. Earth backfill, including specified class.

2. Trench stabilization material.

3. Bedding and pipe zone material.

PART 3 – EXECUTION

3.01 TRENCH PREPARATION

A. Water Control:

1. Promptly remove and dispose of water entering trench as necessary to grade trench bottom and to compact backfill and install manholes, pipe, conduit, direct-buried cable, or duct bank. Do not place concrete, lay pipe, conduit, direct-buried cable, or duct bank in water. Control groundwater as specified in Section 31 23 19.01 Dewatering.

2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.

3. Provide continuous water control until trench backfill is complete.

B. Remove foreign material and any backfill materials that are contaminated with foreign materials that fall into trench.

3.02 TRENCH BOTTOM

A. Firm Sub grade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.

B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Engineer. Engineer will determine depth of over excavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

A. Rebuild trench bottom with trench stabilization material.

B. Place material over full width of trench in six-inch lifts to required grade, providing allowance for bedding thickness.

C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

A. Furnish imported bedding material where, in the opinion of Engineer, excavated material is unsuitable for bedding or insufficient in quantity.

B. Place over the full width of the prepared trench bottom in two equal lifts when the required depth exceeds eight inches.

C. Hand grade and compact each lift to provide a firm, unyielding surface.

D. Minimum Thickness as follows:

1. Pipe 15 Inches and Smaller: four inches.

2. Pipe 18 Inches to 36 Inches: six inches.

3. Pipe 42 Inches and Larger: eight inches.

4. Conduit: three inches.

5. Direct-Buried Cable: three inches.

6. Duct Banks: three inches.

E. Check grade and correct irregularities in bedding material. Loosen top one inch to two inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.

F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.

G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 BACKFILL PIPE ZONE

A. Upper Limit of Pipe Zone shall not be Less than Following:

1. Pipe: 12 inches, unless shown otherwise.

2. Conduit: three inches, unless shown otherwise.

3. Direct-Buried Cable: three inches, unless shown otherwise.

4. Duct Bank: three inches, unless shown otherwise.

B. Restrain pipe, conduit, cables, and duct banks as necessary to prevent their movement during backfill operations.

C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.

1. Pipe Ten-Inch Diameter and less: First lift less than or equal to pipe diameter.

2. Pipe Over Ten-Inch Diameter: Maximum six-inch lifts.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by mechanical tamping equipment, plate vibratory compaction, and or concrete vibrators to ensure that voids are completely filled before placing each succeeding lift.

E. After the full depth of the pipe zone material has been placed as specified, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls. Compact the pipe zone material to at least 95 percent of the maximum dry density, as determined by ASTM D1557.

F. Do not use power-driven impact compactors to compact pipe zone material.

3.06 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of all buried piping, on top of last lift of pipe zone material. Coordinate with piping installation Drawings.

3.07 BACKFILL ABOVE PIPE ZONE

A. General:

1. Process excavated material to meet specified gradation requirements.

2. Adjust moisture content as necessary to obtain specified compaction.

3. Do not allow backfill to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least two feet of backfill has been provided over the top of pipe.

4. Do not use power driven impact type compactors for compaction until at least four feet of backfill is placed over top of pipe.

5. Backfill to grade with proper allowances for topsoil, crushed rock surfacing, and pavement thicknesses, wherever applicable.

6. Backfill around structures with same class backfill as specified for adjacent trench unless otherwise shown or specified.

3.08 REPLACEMENT OF TOPSOIL

A. Replace topsoil in top six inches of backfilled trench.

B. Maintain the finished grade of topsoil even with adjacent area and grade as necessary to restore drainage.

3.09 MAINTENANCE OF TRENCH BACKFILL

A. After each section of trench is backfilled, maintain the surface of the backfilled trench even with the adjacent ground surface until final surface restoration is completed.

B. Gravel Surfacing Rock: Add gravel surfacing rock where applicable and as necessary to keep the surface of the backfilled trench even with the adjacent ground surface. Grade and compact as necessary to keep the surface of backfilled trenches smooth, free from ruts and potholes, and suitable for normal traffic flow.

C. Topsoil: Add topsoil where applicable and as necessary to maintain the surface of the backfilled trench level with the adjacent ground surface.

D. Concrete Pavement: Replace settled slabs as specified in Section 32 12 16 Asphalt Paving.

E. Asphaltic Pavement: Replace settled areas or fill with asphalt as specified in Section 32 12 16 Asphalt Paving.

F. Other Areas: Add excavated material where applicable and keep the surface of the backfilled trench level with the adjacent ground surface.

3.10 SETTLEMENT OF BACKFILL

A. Settlement of trench backfill, fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

END OF SECTION

INDEX TO

SECTION 31 25 00GA – EROSION AND SEDIMENTATION CONTROLS (GA)

SECTION 31 25 00GA

EROSION AND SEDIMENTATION CONTROLS (GA)

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Soil erosion, sediment, and pollution control measures shall include all temporary and permanent means of soil protection, trapping soils and containment of pollutants on the construction site during land disturbing activities. Activities covered in this section are regulated by the Manual for Erosion and Sediment Control in Georgia (latest revision) and Georgia's National Pollutant Discharge Elimination System Permit (NPDES), General Permit No. GAR100001.

B. Reporting

C. Sampling

1.2 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

B. Section 31 10 00 – Site Clearing

C. Section 33 10 00 – Water Utilities

D. Section 33 30 00 – Sanitary Sewerage Utilities

E. Section 33 40 00 – Storm Drainage Utilities

1.3 PURPOSES

A. The purpose of this section is to achieve the following goals:

1. Minimize soil exposure by proper timing of clearing grading and construction.

2. Retain existing vegetation whenever feasible.

3. Vegetate and mulch disturbed areas as soon as possible.

4. Divert runoff away from disturbed areas.

5. Minimize length and steepness of slopes when it is practical.

6. Reduce runoff velocities with check dams or surface roughing.

7. Trap sediment on site.

8. Inspect and maintain erosion, sedimentation, and pollution control measures.

9. Report on condition of Best Management Practices (BMPs).

10. Sample site run off per Georgia's NPDES Permit.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of soil erosion, sedimentation and pollution control systems products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards: Comply with all applicable Local, State, and Federal Standards pertaining to soil erosion, sedimentation, and pollution control.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instruction for soil erosion, sedimentation and pollution control materials and products.

1.6 MEASUREMENT AND PAYMENT

A. No unit measurements will be made for soil erosion control. Payment will be made at the lump sum price as shown on the bid proposal. The cost of soil erosion control shall include all equipment, labor, maintenance, monitoring, reporting, and materials necessary to comply with the State of Georgia NPDES Permit.

PART 2 – PRODUCTS

2.1 VEGETATIVE MATERIALS

A. Mulch

1. Dry straw or hay.

2. Wood chips, sawdust or bark.

3. Cutback asphalt.

B. Temporary Seeding

1. Annual Ryegrass

2. Browntop Millet

C. Permanent Seeding

1. Common Bermuda

2. Centipede

D. Sod

1. Common Bermuda

2. Centipede

3. St. Augustine

E. Fertilizer

1. Commercial 6–12–12

2.2 STRUCTURAL MATERIALS

A. Check Dam

1. Stone (2" – 10")

2. Bales of densely baled hay or straw wrapped with synthetic or wire bands (two minimum per bale).

B. Construction Exit

1. Minimum 20' x 50' x 0.5' layer of 1.5" to 3.5" stone with a geotextile underliner.

C. Filter Ring

1. Minimum 2' high stone ring. Stone shall be no smaller than 3" to 5" when utilized at storm drain inlets and pond outlets with pipe diameters less than 12".

2. Minimum 2' high stone ring. Stone shall be no smaller than 10" to 15" when utilized at storm drain inlets and pond outlets with pipe diameters greater than 12".

D. Sediment Barrier

1. Bales of densely baled hay or straw wrapped with synthetic or wire bands (two minimum per bale).

2. Silt Fence – Shall be a woven geotextile fabric sheet of plastic yarn composed of a long chain synthetic polymer with at least 85% by weight propylene, ethylene, amide, ester or vinylidene chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra–violet and/or heat exposure. The fabric shall be finished so the filaments will retain their relative position with respect to each other. The fabric shall be free of defects, rips, holes, or flaws. The manufacturer shall have either an

approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100'.

The fabric shall meet the following requirements:

Grab Strength	90 lbs.
Mullen Burst Strength	150 lbs.
UV Resistance	80 %

E. Inlet Sediment Trap

1. Silt fence (Type C) supported by steel posts.

2. Baffle Box – Constructed of 2" x 4" boards spaced a maximum of 1" apart or plywood with weep holes 2" in diameter (See detail).

3. Sod Inlet Protection – Four – 1 foot wide strips of sod on each side of the inlet (See detail).

4. Curb Inlet Protection – Eight inch concrete blocks wrapped in filter fabric, placed in front of a curb inlet.

F. Storm Drain Outlet Protection

1. Geotextile fabric equivalent to Mirafi FW700.

2. Rip–rap (See detail for size).

2.3 CHEMICAL MATERIALS

A. Dust Control – Calcium Chloride, Anionic Asphalt Emulsion, Latex Emulsion, or Resin–in–Water Emulsion.

B. Anionic Polyacrylamide (PAM) – Consult state and local laws concerning the regulations of this chemical.

PART 3 – EXECUTION

3.1 GENERAL

A. All disturbed soil areas except those to support paving shall be graded and protected from erosion with vegetative materials. Sedimentation discharge from the construction site into natural drainage ways and storm drainage systems shall be prevented by means of vegetative measures and temporary structural practices. These vegetative measures and structural practices are known as Best Management Practices (BMPs). Rainfall, pollution control measures, and construction exit condition shall be monitored and reported on each day when construction activities take place. Erosion and sedimentation control measures shall be monitored and reported on every seven days and within 24 hours of a qualifying rainfall event of 0.5 inches or more. Sampling of construction site discharging water shall be sampled within 45 minutes of a qualifying rainfall event

and analyzed immediately or no later than 48 hours after collection. The above reports shall be submitted to the Georgia EPD by the fifteenth day of the month following the reporting period.

B. The Contractor (Operator) is considered a "Primary Permittee" and shall submit a Notice of Intent (NOI) in accordance with General Permit No. [GAR100001], [GAR100002], or [GAR100003] at least 14 days prior to the commencement of construction activities. Contractor shall retain a copy of the Erosion, Sedimentation, and Pollution Control Plan and Comprehensive Monitoring Program required by above permit at construction site or be readily available at a designated alternate location from date of project initiation to date of final stabilization. Copies of all Notice of Intent, Notice of Termination, plans, monitoring reports and all other records required by above permit shall be retained by Contractor for a period of at least three years from date the site is finally stabilized. Copies of Notice of Intent (NOI), Notice of Termination (NOT) and General Permit Number GAR100001 are found at the end of this section.

3.2 ON–SITE OBSERVATION

A. Engineer is required by General Permit No. GAR100001 to check the installation of Erosion, Sedimentation and Pollution Control measures within one week after initial construction activities commence. The Contractor shall notify Engineer within 24 hours of control measures installation for the above site visit. Engineer, within the above parameters, shall check subsequent installation of control measures.

3.3 VEGETATIVE PRACTICES

A. Mulch

1. Dry straw or hay shall be applied at a depth of 2 to 4 inches by hand or mechanical equipment providing complete soil coverage. Straw or hay shall be anchored immediately after application. Straw or hay can be anchored with a disk harrow, packer disk or emulsified asphalt.

2. Wood chips, sawdust, or bark shall be applied at a depth of 2 to 3 inches by hand or mechanical equipment providing complete soil coverage. Netting of the appropriate size shall be used to anchor the above materials.

3. Cutback asphalt shall be applied at 1,200 gallons per acre or 1/4 gallon per square yard.

B. Seeding

1. Seed shall be applied uniformly by hand, cyclone seeder, drill, cultipacker seeder, or hydraulic seeder. Drill or cultipacker seeders shall place seed 1/4" to 1/2" deep. Soil shall be raked lightly to cover seed with soil if seeded by hand.

2. During times of drought, water shall be applied at a rate not causing runoff and erosion. The soil shall be thoroughly wetted to depth insuring

germination of the seed. Subsequent applications of water shall be made when needed.

3. Refer to Section 32 92 00 – Turf and Grasses for additional seeding requirements.

C. Sodding

1. Bring soil surface to final grade. Clear surface of trash, woody debris stones, and dirt clods larger than 1". Mix fertilizer into soil surface. Apply sod to soil when surface is not muddy or frozen. Lay sod with tight joints and in straight lines. Do not overlap joints. Stagger joints and do not stretch sod. On slopes steeper than 3:1, sod shall be anchored with pins or other approved methods. Installed sod shall be rolled or tamped to provide good contact between sod and soil. Irrigate sod and soil to a depth of 4" immediately after installation. Irrigation shall be used to supplement rainfall for a minimum of 2–3 weeks.

2. Refer to Section 32 92 00 – Turf and Grasses for additional sodding requirements.

3.4 STRUCTURAL MEASURES

A. Check Dam

1. Stone – Shall be constructed of graded size 2–10 inch stone underlayed with a geotextile fabric. Mechanical or hand placement shall be required to insure complete coverage of entire width of ditch or swale and center of dam is lower than edges. Sediment shall be removed when it reaches a depth of one–half the original dam height or before.

2. Haybale – Shall be staked and embedded a minimum of 4" and may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. They should not be used where the drainage area exceeds one acre. Sediment shall be removed when it reaches a depth of one–half the original dam height or before.

B. Construction Exit

1. A stone stabilized pad shall be located at any point where traffic will be leaving the construction site to a public right–of–way, street, alley, sidewalk, parking area or any other area where there is a transition from bare soil to a paved area. The pad shall be constructed of 1.5" to 3.5" stone, having a minimum thickness of 6" and not less than 20' wide and 50' long. The pad shall be underlayed with a geotextile fabric. The pad shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights–of–way. This may require periodic top dressing with 1.5" to 3.5" stone. All materials spilled, dropped, washed, or tracked from vehicles or site onto roadways or into storm drains must be removed immediately.

C. Filter Ring

1. Shall surround all sides of the structure receiving runoff from disturbed areas. It shall be placed a minimum of 4' from the structure. It may also be used below storm drains discharging into detention ponds, creating a centralized area for sediment accumulation. When utilized below a storm drain outlet, it shall be placed such that it does not create a condition causing water to back–up into the storm drain and inhibit the function of the storm drain system. The larger stone can be faced with smaller filter stone on the upstream side for added sediment filtering capabilities. Mechanical or hand placement of stone shall be required to uniformly surround the structure.

2. Filter ring must be kept clear of trash and debris. This requires continuous monitoring and maintenance, which includes sediment removal when one–half full. Filter rings are temporary and should be removed when the site has been stabilized.

D. Sediment Barrier

1. Hay or straw bales may be used in areas of low sheet flow rates. They shall not be use if the project duration is expected to exceed three months. Bales shall be placed in a single row, lengthwise, and embedded in the soil to a depth of 4". Bales must be securely anchored in place by stakes or bars driven through the bales or by other acceptable means to prevent displacement. Bales shall be placed so the binding wire or twine around the bale will not touch the soil. Sediment shall be removed once it has accumulated to one–half the original height of the barrier. Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed. The slope lengths contributing runoff to a bale barrier cannot exceed those listed below.

Land Slope (Percent)	Maximum Slope Length Above Bale (Feet)
< 2	75
2 to 5	50
5 to 10	35
10 to 20	20
> 20	10

2. Silt fence may be used in areas of higher sheet flow rates. The drainage area shall not exceed ¼ acre for every 100' of silt fence. **Silt fence shall not be installed across streams, ditches, waterways or other concentrated flow areas.** Silt fence shall be installed according to this specification, as shown on the construction drawings or as directed by the Engineer. See details on the construction drawings for installation requirements.

   a. Type A – A 36" wide filter fabric silt fence shall be used on construction sites where the life of the project is greater than or equal to six months.

b. Type B – A 22" wide filter fabric silt fence shall be limited to use on minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than six months.

c. Type C – A 36" wide filter fabric silt fence with wire reinforcement shall be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10'. Along stream buffers and other sensitive areas, two rows of Type C silt fence or one row of Type C silt fence backed by hay bales shall be used.

3. Where all runoff is to be stored behind the silt fence (where no stormwater disposal system is present), the slope lengths contributing runoff to a silt fence barrier cannot exceed those listed below.

Land Slope (Percent)	Maximum Slope Length Above Fence (Feet)
< 2	100
2 to 5	75
5 to 10	50
10 to 20	25
> 20*	15

*In areas where the slope is greater than 20%, a flat area length of 10' between the toe of the slope and the fence shall be provided.

4. Sediment shall be removed once it has accumulated to one–half the original height of the barrier. Filter fabric shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months). Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed.

E. Inlet Sediment Trap

1. Shall be installed at or around all storm drain inlets receiving runoff from disturbed areas. Sediment traps must be self draining unless they are otherwise protected in an approved manner that will not present a safety hazard. The drainage area entering the inlet sediment trap shall be no greater than one acre. Sediment traps may be constructed on natural ground surface, on an excavated surface or on machine compacted fill provided they have a non–erodible outlet.

2. Type C silt fence supported by steel posts may be used where the inlet drains a relatively flat area (slope no greater than 5%) and shall not apply to inlets receiving concentrated flows, such as in street or highway medians. The stakes shall be spaced evenly around the perimeter of the inlet a maximum of 3' apart and securely driven into the ground,

approximately 18" deep. The fabric shall be entrenched 12" and backfilled with crushed stone or compacted soil. Fabric and wire shall be securely fastened to the posts and fabric ends must be overlapped a minimum of 18" or wrapped together around a post to provide a continuous fabric barrier around the inlet. The trap shall be inspected daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one–half the height of the trap. **Sediment shall not be washed into the inlet.** It shall be removed from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

3. A baffle box shall be used for inlets receiving runoff with a higher volume or velocity. The box shall be constructed of 2" x 4" boards spaced a maximum of 1" apart or of plywood with weep holes 2" in diameter. The weep holes shall be placed approximately 6" on center vertically and horizontally. The entire box shall be wrapped in Type C filter fabric that is entrenched 12" and backfilled. Gravel shall be placed around the box to a depth of 2" to 4". The trap shall be inspected daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one–half the height of the trap. **Sediment shall not be washed into the inlet.** It shall be removed from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

4. Sod Inlet Protection shall be used only at the time of permanent seeding, to protect the inlet from sediment and mulch material until permanent vegetation has become established. The sod shall be place to form a turf mat covering the soil for a distance of 4' from each side of the inlet structure. Sod strips shall be staggered so adjacent strip ends are not aligned. Re–sod areas where an adequate stand of sod is not obtained. New sod should be mowed sparingly. Grass height should not be less than 2" to 3".

5. Curb Inlet Protection shall be used on curb inlets receiving runoff from disturbed areas once pavement has been installed. Place 8" concrete blocks wrapped in filter fabric in front of the curb inlet opening. A gap of approximately 4" shall be left between the inlet filter and the inlet to allow for overflow and prevention of hazardous ponding in the roadway. **This method of inlet protection shall be removed if a safety hazard is created.** Sediment shall be removed from curb inlet protection immediately.

F. Storm Drain Outlet Protection

1. Outlet protection aprons shall be constructed at all storm drain outlets, road culverts, paved channel outlets discharging into natural or constructed channels. Apron will extend from end of the conduit, channel, or structure to the point of entry into an existing stream or publicly maintained drainage system. Apron length, width, and stone size shall conform to details on the construction drawings. Apron shall be constructed with no slope along its length. Invert elevation of the downstream end of apron shall be equal to the elevation of the receiving channel invert. There shall be no overfall at the end of apron. Apron shall be located so there are no bends in the horizontal alignment.

2. Subgrade for geotextile fabric and rip–rap shall follow required lines and grades shown on the construction drawings. Compact any subgrade fill required to the density of surrounding undisturbed material. Low areas in subgrade on undisturbed soil may also be filled by increasing rip–rap thickness. Geotextile fabric shall be protected from punching or tearing during installation. Repair any damage by removing rip–rap and placing another piece of fabric over the damaged area. All connecting joints shall overlap a minimum of 1'. If damage is extensive, replace entire geotextile fabric. Rip–rap shall be placed by equipment or hand. Minimum thickness of rip–rap shall be 1.5 times the maximum stone diameter. Immediately after construction, stabilize all disturbed areas around apron with vegetation.

3. Check outlet apron after heavy rains to see if any erosion around or below the rip–rap has taken or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

3.5 CHEMICAL MEASURES

A. Dust Control

1. Dust raised from vehicular traffic shall be controlled by wetting down roads with water or by the use of chemicals. Chemicals shall be applied in accordance with the manufacturer's recommendations.

B. Soil Binding

1. This temporary practice is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. **This temporary practice is not intended for application to surface waters of the state.** It is intended for application within construction storm water ditches and storm drains that feed into previously constructed sediment ponds or basins.

2. Anionic Polyacrylamide (PAM) is available in emulsions, powders, gel bars, and logs. It is required that other Best Management Practices be used in combination with anionic PAM. The use of seed and mulch for additional erosion protection beyond the life of anionic PAM is recommended. Use 50' setbacks when applying anionic PAM near natural water bodies. Never add water to PAM, add PAM slowly to water. If water is added to PAM, globs can form which can clog dispensers. This signifies incomplete

dissolving of PAM and therefore increases the risk of under application. Application rates shall conform to manufacturer's guidelines. **The maximum application rate of PAM, in pure form, shall not exceed 200pounds/acre/year.** Contractors using anionic PAM shall obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations. Gel bars and logs of anionic PAM mixtures may be used in ditch systems. This application shall meet the same testing requirements as anionic PAM emulsions and powders. Maintenance will consist of reapplying anionic PAM to disturbed areas, including high traffic areas, which interfere in the performance of this practice.

3.6 MONITORING AND REPORTING

A. Each day, when any type of construction activity takes place on the construction site, Contractor's qualified personnel shall monitor and record rainfall, inspect all areas where petroleum products are stored, used or handled for spills and leaks from vehicles and equipment and check all locations where vehicles enter or exit the site for evidence of off site sediment tracking. These inspections shall be conducted until a Notice of Termination (NOT) is submitted. For linear construction where a phased activity is conducted, this paragraph applies to the active phase(s) of work.

B. Once every seven calendar days and within 24 hours of the end of a storm 0.5 inches or greater, Contractor's qualified personnel shall inspect disturbed areas of the construction site that have not undergone final stabilization, areas used for storage of materials that are exposed to precipitation that have not undergone final stabilization and structural control measures (BMPs). Erosion and sediment control measures identified in the Erosion, Sedimentation, and Pollution Control Plan shall be observed to ensure 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). These inspections must be conducted until a Notice of Termination is submitted. For linear construction where a phase activity is conducted, this paragraph applies to the active phase(s) of work.

C. Contractor's qualified personnel shall inspect a least once per month during the term of the General Permit, areas of the construction site having undergone final stabilization. These areas hall be inspected for evidence of, or the potential for, pollutants entering the drainage system and receiving water(s). Erosion and sediment control measure shall be observed to ensure they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measure are effective in preventing significant impacts to receiving water(s). For linear construction, monthly inspections in accordance with this paragraph shall be made for those phases on which final stabilization has been completed.

D. Contractor shall prepare a report summarizing the scope of inspections, name(s) of qualified personnel making the inspections, date(s) of inspections, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan and any actions taken. This report shall be retained on the construction site or be readily available at a designated alternate location until the entire site or portion of a construction project that was phased, has undergone final stabilization and a Notice of Termination (NOT) is submitted to

EPD. Such reports shall identify any incidents of non–compliance. Where the report does not identify any incidents of non–compliance, the re report shall contain a certification that the facility is in compliance with the Erosion, Sedimentation and Pollution Control Plan and the General Permit. The report shall be signed in accordance with the General Permit.

3.7 SAMPLING AND ANALYSIS

A. Contractor must manually or automatically sample in accordance with the Comprehensive Monitoring Plan (CMP) at least once for each rainfall event described below. For a qualifying event, samples must be taken within forty–five (45) minutes of:

1. The accumulation of the minimum amount of rainfall, if the storm water discharge to a monitored receiving water or from a monitored outfall has begun at or prior to the accumulation.

2. The beginning of any storm water discharge to a monitored receiving water or from a monitored outfall, if the discharge begins after the accumulation of the minimum amount of rainfall.

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

B. Sampling shall occur for the following events:

1. For each area of the site discharging to a receiving stream, the first rain event reaching or exceeding 0.5 inch and allows for monitoring during normal business hours* (Monday thru Friday, 8:00 a.m. to 5:00 p.m. and Saturday 8:00 a.m. to 5:00 p.m. when construction activity is being conducted by the Primary permittee) occurring after all clearing and grubbing operations are completed in the drainage area of the location selected as the sampling location;

2. In addition to (1) above, for each area of the site discharging to a receiving stream, the first rain event reaching or exceeding 0.5 inch and allows for monitoring during normal business hours* occurring either 90 days after the first sampling event or after all mass grading operations are completed in the drainage area of the location selected as the sampling location, whichever comes first.

3. At the time of the sampling performed pursuant to (1) and (2) above, if BMPs are found to be properly designed, installed, and maintained, no further action is required. If BMPs in any area of the site discharging to a receiving stream are not properly designed, installed, and maintained, corrective action shall be defined and implemented within two business days, and turbidity samples shall be taken from discharges of the same area for each subsequent rain event reaching or exceeding 0.5 inch during normal business hours* until the selected turbidity standard is

attained, or until post–storm event inspections determine BMPs are properly designed, installed, and maintained;

4. Existing construction activities, i.e., those occurring on or before the effective date of this permit, having met the sampling required by (1) above shall sample in accordance with (2). Those existing construction activities having met the sampling required by (2) above shall not be required to conduct additional sampling other than as required by (3) above.

   * Note the Permittee may choose to meet the requirements of (1) and (2) above by collecting turbidity samples from any rain event reaching or exceeding 0.5 inch and allows for monitoring at any time of the day or week.

5. For linear construction, if at any time during the life of the project, BMPs have not been properly designed, installed or maintained for the construction activities that discharge into a receiving water which is not being sampled, the Contractor shall sample that receiving water for the first rainfall event greater than or equal to 0.5 inches thereafter and for every rainfall event greater than or equal to 0.5 inches until BMPs are properly designed, installed and maintained.

C. Sampling shall be collected by "grab samples" and the analysis of these samples must be conducted in accordance with methodology and test procedures established in the General Permit. Sample containers shall be labeled prior to collecting the samples. Samples shall be well mixed before transferring to a secondary container. Large mouth, well cleaned and rinsed glass or plastic jars shall be used for collecting samples. The jars shall be cleaned thoroughly to avoid contamination. Manual or automatic sampling shall be utilized. Samples required by the General Permit shall 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. Samples are not required to be cooled. Samples taken for the purpose of compliance with the General Permit shall be representative of the monitored activity and representative of the water quality of the receiving water(s) and/or the storm water outfalls using the following minimum guidelines:

1. The upstream sample for each receiving water(s) must be taken immediately upstream of the confluence of the first storm water discharge from the permitted construction site but downstream of any other storm water discharges not associated with the site. Where appropriate, several upstream samples from across the receiving water(s) may need to be taken and the average turbidity of these samples used for an upstream turbidity value.

2. The downstream sample for each receiving water(s) must be taken downstream of the confluence of the last storm water discharge from the construction site but upstream of any other storm water discharge not associated with the site. Where appropriate, several downstream samples

from across the receiving water(s) may need to be taken and the average turbidity of these samples used for a downstream turbidity value.

3. Samples shall be taken from the horizontal and vertical center of the receiving water(s) or the storm water outfall channel(s).

4. Care shall be taken to avoid stirring the bottom sediments in the receiving water(s) or in the outfall storm water channel(s).

5. Sampling container shall be held so the opening faces upstream.

6. Samples shall be kept from floating debris.

D. For all construction sites and common developments other than linear construction projects, the Contractor shall sample all receiving water(s), or all outfall(s) or a combination of receiving water(s) and outfall(s). For linear construction projects, the Contractor must sample all perennial and intermittent streams and other water bodies shown on an 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.

E. Contractor shall provide and implement all safety equipment and procedures necessary for sampling during hazardous weather conditions and in the event of biological, chemical or physical hazards

F. Contractor shall submit a summary of the monitoring results to the EPD at the address shown in the General Permit by the fifteenth day of the month following the reporting period. For a monitoring period during which no qualifying rainfall events occur, a monitoring report must be submitted stating such. Monitoring periods are calendar months beginning with the first month after the effective date of the General Permit. Monitoring reports shall be signed in accordance with the General Permit and submitted to EPD until such time as a NOT is submitted.

G. Contractor must retain copies of all monitoring results and monitoring information reported. In addition to other record keeping requirements, the monitoring information shall include:

1. Date, exact place, and time of sampling or measurements.

2. Name(s) of the individual(s) who performed the sampling and measurements.

3. Date(s) analyses were performed.

4. Time(s) analyses were initiated.

5. Name(s) of the individual(s) who performed the analyses.

6. References and written procedures, when available, for the analytical techniques or methods used. A quality control/quality assurance program must be included in the written procedures.

7. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, used to determine these results.

8. Results exceeding 1,000 NTU shall be reported as "Exceeds 1,000 NTU."

H. Suggested monitoring and report forms are found at the end of this section.

End of Section

INDEX TO

SECTION 31 31 16 – TERMITE CONTROL

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following for termite control:

1. Soil treatment.

1.03 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

E. Test Results: Furnish written test results, performed by the State Department of Fertilizer and Pest Control, showing that treatment meets requirements of specifications.

F. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance. All termite pesticides shall be provided in strict accordance to South Carolina Pesticide Control Act [SC Law 46-13 and amendments] and Federal Regulations. The contractor shall notify Clemson University Pesticide Regulation and Controls program prior to beginning of treatment and application. Applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

C. Standards for Application: Current edition of Georgia Division of Regulatory and Public Service Programs Standard 27-1085.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

B. Soil Moisture:

1. Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

1.06 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.07 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion. Warranty shall be transferred to the Owner.

D. Monitoring and Continued Service: Monitoring and continued service with applicator shall be responsibility of the Owner after the first year from the date of submittal completion.

1.08 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions and terms for agreement period and for future renewal options.

1.9 SAFETY REQUIREMENTS

A. The Contractor shall formulate, treat, and dispose of termiticides and their containers in accordance with label directions and regulatory requirements. Use the clothing and personal protective equipment specified on the labeling for use during all phases of the application.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

B. Storage

1. Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

C. Handling

1. Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.11 INSPECTION

A. Termiticides shall be inspected upon arrival at the job site for conformity to type and quality. Each label shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

PART 2 – PRODUCTS

2.01 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

1. Use compatible dye in termiticide solution to provide visible evidence of treatment.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BASF Corporation, Agricultural Products; Termidor.

2. Bayer Environmental Science; Premise 75.

3. Control Solutions, Inc.; Bifen I/T.

4. FMC Corporation, Agricultural Products Group; Talstar.

5. Syngenta; Probuild TC.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.04 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Masonry: Treat voids.

4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.05 VERIFICATION OF MEASUREMENT

A. Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.06 CLEAN UP, DISPOSAL, AND PROTECTION

A. Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

1. Clean Up

   a. The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed offsite.

2. Disposal of Termiticide

   a. The Contractor shall dispose of residual termiticides and containers off Owner property, and in accordance with label instructions and EPA criteria.

3. Protection of Treated Area

   a. Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed.

3.07 CONDITIONS FOR SATISFACTORY TREATMENT

A. Equipment Calibrations and Measurements

1. Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

B. Testing

1. Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

C. Disturbance of Treated Soils

1. Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

D. Termites Found Within the Warranty Period

1. If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.08 RE-TREATMENT

A. Where re-treatment is required, the Contractor shall:

1. Re-treat the soil and/or perform other treatment as necessary for prevention or elimination of subterranean termite infestation.

2. Repair damage caused by termite infestation.

END OF SECTION

INDEX TO

SECTION 31 62 13 – PRESTREESED CONCRETE PILES

SECTION 31 62 13

PRESTRESSED CONCRETE PILES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Prestressed precast concrete piles.

1.2 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Section 312313 – Subgrade Preparation

C. Section 033000 - Cast-In-Place Concrete

D. Section 316244 – Pile Load Test

1.3 REFERENCES (LATEST REVISION)

A. AASHTO M 203 – Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

B. ACI 301 – Specifications for Structural Concrete.

C. ACI 543R – Recommendations for Design, Manufacture and Installation of Concrete Piles.

D. ASTM A 706 – Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

E. PCI JR 382 – Recommended Practice for Design, Manufacture, and Installation of Prestressed Concrete Piling.

F. PCI MNL-116 – Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.4 MEASUREMENT AND PAYMENT

A. Production Piles:

1. Base proposal on the number and length of piles indicated on construction drawings.

2. Accepted piles will be paid for at the contract price per unit length for the piles procured.

3. Contract pricing shall include a lump sum cost of the project which shall include the cost of piles. A unit price per length for piles shall also be included with the contract pricing and shall be used for pile length adjustments (if needed) or changes in pile quantities.

B. Payment for piles shall constitute full compensation for all costs of furnishing, driving, jetting, spudding, and cutting off of piles, disposing of cut-offs, furnishing, placing and removing temporary bracing required to hold piles in alignment, and other work necessary to complete the project as specified herein.

1.5 PERFORMANCE REQUIREMENTS

A. Drive piles under equipment/operations building to a depth capable of supporting an axial load of 60 tons. Pile lengths stated on the drawings are assumed to achieve the needed capacity. This is to be confirmed through results of pile testing. Test piles shall be 5 feet longer.

B. Drive piles under water treatment structure basins to a depth capable of supporting an axial load of 30 tons. Pile lengths stated on the drawings are assumed to achieve the needed capacity. This is to be confirmed through results of pile testing. Test piles shall be 5 feet longer.

C. Design piles to resist the following:

1. Piles under equipment / operations building: axial load of 60 tons and lateral load of 11 tons (factored loads).

2. Piles under water treatment structure basins: axial load of 30 tons and lateral load of 5 tons (factored loads).

D. If precast designer requires additional design information, precast designer shall contact engineer.

1.6 SUBMITTALS

A. Pile Installation Plan: At least 30 days prior to installation, Contractor shall submit a Pile Installation Plan to the Engineer for approval. Pile Installation Plan shall include the following:

1. List of proposed installation equipment including cranes, driving equipment, jetting equipment, compressors, hammers and pre-drilling equipment. Include manufacturer's data sheets with submittal.

2. Methods to determine hammer energy or stroke in the field for determination of pile capacity. Include the necessary charts and recent calibrations for any pressure measuring equipment and method for monitoring pile advancement.

3. Details of proposed load test equipment and procedures including recent calibrations of jacks and required load cells.

4. Shop drawings of piles indicating fabrication details, reinforcement, dimensions and pick points.

5. Drawings of templates and followers (if permitted).

6. Sequence of driving.

7. Methods and equipment proposed to prevent displacement of piles during placement and compaction of fill within 20 feet of piles.

B. Pile Load Test Reports: The results of which will determine the final pile length for procurement of the remaining production piles.

C. Record of Driving: Within three (3) days of installation, submit a complete report of each pile driven to include:

1. Sizes, lengths, locations, and batters (if any) of piles.

2. Make and type of hammer.

3. Driving energy of each hammer blow.

4. Number of blows per foot of penetration for entire length of pile and set for the last 10 blows.

5. Final tip and butt elevations.

6. Piles requiring drilling and the hole diameters.

1.7 QUALITY ASSURANCE

A. Concrete work shall conform to all requirements of ACI 301 and PCI MNL-116.

B. Manufacture and transportation of prestressed concrete piles shall be by a company having not less than three (3) years' experience in the manufacture of prestressed concrete structural components of equivalent type, size and complexity to those included herein. Upon Engineer's request, the manufacturer shall show successful completion documentation of similar and comparable work.

C. Plant organization and manufacturing procedures shall conform to PCI MNL-116 and plant shall be certified by the PCI Certification Program.

D. Plant Inspection:

1. Plants shall be subject to Engineer's, Owner's, or Owner's Representatives inspection to confirm compliance with the specifications.

2. The Engineer shall be given ample notice before the beginning of work so all of plant facilities involved in production can be inspected. No member shall be manufactured until all facilities are approved.

3. Engineer shall be allowed free access to all parts of the production process premises.

4. Engineer will have the authority to reject materials or workmanship that does not meet contract specifications.

5. Acceptance of any material or finished members by the Engineer shall not prevent them from being rejected later if they are found to be defective. Rejected material and workmanship shall be replaced promptly or made good at the Contractor's expense.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with minimum five (5) years' documented experience.

B. Design of piles, components and subsequent shop drawings shall be completed by and sealed by a professional engineer registered in the state of the project.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene two (2) weeks prior to commencing pile driving activities.

1.10 SCHEDULING

A. Schedule work under the provisions of Section 01300.

B. Engineer shall be provided with pile installation schedule at the pre-installation conference. Changes to the pile installation schedule shall be submitted to the Engineer as soon as possible.

C. Schedule Work to perform driving during 8:00a.m. and 6:00p.m, unless other arrangements are made with the Owner.

D. Schedule test piles with all necessary parties, including owner, testing agency and engineer.

PART 2 – PRODUCTS

2.1 PILES

A. Piles shall be provided in accordance with the following: ACI 543R – Recommendations for Design, Manufacture and Installation of Concrete Piles, PCI JR 382 – Recommended Practice for Design, Manufacture, and Installation of Prestressed Concrete Piling and PCI MNL-116 – Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

B. Piles shall be manufactured by a plant certified by the PCI Certification Program.

2.2 MATERIALS

A. Concrete: Minimum 5,000 psi 28-day strength, Normal Portland cement; aggregates and sand as recommended by pile manufacturer.

B. Tensioning Steel Tendons: AASHTO M 203, Grade 270k, of sufficient strength commensurate with member design.

C. Reinforcing Steel: ASTM A706 Grade 60.

2.3 FABRICATION

A. Pile Points: Hardened steel, hollowed tip to minimize bounce or deflection.

B. Pile Connectors: Fabricated of steel angles, fitted to square pile ends outside dimensions.

C. Shop fabricate pile in maximum practical lengths to meet design requirements.

2.4 SOURCE QUALITY CONTROL

A. Provide shop testing and inspection of piles under provisions of Section 01400.

B. Test sample piles in accordance with PCI MNL-116.

2.5 DRIVING EQUIPMENT

A. Hammers: Piling shall be driven with power hammers of approved make and model, steam or air hammers shall be furnished with boiler or air compressor capacity and hose sizes at least equal to those specified by the hammer manufacturer. The boiler or compressor shall be equipped with an accurate pressure gauge at all times. Power hammers shall be maintained in such condition so length of stroke and blows per minute are obtained as specified by the manufacturer. Driving resistance values computed when these requirements are not met will be considered invalid and driving operations shall cease until corrective measures are taken. Vibratory pile driving equipment shall not be used. Power hammers shall develop an energy per blow of at least one foot-pound for each pound of pile weight, but not less than 15,000 foot-pounds. Driving conditions may necessitate the use of hammers developing more energy than required minimum, but, for purpose of ascertaining required driving resistance, Contractor will not be required to furnish a hammer having more than a minimum manufacturer's energy rating of 22,400 foot-pounds.

B. Leads: Pile driving rigs shall be equipped with leads constructed in a manner to afford freedom of movement for the hammer and to provide adequate pile support during driving. Vertical axis of leads and hammer shall coincide with the vertical axis of the pile. Leads shall be of sufficient length and rigidity to hold the pile in accurate alignment while being driven. However, the driving rig shall be capable of making minor adjustments in positioning leads, to compensate for minor changes in direction while driving.

C. Followers: The driving of piling by means of followers must be approved by the Engineer prior to implementation.

PART 3 – EXECUTION

3.1 PREPARATION

A. It shall be the Contractor's responsibility to verify site conditions will support proposed driving equipment.

B. Contractor shall use a driving method at all times, which will not cause damage to nearby structures. No piles shall be driven within 20 feet of concrete less than seven (7) days old unless so directed by the Engineer.

C. Notify adjacent and affected land owners and building occupants with 30 days notice before proceeding with the work.

D. Do not ship piles prior to the completion of a 72-hour (min) curing period and attainment of the required 28-day strength.

3.2 PROTECTION OF PILES DURING DRIVING

A. A structural steel driving head/helmet suitable for the type and size of pile being driven shall be used. It shall adequately hold the pile in proper positioning for driving. It shall be constructed to prevent undue damage to the pile and transmit hammer energy along pile axis. Suitable hammer cushion shall be used above driving head / helmet as necessary to prevent damage to the pile. Do not use wood chips, wood blocks, rope or other material which permits excessive loss of hammer energy. Driving head / helmet shall fit loosely around pile head, enabling pile to rotate slightly without binding.

B. A suitable pile cushion shall also be provided for the top of the pile. It shall be made of a material which will not compress to such an extent the cushioning effect is lost. Pile cushion shall be replaced if, through pile driving, it is compressed to more than one-half original thickness.

3.3 PILE DRIVING

A. Extreme care shall be exercised in the locating and driving of piles so that no other piles, utilities or existing structures are damaged in the process.

B. Plan Driving Objective (PDO): Driving of all piles shall be continuous without interruption until the PDO is obtained. The PDO has these minimum requirements to be obtained during pile driving:

1. The minimum driven length of piles shall be as indicated on the drawings. Test piles shall be 5 feet longer than that specified.

2. The Driving Resistance per pile shall be as stated in this Specification, Section 1.5, Performance Requirements.

C. Drive piles at any time after the concrete has been cured in accordance with PCI MNL-116 and the concrete compressive strength is equal to or greater than the specified 28-day strength.

D. Templates shall be required for all pile driving systems except where fixed leads are utilized.

E. Removal of Obstacles: Unless otherwise permitted, underground obstructions that prevent attainment of the PDO shall be removed or cut-out. Removal or cutting will

be measured and paid for at a price mutually agreed upon by the Owner and Contractor.

F. Practical Refusal: 2.5 times the design bearing capacity with a minimum penetration of 40'-0" below existing grade. When point of refusal is reached during pile driving before attaining PDO, care shall be taken to avoid damaging the pile by overdriving.

G. Jetting: Jetting shall not be used on this project.

H. Drilling / Augering: If conditions warrant the need for pre-drilling or augering prior to driving piles, Contractor shall submit a request with explanation to Engineer for approval.

I. Protection: Piling shall not be subjected to excessive tensile stresses due to the combination of a particular hammer with the given soil conditions, such as may occur when driving a long pile through soft material or when hard driving resistance is encountered at the tip of a long pile. When such damage occurs, the Contractor shall make such changes as necessary to provide undamaged piling in place. If such damage occurs, the Engineer may require:

1. Reduced energy delivered to the pile. This may be reduced stroke, change in cushioning, or a lighter ram.

2. Equivalent energy, but with a heavier or lighter ram with a different stroke.

3. Smaller hammer for the easier initial driving.

4. Jetting may be considered.

J. Delay: When driving is interrupted before final penetration is reached, drive an additional 12 inches before resuming recording or performance data.

K. Back-Driving: In the event uplift of a previously driven pile occurs due to driving of adjacent piles or soil uplift, the pile shall be back-driven to its original penetration.

L. Followers may be used upon approval of the Engineer. Cross sectional area of the follower must be at least 18% of the cross-sectional area of the pile. Followers must maintain the alignment of the pile and hammer and must allow the pile to be driven within allowable tolerances.

3.4 TOLERANCES

A. Maximum Variation from Vertical for Plumb Lines: 1 in 48.

B. Maximum Variation from Required Angle for Batter Piles: 1 in 24.

C. Maximum Variation from Pile Cut-Off Elevation: 4 inches, provided specified embedment in pile cap is achieved.

D. Maximum Out-of-Position: 3 inches for any one pile. The sum of any two piles shall not exceed 5 inches.

E. Pile butts shall not be pulled into required location more than 2 inches.

3.5 LOAD CAPACITY

A. Approximate load capacity of all piles shall be determined by evaluation of driving resistance, regardless of the PDO requirements. Driving resistance will be determined by the following formulas:

For Single-Acting Hammers: $DR = \frac{2\,WH}{S + 0.1}$

For Double-Acting Hammers: $DR = \frac{2\,(W + AP)H}{S + 0.1}$

Where:

DR = Driving resistance in tons

W = Weight of striking part of hammer in tons

H = Height of fall in feet, 10-feet maximum.

A = Area of piston in square inches

P = Pressure at the hammer in tons per square inch

S = Average penetration in inches per blow for the last 10 to 20 blows

Above formulas are applicable only when hammer has a free fall, head of the pile is not cracked or crushed, penetration is at a uniform rate, and a follower is not used.

3.6 CUTOFFS, SPLICES, AND EXTENSIONS

A. All piling shall be driven to or cut off at the required elevation at a right angle to the axis of the pile. Piling driven below this elevation shall be spliced and extended in accordance with SCDOT standard details.

B. Concrete at the end of pile to be extended shall be cut back a required amount leaving pre-stressed strand exposed. Final cut shall be at right angle to the pile axis. Cutting shall be performed in a manner to avoid spalling or damaging the pile below cut-off elevation. In case of such damage, the pile shall be replaced or damage remedied by further cut back as determined by the Engineer at Contractor's expense. Cutting may be performed with pneumatic tools, saws, or other approved methods. In no case shall explosives be used.

C. Formwork necessary for the extension shall be built, placed, and braced with special care to obtain true alignment and to prevent leakage at the construction joint.

D. Just prior to placing new concrete, the cut area shall be thoroughly wetted and then covered with a thin coating of cement paste.

E. Extensions are not permitted for this project.

3.7 NON-CONFORMING PILES

A. Non-conforming piles are any piles that fail to meet material certification, are driven out of position, are driven below the specified cut-off elevation, or are damaged by reason of internal defects or by improper driving.

B. Non-conforming piles shall be corrected at Contractor's expense by one or more of the following methods, as directed by the Engineer:

1. Extract the pile and replace it with a new pile.

2. Drive a new pile adjacent to the defective pile.

3. Extend footing or cap concrete to embed the pile properly, and make required changes to bar reinforcement steel.

4. Delay the work pending a design analysis. Corrections specified by the Engineer shall be made. Delay will be considered as incidental to the work.

C. Cracks that develop in a pile which do not warrant classifying the pile as defective shall be sealed with an approved epoxy crack sealer placed as directed, at no cost to the Owner. The Engineer will be solely responsible for determining if a pile shall be classified as defective.

3.8 FIELD QUALITY CONTROL

A. Field observation will be performed under provisions of Section 014500, Quality Control.

B. At the Owner's expense, the Special Inspector shall inspect piles prior to installation, conduct all pile testing, and maintain records of blow counts throughout installations. Contractor is responsible for scheduling testing agency for Special Inspection services.

C. Contractor shall be responsible for payment to testing agency if it is the Contractor's fault that Special Inspection services are requested and not needed. Some examples of this are schedule mishaps, equipment malfunction, subcontractor failure to perform, etc. This does not include delays or cancellations due to acts of God or inclement weather.

D. Test piles shall be production piles.

END OF SECTION

INDEX TO

SECTION 31 62 44 – PILE LOAD TEST

SECTION 316244

PILE LOAD TESTS

PART 1 – GENERAL

1.1SECTION INCLUDES

A. Pile load testing with documented results.

1.2 RELATED SECTIONS

A. Section 316213 – Concrete Piles.

1.3 REFERENCES (LATEST REVISION)

A. ASTM D 4945 – Standard Test Method for High–Strain Dynamic Testing of Deep Foundations.

1.4 MEASUREMENT AND PAYMENT

A. Test Piles:

1. Accepted test piles required by the plans shall be included in the lump sum price of the project. Payment includes set–up, applying test load, test equipment, monitoring, and reporting results.

2. It is intended that test piles will be production piles.

B. The cost of testing of piles shall be borne by the Owner, included in the scope of services for the special inspector. Owner is not responsible for any additional costs incurred as a result of Contractor's mistakes or unpreparedness for testing procedures.

1.5 SUBMITTALS

A. Equipment and Test Data: Indicate test method and equipment, load type, and calibration equipment.

B. Dynamic Pile Test Report: Following completion, submit to Engineer.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with ASTM D 4945.

B. Maintain one (1) copy of document on site during testing.

1.7 QUALIFICATIONS

A. Monitor test pile placement and elevations under direct supervision of a Registered Land Surveyor experienced in design of this work and licensed in the state where the project is located.

B. Testing shall be performed by the agency performing special inspections.

1.8 SEQUENCING

A. Sequence work to allow other excavations and site work during testing.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Equipment Type, Load Carrying Device, Load, and Instrumentation: Conform to ASTM D 4945 and use same type as will be used for installation of all other piles.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify site conditions will support loads and equipment necessary for testing purposes. Submit documents to support verification.

3.2 PREPARATION

A. Establish stable working elevation for test equipment.

3.3 TESTING

A. Following installation of test piles, allow test piles to sit idle for 7 days for set–up. Following set–up, perform Dynamic Load Testing using a Pile Dynamic Analyzer (PDA).

B. Load test the following:

1. WWTP Basins/Building: Test (2) piles prior to installation of production piles. It is assumed that test piles will also be production piles and should be located at opposite ends of the building/basin structure. Contractor may propose location to Engineer for approval.

   Test (4) additional piles throughout duration of installation to ensure consistency and confirm results.

C. Load test results should confirm a minimum of two times the design service load of the pile. If tested piles do not conform to requirements, static load test or testing of additional piles may be required.

D. Test results shall be provided to the Engineer within three (3) business days of completion of the testing.

3.4 FIELD QUALITY CONTROL

A. Field observation and monitoring of testing will be performed by special inspector and Engineer.

B. Document test equipment used, method of calibration and recording, test results, and recommendations or modification of piling method used.

C. Accurately record actual dimensions and locations of tested piles and movement or distortion caused by testing.

3.5 EQUIPMENT REMOVAL

A. Remove test equipment from site following completion of test procedures.

END OF SECTION