SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and debris; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 12 inches below subgrade.

D. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.

E. Stripping: Removal of topsoil remaining after applicable scalping is completed.

F. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 SCHEDULING AND SEQUENCING

A. Prepare site and pipeline corridors only after adequate erosion and sediment controls are in place. Limit areas unprotected from erosion during installation of temporary erosion and sediment controls to a maximum of 1/2 acre.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 LIMITS

A. Clear, grub, scalp, and strip areas needed to construct the proposed improvements within limits shown or specified.

B. Clear, grub, scalp, and strip areas within the pipeline corridors to facilitate construction of the proposed facilities. Minimize disturbed areas within the corridors and do not disturb areas outside the right-of-way.

C. Do not injure or deface vegetation that is not designated for removal.

3.02 CLEARING

A. Clear areas within limits shown or specified.

B. Preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer to remain as specified below.

C. Fell trees so that they fall away from facilities and vegetation not designated for removal.

D. Cleared areas beyond specified limits shall be restored to their original state at the expense of the Contractor. Trees damaged during construction shall be replaced by the Contractor; or at the Engineer's discretion, trees that are damaged during construction may have their wounds dressed and coated with an approved pruning paste.

3.03 GRUBBING

A. Grub areas within limits shown or specified.

B. Grub and remove all stumps, roots in excess of 2-inches

3.04 SCALPING

A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.

B. Scalp areas within limits shown or specified.

3.05 STRIPPING

A. Do not remove topsoil until after scalping is completed.

B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.

C. Stockpile and protect strippings for topsoil, separately from other excavated material. Dispose of surplus topsoil after all work is completed at an off-site location at no cost to the Owner.

D. Stockpile strippings for topsoil, separately from other excavated material.

3.06 DISPOSAL

A. Clearing and Grubbing Debris:

1. Dispose of debris offsite.
2. Burning of debris onsite will not be allowed.
3. Limit offsite disposal of clearing and grubbing debris to locations that are approved by Federal, State, and Local authorities.

B. Scalpings: As specified for clearing and grubbing debris.

C. Strippings:

1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
2. Stockpile topsoil in sufficient quantity to meet project needs. Dispose of excess strippings as specified for clearing and grubbing.

3.07 PROTECTION

A. The Contractor shall not cut or injure any trees or other vegetation outside the areas to be cleared, grubbed, scalped, and stripped without written permission from the Engineer. The Contractor shall be responsible for all damage done outside these lines.

END OF SECTION

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. Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition.
2. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   c. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   d. D448, Classification for Sizes of Aggregate for Road and Bridge Construction
   e. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
   f. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
   g. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   j. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.02 DEFINITIONS

A. Clay: Native or imported soils with at least 70 percent of the material passing the No. 200 sieve and having a liquid limit of at least 45. Material shall have a maximum dry density of at least 100 lbs/ft^3 under ASTM D698.

B. Common Fill: Native or imported materials which are low plastic silty sandy clays with a liquid limit of less than 50 and a plasticity index of less than 30. Material shall have a maximum dry density of at least 101 lbs/ft^3 under ASTM D698.

C. Crushed Stone: Clean hard inert crushed rock or stone with a No. 57 size as defined in ASTM D448.

D. Optimum Moisture Content: As defined under ASTM D698.

E. Prepared Ground Surface: Ground surface after completion of clearing, grubbing, scalping, stripping, and excavation inclusive of any undercutting.

F. Proof-Rolling: Testing of prepared ground surface by compactive effort to identify areas that will not support the future loading without excessive settlement.

G. Relative Compaction: As defined under ASTM D698.

H. Subgrade: Surface that will support structures or roadway.

1. Subgrade may be a prepared ground surface after proof-rolling, and compaction to provide a suitable foundation for structures or pavement.
2. Subgrade may also be an embankment or fill section that is constructed after proof-rolling the prepared ground surface and subsequently placing and compacting fill material to provide a suitable foundation for structures and pavement.

I. Undercut: Excavation of soil below the level that will support the structure, roadway, fill, or embankment in order to remove soft or otherwise unsuitable materials.

1.03 SUBMITTALS

A. Submit gradation analyses and other supporting data for imported material to demonstrate conformance with the Specifications.

1.04 QUALITY ASSURANCE

A. Notify Engineer when area are ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Prepare area when unfrozen and free of ice and snow.

B. Areas shall be dry and free from standing water.

PART 2 PRODUCTS

A. Definitions for materials to be used are presented above.

PART 3 EXECUTION

3.01 GENERAL

A. Perform undercutting as necessary to remove soft or otherwise unsuitable soils. Undercutting shall be performed for the GAC contactors, elevated washwater storage tank, sludge thickener, sludge pump building, and sludge drying beds. Undercutting shall also be performed to accommodate the crushed stone and piping for underdrains. Approximate information related to the thickness of undercutting is presented in OMI's Geotechnical Report dated September 18, 2013 (OMI Job No. 6644). Additional undercutting may be necessary above and beyond the amounts set forth in this report and such work shall be at no additional cost to the Owner.

B. All prepared ground surfaces shall be proof-rolled. It is intended that proof-rolling be completed for all surfaces that will support roadways or structures. It is also intended that proof-rolling be completed for all surfaces that will support embankments or fill sections that will ultimately support roadways or structures.

1. Proof-rolling shall consist of at least 10 passes of a self-propelled roller that imparts a force not less than 40,000 pound per drum to the soils. Each pass shall overlap the preceding pass by 30 percent to ensure complete coverage.
2. Soft materials revealed through proof-rolling shall be excavated and filled with common fill or crushed stone in 6-inch lifts and compacted to at least 100 percent of the ASTM D698 density.
3. The proof-rolling and other compaction efforts shall result in a soil density not less than 100 percent of the ASTM D698 density for a depth of at least two (2) feet.

C. After proof rolling, compacting, and density testing tasks have been completed embankment or fill material shall be placed and compacted. Material shall be common fill or crushed stone placed in 6-inch lifts and compacted to at least 100 percent of the ASTM D698 density with the following exceptions.

1. Shot rock or surge stone less than 12 inches in diameter may be used for the WTP entrance road in sections that require two (2) feet of fill or more that do not include process piping. Shot rock or surge stone shall not be used within the parking areas or loop road within the WTP. The material shall be placed in 18-inch lifts and "walked in" with a bulldozer to ensure a stable foundation. Subsequently, the material shall be capped with clean

sound ASTM D448 No. 2 stone that shall be "walked in" with a bulldozer to fill all voids and provide a stable embankment to support the road subbase. Sideslopes on these embankments shall include a 12-inch thick layer of common fill or clay placed in 6-inch lifts and compacted to at least 100 percent of the ASTM D698 density plus a 6-inch layer of topsoil.

2. A 12-inch layer of clay placed in 6-inch lifts and compacted to at least 100 percent of the ASTM D698 density shall be provided under the granular material used for the sludge drying beds.

D. Section 31 23 23, Fill and Backfill, includes additional requirements related to placement of fill and embankment materials.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all excavation work and grading as shown on the Drawings and as specified herein.

B. Provide the services of a licensed professional engineer registered in the State in which the work is located, to prepare temporary excavation system designs and submittals.

C. Furnish and install temporary excavation support systems, including sheeting, shoring and bracing, to insure the safety of personnel and protect adjacent structures, piping, etc., in accordance with Federal, State and Local laws, regulations and requirements.

1.02 DEFINITIONS

A. Clay: Native or imported soils with at least 70 percent of the material passing the No. 200 sieve and having a liquid limit of at least 45. Material shall have a maximum dry density of at least 100 lbs/ft^3 under ASTM D698.

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

C. Common Fill: Native or imported materials which are low plastic silty sandy clays with a liquid limit of less than 50 and a plasticity index of less than 30. Material shall have a maximum dry density of at least 101 lbs/ft^3 under ASTM D698.

D. Rock and Boulder Excavation:

1. General: Removal of solid material which by actual demonstration cannot, in Engineer's opinion, be reasonably loosened or ripped by a single-tooth, hydraulically operated ripper mounted on a crawler tractor in good condition and rated at minimum 410 flywheel horsepower; and which must be systematically drilled and blasted or broken by a power- operated hammer, hydraulic rock breaker, expansive compounds, or other similar means prior to removal.
2. Trench: Removal of solid material which by actual demonstration cannot, in Engineer's opinion, be reasonably excavated with minimum 195-horsepower backhoe in good condition and equipped with manufacturer's standard boom, two (2) rippers, and rock points or similar approved

equipment; and which must be systematically drilled and blasted or broken by power-operated hammer, hydraulic rock breaker, expansive compounds, or other similar means prior to removal.

3. Term "rock excavation" indicates removal of solid material, as specified above, and does not necessarily correspond to "rock" as implied by names of geologic formations.
4. Removal of boulders larger than 1/2 cubic yard will be classified as rock excavation, if drilling and blasting or breaking them apart with power-operated hammer, hydraulic rock breaker, expansive compounds, or other similar means is both necessary and actually used for their removal.
5. Blasting: See Blasting Specification Section 31 23 16.30.
6. Where the phrase "in-the-dry" is used in the Specifications, it shall be defined to mean ground water level at least 2 feet below the exposed subgrade such that the exposed subgrade is stable with no ponding water, mud or muck and is suitable for the placement and compaction of fill material or foundation construction.

E. Crushed Stone: Clean hard inert crushed rock or stone with a No. 57 size as defined in ASTM D448.

F. Undercut: Excavation of soil below the level that will support the structure, roadway, fill, or embankment in order to remove soft or otherwise unsuitable materials.

1.03 QUALITY ASSURANCE

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

B. At all structures, prior to the placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with the soils testing laboratory to verify the suitability of the existing soils and to perform in-place soil density tests as required to verify that the bearing capacity of the existing surface is sufficient.

1.04 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.05 SUBMITTALS

A. Excavation support system designs shall be prepared by a licensed professional engineer in the State in which the work is located, having a minimum of five (5) years of professional experience in the design and construction of excavation

support systems. Submit in accordance with Section 01 33 00 the proposed methods of construction, including excavation and excavation support system designs. Review will be for information only. Contractor shall remain responsible for adequacy and safety of construction means, methods, and techniques.

PART 2 PRODUCTS

2.01 GROUT SEAL

A. Grout shall consist of Portland cement, water, and aggregate as required to produce a grout with a minimum 28-day compressible strength of at least 500 psi.

PART 3 EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish the 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. Remove or protect obstructions as shown on the Drawings and as specified in Section 01 50 00, Temporary Facilities and Controls.

C. Excavation for structures shall be suitably wide for construction of the structures, including excavation supports, dewatering and drainage systems and working clearances.

D. Excavation shall be performed in-the-dry and shall be accomplished by methods which preserve the undisturbed state of native soils when they are suitable. Drainage and dewatering systems shall be in place and operational prior to beginning excavation work. Soils which become loose, "quick," or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced with lean concrete, compacted common fill or crushed stone as directed by the Engineer, at no additional cost to the Owner.

E. Perform undercutting as necessary to remove soft or otherwise unsuitable soils pursuant to Section 31 23 13, Subgrade Preparation. No additional compensation will be allowed for such work.

F. Over excavation beyond the limits and depths required by the Contract Documents shall be replaced at no additional cost to the Owner by common fill or crushed stone as directed by the Engineer.

3.02 EXCAVATION CLASSIFICATION

A. All excavation for the work shall be unclassified for payment. Complete all excavation regardless of the type, nature, or condition of the materials encountered. No additional compensation will be allowed for rock removal, blasting, removal and replacement of unsuitable materials, or any other similar activity.

3.03 EXCAVATION SUPPORT

A. Furnish, install, monitor and maintain excavation support (e.g. shoring, sheeting, bracing, trench boxes, etc.) as required by Federal, State or Local law, ordinances, regulations and safety requirements. Support the sides of excavation, to prevent any movement which could in any way reduce the width of the excavation below that necessary for proper construction and protect adjacent structures from undermining, settlement or other damage. Take care to prevent the formation of voids outside of sheeting. If voids occur behind sheeting, immediately backfill and compact the voids with common fill material. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete.

B. Where pipes cross under existing buried pipes, the existing pipes shall be provided with overhead support at all times until backfill again provides the required support. The overhead support shall be designed by a professional engineer and shall be designed to support the total load of the pipe filled with water and under pressure where applicable.

3.04 REMOVAL OF WATER

A. At all times provide and maintain ample means and devices to promptly remove and dispose of all water from excavations pursuant to Federal, State, and Local regulatory requirements. Remove all water during periods when concrete is being deposited, during the time the trench is being prepared for pipe laying, during the laying of pipe, and until all backfill has been completed. These provisions shall apply 24 hours per day, seven days a week, including holidays. Do not, under any circumstances, permit or allow water to enter the construction area of any other Contractor. Provide the necessary means and devices, as approved, to positively prevent such occurrences.

B. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. Groundwater level shall be lowered to at least 2 feet below bottom of the excavation until backfilling is completed.

C. Dispose of the water in a manner to prevent damage to adjacent property or violate Federal, State, or Local permits.

D. The Contractor shall have sole responsibility for dewatering operations including any required permits associated with the Work.

3.05 EMBANKMENT AND CUT SLOPES

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

B. Remove stones and rock that exceed 3-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 6-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. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs shall be clearly worded and readable by equipment operators from their normal seated position.

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

D. 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.

E. 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 ROCK AND BOULDER EXCAVATION

A. Rock and boulder excavation shall be as specified in Section 31 23 16.30: Blasting, unless another acceptable means of removal is approved by the Engineer. Alternative method technologies which are considered acceptable include power hammers, hydraulic rock breakers, or expansive chemicals. Rock and boulder excavation shall also be in accordance with the technical requirements of ALDOT Specification Section 210. Removal of rock below the bottom of a foundation slab or pipe (rock undercutting) shall be provided as shown on the Drawings or as necessary to provide appropriate subgrade

conditions for the construction of the proposed improvements. The Contractor's attention is directed to the fact that the ALDOT specification requires a presplitting technique to provide the desired slope condition and such technique is required on this project.

3.08 MISCELLANEOUS EXCAVATION

A. The Contractor shall perform all miscellaneous excavation. The Contractor shall make all excavations necessary to permit the placing of loam and plants, for constructing roadways, and any miscellaneous earth excavation required under this Contract.

END OF SECTION

SECTION 31 23 16.20
COFFERDAMS AND DEWATERING

PART 1 GENERAL

1.01 SCOPE

A. The work specified in this Section includes excavation support systems for construction of the work as shown on the Drawing and specified herein. The Contractor shall furnish all labor, material and equipment necessary for the removal of all surface and subsurface waters from excavation areas.

B. This Section includes the construction of temporary cofferdams and dewatering as required. The work also includes the removal of temporary cofferdams and dewatering systems at the completion of the work.

1.02 STANDARDS

A. Comply with applicable Federal, State, and Local safety requirements.

B. Comply with all conditions of permits issued for this project, including, but not limited to, permits issued by ADEM, TVA, and Marshall County.

C. Design of cofferdams and dewatering systems shall be completed by a Professional Engineer licensed in the State of Alabama.

1.02 DEFINITIONS

A. Lagging: Temporary or permanent excavation support structure consisting of heavy timber boards, planking, or reinforced precast concrete planks secured in place by steel beam sections.

B. Timber Sheeting: A line of timber or planks, plain or tongue-and-grooved on sides, driven endwise into ground to protect subgrade operations.

C. Sheet Piling: Interlocking steel sheet piling installed vertically and forming a continuous diaphragm to hold back earth or retain soil and to keep water out of a foundation excavation.

D. Shores: Props or posts of timber or other composite material, used for temporary support of structures.

E. Soldier Piles: Vertical steel shapes installed to take vertical loads and lateral thrust of the lagging. Also called soldier beams, in the absence of vertical loads.

F. Strut: A brace or supporting member which resists thrusts in the direction of its own length; may be diagonal or perpendicular.

1.02 SUBMITTALS

A. The Contractor shall make submittals in accordance with Section 01 30 00 and the following:

1. When cofferdams and dewatering operations are necessary to construct certain components for the project, the Contractor shall submit to the Engineer a dewatering plan, which includes the cofferdam and dewatering equipment design, safety procedures, sequence of construction, and re-watering procedures.
2. Submit certification from a licensed structural engineer registered in the State of Alabama that the temporary cofferdams and dewatering systems have been designed to meet conditions anticipated for the project.
3. Six (6) sets of sealed drawings for the cofferdams and dewatering systems shall be submitted to Engineer for reference.
4. Acquire all permits required to discharge water and protect waterways from turbidity during the dewatering operation.

1.03 RESPONSIBILITIES

A. This is a performance specification. Except as otherwise specified or indicated, selection of equipment, materials, and methods shall be Contractor's responsibility. The dewatering of any excavation areas and disposal of all water shall be handled shall be in strict accordance with all Federal, State, and Local rules and regulations and all permits issued for construction of the project.

B. The Contractor shall be responsible for the design of the dewatering system including, but not necessarily limited to, the temporary cofferdam, required pump equipment, temporary shoring, and any miscellaneous temporary structures required.

1.04 INSPECTION COORDINATION

A. The Contractor shall provide access to the work for the Engineer as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new work activities.

PART 2 PRODUCTS

A. General: Materials for excavation support systems may be new or used, provided they are sound and free from strength-impairing defects.

B. Soldier Piles: ASTM A690 or ASTM A36 shapes of sizes indicated on approved working drawings. Provide soldier piles and sizes required to contain lagging or planking as indicated.

C. Steel Sheet Piling: ASTM A328, continuous interlocking type, of sizes indicated on approved working drawing, with suitable handling holes.

D. Steel Wales and Internal Bracing: ASTM A36 shapes and sizes indicated on approved working drawings.

E. Timber: Structural grade lumber with a minimum fiber stress in bending of 1,100 psi.

1. Lagging: Heavy timber boards or planking of sizes indicated on Shop Drawings. Lagging boards or planking shall be secured and contained in place by soldier piles with boards inserted behind the steel flanges on the excavation side.
2. Posts, Struts, and Wales: Heavy timber posts, beams, stringers, and planking, as required, of sizes indicated on Shop Drawings.

PART 3 EXECUTION

3.01 PERFORMANCE:

A. The Contractor shall employ the services of a structural engineer registered in the State of Alabama for the design of the cofferdam system. The walls and bracing shall be designed to withstand, without damage, all soil hydrostatic and equipment loads that are applicable to the design.

B. Approximate locations of cofferdam, structural characteristics and embedment depths shall be determined by the engineer designing the cofferdam.

C. The layout and design of the interior and exterior bracing system for the cofferdam shall fully accommodate, with appropriate factors of safety, all applicable loadings.

3.02 DEWATERING

A. The Contractor shall provide adequate equipment for removal of storm, subsurface or cofferdam leakage waters, which may accumulate in the cofferdam interior or in sheeted or unsheeted excavations.

B. The Contractor shall perform all work in an excavation or cofferdam interior free from water. The Contractor shall furnish, install, maintain, and operate all necessary pumping and other equipment necessary for dewatering the work area.

1. All dewatering equipment shall be in first-class condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the cofferdam interior free from standing water or wet conditions that prevent proper construction.

C. The Contractor shall provide dewatering facilities with stand-by pumps with 100 percent standby capacity. The failure of any dewatering system or component before an excavation is backfilled may cause buoyant conditions that cause structures to float or become damaged. Such failures shall be the sole responsibility of the Contractor and all costs to remedy structural flotation or damages shall be borne by the Contractor.

D. The Contractor shall comply with all Federal, State, and Local regulations when disposing of water generated by dewatering operations.

E. The Contractor is required to meet the special requirements of any environmental permits that have been issued.

3.03 REMOVAL OF DEWATERING SYSTEMS AND COFFERDAMS

A. The Contractor shall remove the groundwater dewatering systems in such a manner as to allow groundwater elevations to return to natural elevations.

B. When removing cofferdams and dewatering systems needed to control surface waters, the Contractor shall slowly flood the dewatered area to re-establish normal water surface elevations.

C. If a portion of the cofferdam is incorporated into the structure, the Contractor shall review the Drawings to determine which portion of the cofferdam shall be removed.

END OF SECTION

SECTION 31 23 16.30
BLASTING

PART 1 GENERAL

1.01 SCOPE

A. This Section provides the specifications for rock and boulder excavation on this project.

B. Furnish all labor, materials, equipment, and incidentals required and perform excavation and removal of all rock as required for excavation of the buildings, structural footers, trenches, pits, etc.

C. Provide all transporting, storage, and handling of explosives, which shall be conducted in full compliance with all Federal, State and Local laws, regulations, ordinances, and with all possible care to avoid injury to persons and property.

D. The Blasting Contractor shall secure all Local, County, and State permits and licenses prior to commencement of any blasting operations.

E. The Blasting Contractor shall hold the Owner harmless from all claims or actions related to blasting.

F. **All blasting operations shall comply with conditions in *TVA Section 26a Approval for Permit # 227698* issued to Huntsville Utilities, including the *Additional Conditions (RLR ID: 227698)* and *RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting.***

1.02 DEFINITIONS

A. The following definitions are specific to rock blasting only.

1. Blasting Contractor – Company with specific experience in the use of explosives for the removal of rock.

2. Blaster-in-Charge – Licensed blaster employed by the Blasting Contractor designated as the person in charge of all blasting operations.

3. Owner – For this section the term Owner designates the owner of the project and their designated representatives/consultants.

1.03 QUALITY ASSURANCE

A. The Blasting Contractor must have at least 10 years of experience in design and implementation of rock excavation using controlled blasting methods for similar construction.

B. The Blaster-in-Charge shall be licensed in the state of Alabama and have experience as the Blaster-in-Charge of at least 5 projects with similar scope and complexity.

C. The Blasting Contractor shall assume complete responsibility to protect the existing facilities and the work under construction. The Owner's approval of blasting plans and procedures shall not relieve the Blasting Contractor of responsibility to perform the work in accordance with the Contract Documents and to protect life, property, and the work under construction. Any damage resulting from the blasting operations shall be repaired at the Blasting Contractor's expense.

1.04 SUBMITTALS

A. Blasting operations will not be permitted until specifically authorized in writing by the Owner and all requirements have been fulfilled.

B. Digital submittals of all materials are preferred provided they are clearly legible.

C. Blasting Contractor

1. The Blasting Contractor shall supply approved copies of all required permits.

2. The Blasting Contractor shall provide a current insurance certificate with minimum liability coverage of $5,000,000.00 naming the Owner and Engineer as additional insureds.

3. The Blasting Contractor shall provide MSDS sheets on all explosive products including, but not limited to, type of detonators, detonating system, and type of explosives.

D. Blaster-in-Charge

1. The Blaster-in-Charge shall provide copies of all current blasting licenses relevant to blasting activities on this project.

2. The Blaster-in-Charge shall provide examples of 5 projects similar in size and nature including references and contact information.

3. The Blaster-in-Charge shall present documentation of ongoing training and/or refresher courses.

E. General Blast Plan

1. At least 60 days before commencing blasting operations, the Blasting Contractor shall submit a General Blasting Plan for review/approval by the Owner and TVA. Use of explosives at the project site will not be allowed until the General Blasting Plan is received and approved by the Owner.

2. The General Blasting Plan shall include a complete summary of proposed transportation, handling, storage, and use of explosives. The General Blasting Plan shall also include the proposed general concept for the blasting (drill pattern, hole diameter, hole depth, products) and for the control of noise, dust, fly rock, air overpressure, and vibrations. Details of planned test blast(s) shall be included.

3. The General Blasting Plan shall include details of clearing and guarding the site during blasting operations and all notification/alert procedures.

F. Test Blast Plan

1. Initial blasts shall follow the Blast Ramp-up Plan detailed in ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting***. The detailed plans for Test Blasts must be submitted for review/approval by the Owner at least 48 hours prior to each planned test blast. The Test Blast Plan must be approved prior to the commencement of any blasting activities.

2. Until a site specific vibration prediction formula is determined/approved, vibration levels shall be calculated using the prediction formula from the "Blasters Handbook" by E.I. DuPont de Nemours & Co. This formula is:

$$V = 160\left(\frac{R}{\sqrt{W}}\right)^{-1.6}$$

Where:

V = Peak particle velocity (in/sec)
R = Distance from blasting (ft)
W = Max. Weight of explosives per delay (lbs)

G. Individual Shot Plans

1. Individual Shot Plans shall be submitted for review/approval by the Owner at least 24 hours prior to any loading. No loading shall begin until the submitted Individual Shot Plan is approved by the Owner. Individual Shot Plans shall include, but shall not be limited to, the following information:

a. Drilling pattern
b. Number, location, inclination, diameter, and depth of drilled holes
c. Amount, type, and distribution of explosives per hole
d. Powder factor; time delays; weight of explosives in each delay
e. Sequence of firing
f. Time of blast
g. Total pounds of explosive
h. Site sketch indicating the location of the blast and distance/direction of all seismographs
i. Any other pertinent data indicating Contractor's intent and purpose to produce smooth and sound surfaces of excavation and to protect adjacent facilities.

H. Vibration and Air Overpressure Monitoring Company

1. Submit the name and qualifications of the person(s) responsible for monitoring and reporting blast vibrations and overpressures.

2. Submit a listing of instrumentation proposed to monitor vibrations complete with performance specifications supplied by the manufacturer.

3. Submit current calibration certificates (within previous 12 months) for the proposed blast monitoring instrumentation. Calibration shall be over the required frequency response ranges specified for blast monitoring instrumentation and to a standard traceable to the National Bureau of Standards.

I. Preblast Inspection Company

1. Submit the name and qualifications of the person(s) responsible for performing preblast inspections.

2. Submit one copy of all inspections and contact documentation.

PART 2 PRODUCTS

2.01 MATERIALS

A. All products used for blasting are to be submitted per Paragraph 1.04 – SUBMITTALS.

PART 3 EXECUTION

3.01 DRILLING

A. Drilling shall be performed by an experienced driller with past experience in drilling for mass rock and/or trenching.

B. The hole layout for each blast shall be completed by the Blaster-in-Charge. If the Blaster-in-Charge is not present for the actual drilling of the holes, the driller shall keep a detailed drill log for the Blaster-in-Charge's review.

C. The Blaster-in-Charge shall verify the details of the drill log before loading each hole by visual inspection using blaster's tape and/or mirrors.

3.02 TRANSPORTATION AND STORAGE OF EXPLOSIVES

A. The Blasting Contractor or explosives supplier shall supply and transport the explosives to the project site.

B. All drivers will have current licenses issued by the State of Alabama. All the drivers shall have been through D.O.T. and A.T.F. security training.

C. No motor vehicle transporting explosives shall be left unattended at the project site.

D. Absolutely NO explosives or explosive agents shall be stored on site. All explosives and related explosive agents shall be delivered from the blasting company or powder supplier's magazine site the morning of the blast.

E. All unused explosives and related products shall be transported back to the respective site after each blast or at the end of the day.

F. No person shall smoke, or carry flame-producing devices nor shall firearms nor loaded cartridges be carried in or near a motor vehicle or any other conveyance while transporting or temporarily storing explosives while working at the project site.

3.03 EXPLOSIVES HANDLING

A. All personnel handling explosives shall have current A.T.F. background checks. Handling of explosives is defined as loading or unloading the truck, distributing explosives to the different drill holes, distributing boosters, and loading unused explosives back into the truck.

B. Only personnel from the approved Blasting Contractor and the approved Powder Supplier shall handle explosives.

3.04 PREBLAST INSPECTIONS

A. Preblast inspections shall be performed in order to provide documentation of the existing condition of buildings and structures within 1,000 feet of the blasting area. TVA structures to be inspected will be determined by ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting***

B. The preblast inspections shall be performed by an independent company with experience performing these inspection services.

C. The preblast inspection shall document the existing conditions of the interior and exterior of the structures. The inspection shall accurately record existing damage by means of written notes, sketches and pictures or other approved format or combination that accurately documents the pre-existing conditions prior to the blasting.

D. A minimum of three (3) attempts shall be made to contact the owner or authorized agent to offer the inspection. If no response is made after the second attempt, or the owner refuses to sign a notice indicating that they have been offered an inspection and have chosen not to have an inspection performed, a notice offering the survey shall be sent to the owner with any method that provides a receipt of delivery.

E. All original materials from the preblast inspection shall be stored for a period of not less than 5 years from the date of the inspection.

F. One (1) copy of the inspection, signed notice or return receipt must be submitted for each property on the inspection list. These copies must be submitted before any blasting activities can begin. Inspections of TVA Facilities must be submitted at least 30 days prior to start of blasting per ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting***

3.05 BLASTING OPERATIONS

A. The Blasting Contractor shall furnish all labor, equipment, materials, and incidentals necessary to provide services and perform operations required to fragment rock utilizing controlled blasting techniques such that damage is prevented to adjacent utilities, structures, property and work and such that resulting ground vibrations are consistently maintained below the maximum levels specified in this Section.

B. All blasting operations shall be conducted in full compliance with all Federal, State and Local laws, regulations and ordinances, and with all possible care to

avoid injury to persons and property. In case of conflict between regulations and these Specifications, the Blasting Contractor shall comply with the strictest applicable codes, regulations or Specifications.

C. **All blasting operations shall comply with conditions in *TVA Section 26a Approval for Permit # 227698* issued to Huntsville Utilities, including the *Additional Conditions (RLR ID: 227698)* and *RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting.***

D. The Blasting Contractor shall be completely responsible for any damages resulting from the blasting operations and shall, as a minimum, take whatever measures are necessary to maintain peak particle velocities within the specified limits. Modifications to blasting and excavation methods necessary to meet these requirements shall be undertaken at no additional cost to the Owner.

E. Notwithstanding full compliance with these Specifications, review of all submittals and successful limitation to the peak particle velocity and overpressure specified, the Blasting Contractor shall be solely responsible for any damage, direct or indirect, arising from blasting and shall hold the Owner harmless from any costs, liens, charges, claims, or suits, including the costs of defense, arising from such damage, real or alleged. The Owner and Engineer shall be additionally-named insureds on any insurance policy covering blasting carried by the Blasting Contractor, and this requirement shall also be enforced on any subcontractor.

1. At least 24-hours advance notice shall be given to all tenants and residents within a radius of 1,000 feet of the work before blasting. Notice for TVA structures must comply with ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting***

2. Notify authorized representatives of all utilities which might be affected by blasting operations at least 48 hours before any blasting is performed.

3. The Blasting Contractor shall cooperate with the Owner in permitting observation of the drilling and loading procedures, as well as in providing detailed information on blasting operations.

4. The Blasting Contractor shall obtain and pay for permits and licenses required to complete the work.

5. All activities involved in the blasting operations shall be done only by competent, sober and experienced personnel whose activities shall be conducted in a professional, workmanlike manner.

6. All rock, dirt and debris from blasting shall be contained within the excavation by use of weighted mats or undisturbed overburden. The

blaster-in-charge shall be fully responsible for determining the method of containment and the weight, size and placement of material required to contain the charges being used.

F. Charges shall be sized such that no damage to houses, structures, roadways, etc., outside the limits of the excavation will occur. Where there is a possibility of such damage, the charge shall initially be set at a very low level and increased in small increments until the proper charge is determined, following ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting.***

G. The Blasting Contractor shall not be allowed to blast within any rights-of-way maintained by any agency (D.O.T., R.R., Gas, etc.) without specific approval of the controlling agency and only in accordance with their respective requirements.

H. All drilling and blasting shall be done in a manner which will minimize the disturbance to material outside the required excavation limits. Care shall be taken to ensure against blasts which might damage previously completed portions of the excavation.

I. If rock outside the intended blasting limits is shattered by blasting, caused by holes drilled too deep, or excessive charges of explosives or any other circumstance due to blasting and if, in the opinion of the Owner, the shattered rock is unfit to remain in place, the rock shall be removed and the excavation reformed or refilled suitable material as approved by and at no additional cost to the Owner. This will include breakage extending into adjacent areas with higher finished elevations.

J. Clearing the danger area before blasting: No blasting shall be permitted until all personnel and vehicles in the danger area have been removed to a place of safety. A loud, audible, warning system, devised and put in operation shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, the Owner, abutters, and the general public with the system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared and guards shall be stationed to prevent entry until the area has been cleared by the blaster following the blast.

K. The Blasting Contractor shall be responsible for determining any other safety requirements unique to blasting operations on this particular site so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.

L. The Blasting Contractor shall submit to the Owner and Contractor in writing all blasting complaints received by the Blasting Contractor within 24 hours of receipt. Each blast complaint report shall include the name and address of the

complainant, time received, date and time of blast complained about, and a description of the circumstances which led to the complaint.

M. Review by the Owner of material submitted by the Blasting Contractor shall not relieve the Blasting Contractor of responsibility for the accuracy, adequacy, and safety of the blasting, exercising proper supervision and field judgment, and producing the results within the blasting limits required herein.

N. Special consideration must be given to coordination of blasting with the surrounding facilities per ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting.***

3.05 VIBRATION AND AIR OVERPRESSURE MONITORING

A. Ground vibration and air overpressure levels shall be recorded for all blasting activities. A minimum of 8 seismographs will be used for each blast per ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting***. Monitoring shall be performed at the closest structures to the blasting. Additional instrumentation may be required at the Owner's discretion.

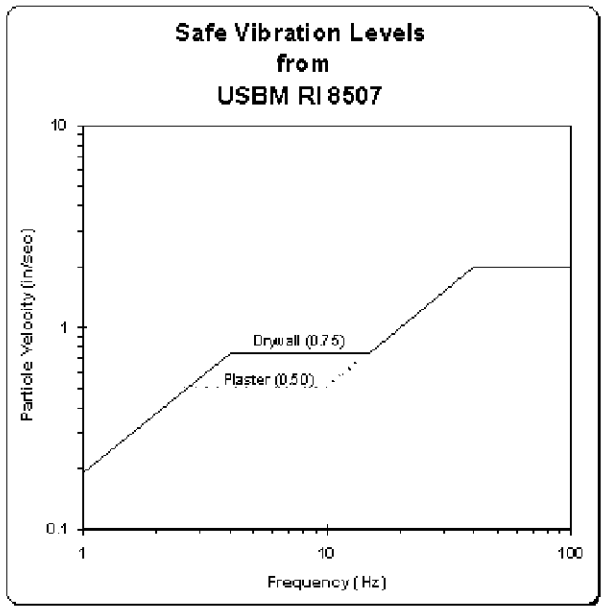
B. An independent company experienced in blast monitoring and the operation of portable seismographs shall perform all vibration and air overpressure monitoring.

1. Vibration and air overpressure monitoring instruments shall have been calibrated within the past year.

2. Vibration and air overpressure records shall include all peak particle velocities with associated frequencies, peak air overpressure levels, vibration and air overpressure waveforms, USBM compliance graph, the distance and direction from the blast, and the location of the instrument.

3. All seismographs used for vibration and air overpressure monitoring shall, at a minimum, record velocity range of 0.02 to 4.0 in/sec with a frequency range from 2 to 200 Hz and a sound range from 90 to 140 dB (flat response) with a frequency range of 2 to 200 Hz. Seismographs shall monitor vibrations in three (3) mutually perpendicular axes. The seismographs shall provide a time-history of event waveform and USBM or OSM velocity/frequency chart. All seismograph data shall be capable of storing the records digitally.

4. Ground vibration levels must comply with ***RLR 222349 - Huntsville Utilities Water Intake and Pipeline - Guntersville Reservoir - TVA/USACE Requirements for Blasting*** and all applicable Federal, State and Local regulations. At a minimum, the vibration levels shall not exceed the safe vibration levels established by the US Bureau of Mines (see chart)



C. Air overpressure levels must comply with all applicable Federal, State and Local regulations. At a minimum, the air overpressure levels shall not exceed the safe levels established by the US Bureau of Mines (see chart)

Lowest Frequency of Monitoring Device (Hz)	Air Overpressure Limit (dB)
0.1 Hz	134
2 Hz	133
6 Hz	129

D. Seismograph data must be available to the Owner within one (1) hour of each blast. One (1) copy of all seismograph records shall be submitted to the owner within 24 hours of each blast. All seismograph records must be stored for a minimum of 5 years.

3.06 DAMAGE COMPLAINTS

A. All damage complaints must be reported to the Owner in writing within 24 hours of the receipt of the complaint.

B. Any damage claimed from blasting operations which cannot be determined from the preblast inspection to be a pre-existing condition shall be investigated by an independent investigator/engineer experienced in blasting damage claim investigations.

C. All damage claimed shall be documented with photographs.

D. All complaints must receive a written response clearly stating whether or not the damage claimed is a result of the blasting activities.

E. One (1) copy of the photographs and the response to the claimant must be submitted to the Owner.

F. The Blasting Contractor shall be responsible for any costs associated with damage claimed.

END OF SECTION

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. Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition.
2. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   c. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   d. D448, Classification for Sizes of Aggregate for Road and Bridge Construction
   e. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
   f. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
   g. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   j. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.02 DEFINITIONS

A. Clay: Native or imported soils with at least 70 percent of the material passing the No. 200 sieve and having a liquid limit of at least 45. Material shall have a maximum dry density of at least 100 lbs/ft^3 under ASTM D698.

B. Common Fill: Native or imported materials which are low plastic silty sandy clays with a liquid limit of less than 50 and a plasticity index of less than 30. Material shall have a maximum dry density of at least 101 lbs/ft^3 under ASTM D698.

C. Crushed Stone: Clean hard inert crushed rock or stone with a No. 57 size as defined in ASTM D448.

D. Optimum Moisture Content: As defined under ASTM D698.

E. Prepared Ground Surface: Ground surface after completion of clearing, grubbing, scalping, stripping, and excavation inclusive of any undercutting.

F. Proof-Rolling: Testing of prepared ground surface by compactive effort to identify areas that will not support the future loading without excessive settlement.

G. Relative Compaction: As defined under ASTM D698.

H. Subgrade: Surface that will support structures or roadway.

1. Subgrade may be a prepared ground surface after proof-rolling, and compaction to provide a suitable foundation for structures or pavement.
2. Subgrade may also be an embankment or fill section that is constructed after proof-rolling the prepared ground surface and subsequently placing and compacting fill material to provide a suitable foundation for structures and pavement.

I. Undercut: Excavation of soil below the level that will support the structure, roadway, fill, or embankment in order to remove soft or otherwise unsuitable materials.

1.03 SUBMITTALS

A. Submit gradation analyses and other supporting data for imported material to demonstrate conformance with the Specifications.

1.04 QUALITY ASSURANCE

A. Notify Engineer when areas are ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

B. Notify Engineer when:

1. Structure is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
2. Soft or loose materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications

1.05 ENVIRONMENTAL REQUIREMENTS

A. Fill and backfill shall be placed on areas when unfrozen and free of ice and snow.

B. Areas that will receive fill or backfill shall be dry and free from standing water.

1.06 SEQUENCING AND SCHEDULING

A. Backfill against concrete structures only after concrete has attained 70 percent of design strength. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill.

B. Backfill around water-holding structures only after completion of satisfactory leakage tests.

D. Do not place granular base, subbase, or surfacing until after subgrade has been prepared and successfully tested.

PART 2 PRODUCTS

2.01 MATERIALS

A. Definitions for materials to be used are presented above.

PART 3 EXECUTION

3.01 FILL AND BACKFILL MATERIAL AND PLACEMENT REQUIREMENTS

A. Use crushed stone for backfill around the raw water intake/pump station from the bottom of the base slab up to 3'-0" below the proposed finished grade. The width of the crushed stone backfill shall extend from the exterior surface of the structure out to the exposed slopes remaining after rock removal. Subsequently a minimum 2'-0" thick layer of clay shall be placed on top of the stone which will support the pavement subbase, topsoil, or other surface feature shown on the Drawings. Crushed rock and clay shall be placed in 6-inch lifts and compacted to 100 percent of the ASTM D698 maximum density

B. Use crushed stone for backfill around the perimeter of buried structures from the bottom of the base slab up to 3'-0" below the proposed finished grade. The horizontal width of the stone backfill shall be 2'-0". The remainder of the backfill shall be common fill; however, a minimum 2'-0" thick layer of clay shall be placed on top of the stone which will support the pavement subbase, topsoil, or other surface feature shown on the Drawings. Crushed rock, common fill, and

clay shall be placed in 6-inch lifts and compacted to 100 percent of the ASTM D698 maximum density.

C. In areas that will not include pavement or structures which require fill to achieve the required grades use common fill placed in 12-inch lifts and compacted to at least 95 percent of the maximum ASTM D698 density. Clearing, grubbing, scalping, stripping and proof-rolling shall be completed prior to placement of fill. Proof-rolling shall consist of at least 10 passes of a self-propelled roller that imparts a force not less than 40,000 pound per drum to the soils. Each pass shall overlap the preceding pass by 30 percent to ensure complete coverage.

D. Shot rock or surge stone may be used to construct certain portions of the WTP entrance road. Refer to Section 31 23 13, Subgrade Preparation, for detailed requirements.

3.02 GENERAL

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

B. Fill and backfill materials shall be placed in lifts no greater than those specified herein to suit the specified compaction requirement to the lines and grades required, making allowances for settlement and placement of cover materials (i.e. topsoil, sod, etc.). Soft spots or uncompacted areas shall be corrected as specified.

C. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation and compact each lift to specified densities 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.

D. During filling and backfilling, keep level of fill and backfill around each structure 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 2 feet above top of item to be installed.
2. Excavate trench for installation of item.
3. Install bedding, if applicable, as specified in Section 31 23 23.15, Trench Backfill.
4. Install pipe, conduit, duct bank, or cable as applicable.
5. Backfill envelope 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 0.1 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.

END OF SECTION

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. American Public Works Association (APWA): Uniform Color Code for Temporary Marking of Underground Utility Locations.
2. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   c. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   d. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf!ft3 (600 kN-mJm3))
   e. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
   f. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf!ft3 (2,700 kN-mfm3)).
   g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   1. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
3. 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 D698. Corrections for oversize material may be applied to either as- compacted field dry density or maximum dry density, as determined by Engineer.

H. Relative Density: As defined by ASTM D4253 and ASTM D4254.

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

J. 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.

K. Standard Specifications: Where the term "Standard Specifications" is used, such reference shall mean the current edition of Alabama Department of Transportation Standard Specifications for Highway Construction. Where reference is made to a specific part of the Standard Specifications, such applicable part shall be considered as part of this Section of the Specifications. In case of a conflict in the requirements of the Standard Specifications and the requirements stated herein, the requirements herein shall prevail.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Manufacturer's descriptive literature for marking tapes.
2. Samples:
   a. Trench stabilization material.
   b. Pipe base and pipe zone material.
   c. Granular backfill.
   d. Earth backfill.
   e. Sand(s).

B. Informational Submittals:

1. 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. Nondetectable:

1. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
2. . Thickness: Minimum 5 mils.
3. Width: 6 inches.
4. Identifying Lettering: Minimum l-inch high, permanent black lettering imprinted continuously over entire length.
5. Manufacturers and Products:
   a. Reef Industries; Terra Tape.
   b. Mutual Industries; Non-detectable Tape.
   c. Presco; Non-detectable Tape.

B. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
2. Foil Thickness: Minimum 0.35 mils.
3. Laminate Thickness: Minimum 5 mils.
4. Width: 6 inches.
5. Identifying Lettering: Minimum l-inch high, permanent black lettering imprinted continuously over entire length.
6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
7. Manufacturers and Products:
   a. Reef Industries; Terra Tape, Sentry Line Detectable.
   b. Mutual Industries; Detectable Tape.
   c. Presco; Detectable Tape.

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

Color*	Facility
Yellow	Gas, oil, stream, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable Water
Purple	Reclaimed water, irrigation, and slurry lines
* As specified in NEMA Z535.1, Safety Color Code.	

2.02 TRENCH STABILIZATION MATERIAL

A. No. 78 crushed stone as specified in the ALDOT Standard Specifications.

2.03 PIPE BASE AND PIPE ZONE MATERIAL

A. Earth Trench: Pipe base and pipe zone material shall be local material consisting of grains of hard, predominantly quartz or other hard rock, including friable, loosely bound deposits of sand stone conglomerate. The sand shall be free from lumps of clay, loam, organic matter, or other foreign material. Sand shall meet the requirements of Section 826.02(b) "Local Sand and Sand Gravel for Miscellaneous Construction Use" of the Alabama Department of Transportation's Standard Specifications (ALDOT's).

B. Rock Trench and Pavement Trench: No. 78 stone as specified in the ALDOT Standard Specifications.

2.04 TRENCH BACKFILL

A. Granular Fill: Granular fill shall conform to the requirements of ALDOT's Standard Specifications 801.11(d) No. 78.

B. Select Fill: Native material obtained from the trench excavation, free from roots, debris, and rocks larger than 3 inches. Provide imported material if necessary.

2.05 GRAVEL SURFACING MATERIALS

A. Gravel surfacing for roads and drives shall conform to Type B in Standard Specification Section 825.

2.06 IMPORTED TOPSOIL

A. Imported topsoil shall be suitable sandy loam from an approved source and shall possess friability and a high degree of fertility. It shall be free of clods, roots, gravel, and other inert material. It shall be free of quack grass, horsetail, and other noxious vegetation and seed. Should such regenerative material be present in the soil, the Contractor shall remove, at his expense, all such growth, both surface and

root, which may appear in the imported topsoil within 1 year following acceptance of the job in a manner satisfactory to the Owner.

PART3 EXECUTION

3.01 TRENCH PREPARATION

A. Water Control:

1. Promptly remove and dispose of water entering trench per governing regulatory authority 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.
2. Remove water in a manner that minimizes soil erosion from trench sides and bottom, as well as preventing turbid discharge in accordance with local, state, and federal regulation.
3. Provide continuous water control until trench backfill is complete.
4. Contractor shall have sole responsibility for dewatering operations and shall obtain any required local, state, federal or other necessary approvals or associated permits.

B. Remove foreign material and backfill contaminated with foreign material that falls into trench.

3.02 TRENCH BOTTOM

A. Firm Subgrade: 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 overexcavation, 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 6-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 PIPE BASE MATERIAL

A. Place pipe base material over the full width of the prepared trench bottom in two equal lifts when the required depth exceeds 8 inches.

B. Grade and compact each lift to provide a firm, unyielding surface.

C. Minimum Thickness: As follows, except increase depths listed by 2 inches in areas of rock excavation:

1. Pipe 30 Inches and Smaller: 6 inches.
2. Pipe 36 Inches and Larger: 9 inches.
3. Conduit: 3 inches.
4. Direct-Buried Cable: 3 inches.
5. Duct Banks: 3 inches.

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

E. 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 PIPE ZONE BACKFILL

A. Upper limit of pipe zone shall not be less than following:

1. Pipe: 12 inches, unless shown otherwise.
2. Conduit: 3 inches, unless shown otherwise.
3. Direct-Buried Cable: 3 inches, unless shown otherwise.
4. Duct Bank: 3 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 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
2. Pipe Over 10-Inch Diameter: Maximum 6-inch lifts.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by "walking in" and slicing material under haunches with a shovel 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.

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.

1. Detectable Marking Tape: Install with nonmetallic piping and waterlines.
2. Nondetectable Marking Tape: Install with metallic piping.

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 2 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 4 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.

B. Earth Trench and Rock Trench:

1. Backfill with earth backfill.
2. Leave trench with backfill material neatly mounded across the entire trench width, but not more than 6 inches above the adjacent ground surface.
3. In lawn, garden, or similar type areas, maintain trench level with the existing adjacent grade.
4. Compact in minimum 12-inch lifts to a minimum of 90 percent relative compaction.

C. Pavement Trench:

1. Use Granular Fill for the full depth of the trench less than 10-inch allowance for the base course under existing or future roadway as shown on Drawings.
2. Place in lifts not exceeding thickness of 6 inches.
3. Mechanically compact each lift to a minimum of 98 percent relative compaction prior to placing subsequent lifts.
4. Repair roadway, driveways, concrete, etc. damaged as specified in Drawings.

3.08 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, and grade and compact as necessary to keep the surface of backfilled trenches smooth, free from ruts and potholes, and suitable for normal traffic flow.

3.09 SETTLEMENT OF BACKFILL

A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill and shall be corrected. Structures damaged by settlement shall be restored to their original condition by the Contractor.

END OF SECTION

SECTION 31 23 23.23
COMPACTION

PART 1 GENERAL

1.01 REFERENCES

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

1. Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition.

2. ASTM International (ASTM):

a. C33, Standard Specification for Concrete Aggregates.
b. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
c. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
d. D448, Classification for Sizes of Aggregate for Road and Bridge Construction
d. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
e. D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
f. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
1. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.02 DEFINITIONS

A. Clay: Native or imported soils with at least 70 percent of the material passing the No. 200 sieve and having a liquid limit of at least 45. Material shall have a maximum dry density of at least 100 lbs/ft^3 under ASTM D698.

B. Common Fill: Native or imported materials which are low plastic silty sandy clays with a liquid limit of less than 50 and a plasticity index of less than 30.

Material shall have a maximum dry density of at least 101 lbs/ft^3 under ASTM D698.

C. Crushed Stone: Clean hard inert crushed rock or stone with a No. 57 size as defined in ASTM D448.

D. Optimum Moisture Content: As defined under ASTM D698.

E. Prepared Ground Surface: Ground surface after completion of clearing, grubbing, scalping, stripping, and excavation inclusive of any undercutting.

F. Proof-Rolling: Testing of prepared ground surface by compactive effort to identify areas that will not support the future loading without excessive settlement.

G. Relative Compaction: As defined under ASTM D698.

H. Subgrade: Surface that will support structures or roadway.

1. Subgrade may be a prepared ground surface after proof-rolling, and compaction to provide a suitable foundation for structures or pavement.
2. Subgrade may also be an embankment or fill section that is constructed after proof-rolling the prepared ground surface and subsequently placing and compacting fill material to provide a suitable foundation for structures and pavement.

I. Undercut: Excavation of soil below the level that will support the structure, roadway, fill, or embankment in order to remove soft or otherwise unsuitable materials.

1.03 SUBMITTALS

A. Submit gradation analyses and other supporting data for imported material to demonstrate conformance with the Specifications.

1.04 QUALITY ASSURANCE

A. Notify Engineer when areas are ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

B. Notify Engineer when:

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

2. Soft or loose materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications

1.05 ENVIRONMENTAL REQUIREMENTS

A. Fill and backfill shall be placed and compacted on areas when unfrozen and free of ice and snow.

B. Areas that will receive fill or backfill shall be dry and free from standing water.

1.06 SEQUENCING AND SCHEDULING

A. Backfill against concrete structures and compact only after concrete has attained 70 percent of design strength. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill.

B. Backfill around water-holding structures and compact only after completion of satisfactory leakage tests.

D. Do not place granular base, subbase, or surfacing until after subgrade has been prepared and successfully tested.

PART 2 PRODUCTS

2.01 MATERIALS

A. Definitions for materials to be used are presented above.

PART 3 EXECUTION

3.01 GENERAL

A. Moisture content of materials that will be compacted shall be within 5 percent of the optimum moisture content as measured under ASTM D698.

B. Proof-rolling shall consist of at least 10 passes of a self-propelled roller that imparts a force not less than 40,000 pound per drum to the soils. Each pass shall overlap the preceding pass by 30 percent to ensure complete coverage.

1. Soft materials revealed through proof-rolling shall be excavated and filled with common fill or crushed stone in 6-inch lifts and compacted to at least 100 percent of the ASTM D698 density.

2. The proof-rolling and other compaction efforts shall result in a soil density not less than 100 percent of the ASTM D698 density for a depth of at least two (2) feet.

C. All fill and backfill that will support pavement, structures, sidewalk, aprons, or similar items shall be placed in 6-inch lifts. Fill and backfill in open areas, other than trenches, shall be place in 12-inch lifts.

D. All subgrades, fill, and backfill shall be compacted to at least 100 percent of the maximum density established under ASTM D698.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The erosion and sedimentation controls shown on the Drawings are illustrative of potential requirements of the Contractor-obtained erosion and sediment permit, but do not imply a fully complete system that would satisfy permit requirements. Contractor is responsible for providing effective erosion and sediment control measures during construction and shall furnish all labor, materials, equipment and incidentals necessary to 1) prepare an erosion and sediment control plan, 2) obtain an erosion and sediment control permit from the appropriate permitting agency, and 3) perform all installation, maintenance, removal and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to, installation of temporary access ways and staging areas, silt fences, rock check dams, straw bale barriers, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, erosion control matting installation, sodding and final cleanup.

B. Soil erosion and sediment control measures are required on all areas disturbed during construction.

1.02 GENERAL

A. See Conditions of the Contract and Division 01, General Requirements, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

B. All activities shall conform to State and Federal regulations, Local codes, and the Drawings and Specifications. In the event of a conflict, the more stringent requirement shall apply.

C. Soil erosion stabilization and sedimentation control consist of the following elements:

1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
2. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
3. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
4. Topsoil and Seeding:

a. Placement and maintenance of temporary seeding on all areas disturbed by construction.
b. Placement of permanent topsoil, fertilizer, and seed, etc., in all areas not occupied by structures or pavement, unless shown otherwise.

5. Soil Stabilization Seeding: Placement of fertilizer and seed, etc., in areas as specified hereinafter.

D. The Contractor shall be responsible for phasing work in areas allocated for exclusive use during this project, including any proposed stockpile areas, to restrict sediment transport. This will include installation of any temporary erosion control devices, ditches, or other facilities.

E. The areas set aside for the Contractor's use during the project may be temporarily developed to provide satisfactory working, staging, and administrative areas for exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to control all sediment transport away from the area.

F. All permanent stockpiles shall be seeded with soil stabilization seed and protected by construction of silt fences and permanent 2-foot, minimum depth, ditches, completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.

G. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences, as necessary. The Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.

H. The Contractor shall maintain all elements of the soil erosion stabilization and sedimentation control systems and facilities to be constructed during this project for the duration of construction on this project. Formal inspections made jointly by the Contractor and the Engineer shall be conducted every 2 weeks to evaluate the Contractor's conformance to these Specifications, regulatory agency requirements, and permit conditions.

I. All silt traps shall be cleaned of collected sediment after every storm or as determined from the biweekly inspections. Cleaning shall be done in a manner that will not direct the sediment into the storm drain piping system. Removed sediment shall be taken to an area selected by the Engineer where it can be cleaned of sticks and debris, then allowed to dry. Final sediment and debris disposal shall be onsite as designated by Engineer.

J. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Contractor within 2 days after receiving written notice from the Engineer.

K. Unpaved earth drainage ditches shall be regraded as needed to maintain original grade and remove sediment buildup. If a ditch becomes difficult to maintain, the Contractor shall cooperate with the Engineer and install additional erosion control devices such as check dams, temporary paving, or silt fences as directed by the Engineer.

L. If the Contractor has not complied with any of the above maintenance efforts to the satisfaction of the Engineer within 2 working days after receiving written notification from the Engineer, the Owner shall have the right to engage others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Contractor's monthly partial payment the costs for such efforts plus a $500 administration fee.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00, Submittal Procedures.

B. Submit an approved erosion and sediment control plan to the Engineer prior to initiating land disturbing activities.

C. In addition, the Contractor shall provide the following specific information:

1. Certificates of inspection of seed by Federal, State or Local authorities and copies of delivery invoices or other proof of quantities of fertilizer.
2. Manufacturer's certificate of compliance attesting that the geotextile meets the requirements of these Specifications.

1.04 REFERENCE STANDARDS

A. The material and method of construction shall be in accordance with the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

1.05 PERFORMANCE REQUIREMENTS

A. The Contractor shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on

the Drawings necessary to prevent the movement of sediment off-site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor.

B. Where Contractor's efforts to control erosion have been demonstrated to be ineffective or potentially ineffective, in the opinion of the Engineer, the Engineer may order that the Erosion Control Plan be amended and that additional erosion control measures be constructed at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 PERMANENT SEED

A. Seed for those areas where topsoil is to be applied shall be per Section 32 92 20, Seeding and Sodding.

2.02 SOIL STABILIZATION AND TEMPORARY SEED

A. Temporary seeding shall be in accordance with the Alabama Department of Transportation Standard Specifications for Highway Construction.

Temporary Seeding	
September through December	
Annual Ryegrass	25 pounds per acre
Kentucky 31 Fescue	30 pounds per acre
Reseeding Crimson Clover	10 pounds per acre
January through April 15	
Kentucky 31 Fescue	30 pounds per acre
Reseeding Crimson Clover	30 pounds per acre
Annual Ryegrass	15 pounds per acre
April 16 through August	
Brown Top Millet	30 pounds per acre
Kentucky 31 Fescue	30 pounds per acre
Hulled Bermuda Grass	10 pounds per acre

2.03 TOPSOIL

A. Topsoil shall be as specified in Section 650 of the Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition.

2.04 FERTILIZER

A. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to Federal, State and Local laws, and suitable for application with equipment designed for that purpose.

B. Fertilizer shall be in accordance with Specification 32 92 20, Seeding and Sodding.

2.05 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds, or clean salt hay.

2.06 SILT FENCE

A. Shall be constructed of synthetic fabric conforming to the requirements of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

2.07 INLET PROTECTION DEVICES

A. Where sediment-laden runoff is diverted to on-site stormwater drain inlets, the inlets shall be protected with an appropriate and approved sediment control device.

2.08 ROCK FILTER DAMS

A. The height of the dam shall be limited by the channel bank height or 8 feet, whichever is less. The dam height should not exceed the elevation of the upstream property line.

B. The minimum media stone size shall be 9 inches. The gradation of rock to be used should be specified using Tables RD-1 and RD-2 of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

C. Geotextiles shall be used as a separator between the graded stone, the soil base and abutments.

2.08 GRAVEL FOR CONSTRUCTION EXITS

A. Aggregate should be course aggregate gradation No. 1 as defined in the Alabama Department of Transportation Standard Specifications for Highway Construction, 2012 Edition. Pad thickness shall be a minimum 6 inches, with a non-woven geotextile under liner meeting Class IV.

2.09 DUST CONTROL

A. Sprinkle the site until the site is wet to control dust.

2.10 FLOATING TURBIDITY BARRIER

A. Floating turbidity barriers shall be Type II

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall install erosion and sediment control measures and maintain in accordance with the Drawings. The sequence of construction shown on the Drawings is made a part of these Contract Documents.

B. The Contractor shall provide and maintain temporary seeding at all times.

3.02 SILT FENCE

A. The Contractor shall install silt fence in accordance with the Alabama Handbook for Erosion, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas (latest version).

3.03 SEEDING

A. General:

1. The Contractor shall give at least three (3) days notice to the Engineer prior to seeding to allow the Owner to inspect the prepared areas. The Contractor shall rework any areas not approved for seeding to the Owner's satisfaction.
2. The Contractor shall keep the Engineer advised of schedule of operations.
3. Seed shall be clean, delivered in original unopened packages and bearing an analysis of the contents, meeting requirements of Section 32 92 20, Seeding and Sodding.

B. Schedules:

1. Refer to Section 2.02 of this Specification.

C. Soil Stabilization and Temporary Seeding:

1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days.
   a. Fertilizer.
   b. Seed.
   c. Mulch.

d. Maintenance.

2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Should the Contractor elect to apply soil stabilization seeding by hydroseeding methods, an operational plan and methods shall be submitted to the Engineer.
3. Temporary Seeding is to be placed and maintained over all disturbed areas prior to permanent seeding. Maintain temporary seeding until such time as areas are approved for permanent seeding. As a minimum, maintenance shall include the following:
   a. Fix-up and reseeding of bare areas or redisturbed areas.
   b. Mowing for stands of grass or weeds exceeding 6 inches in height.

D. Topsoil and Permanent Seeding:

1. Topsoil and Permanent Seeding shall consist of the application of the following materials in quantities as further described herein:
   a. 6-inch depth of topsoil.
   b. Lime.
   c. Fertilizer.
   d. Permanent seed mix.
   e. Mulch.
2. Topsoil is to be placed over all disturbed areas that are not surfaced with concrete, asphalt, or pavers.
3. Preparation:
   a. After rough grading is completed and reviewed by the Engineer, Contractor shall spread topsoil as hereinbefore specified over all areas to receive permanent seeding to a minimum compacted depth of 6 inches with surface elevations as shown on the Drawings. Loosen the finished surface to a depth of 2 inches and leave in smooth condition, free from depressions or humps, ready for seeding.
   b. Finish Grading:
      1) Contractor shall rake the topsoiled area to a uniform grade, so that all areas drain as indicated on the Drawings.
      2) Contractor shall remove all trash and stones exceeding 1 inch in diameter from area to a depth of 2 inches.
4. Permanent Seed:
   a. After soil has been scarified, apply seed and other products at the rate and proportion specified in Section 32 92 20, Seeding and Sodding and water as necessary.
5. Maintenance:
   a. Maintenance Period: Contractor shall begin maintenance immediately after each portion of permanent grass is planted and continue until final completion.

b. Maintenance Operations: Contractor shall water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Mow to 2 inches after grass reaches 3 inches in height, and mow frequently enough to keep grass from exceeding 3-1/2 inches. Weed by local spot application of selective herbicide only after first planting season when grass is established.

6. Guarantee:
   a. If after 8-weeks a satisfactory stand of grass has not been produced, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately, or, if after October 15 during the next planting season. If a satisfactory stand of grass develops by July 1 of the following year, it will be accepted. If it is not accepted, a complete replanting will be required during the planting season meeting all of the requirements specified.
   b. A satisfactory stand is defined as grass or section of grass that has a substantial establishment of new grass, strongly rooted, and uniformly green in appearance from a distance of 50 feet. No noticeable thin or bare areas are allowed as determined by the Engineer.

E. Stone Construction Exit Installation:

1. The stone construction exit shall be installed to meet the minimum required dimensions shown in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

2. The area of the exit must be excavated a minimum of 3 inches and must be cleared of all vegetation, roots, and other objectionable material. A filter fabric underliner shall then be placed the full width and length of the entrance.

3. Following the installation of the filter cloth, the stone shall be placed to the specified dimensions. If wash racks are used, they shall be installed according to manufacturer's specifications. Any drainage facilities required because of washing shall be constructed according to the Specifications. Conveyance of surface water under entrance, through culverts, shall be provided as required. If such conveyance is impossible, the construction of a "mountable" berm with 5:1 slopes will be permitted.

4. The filter cloth utilized shall be a woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns or polyester. The fabric shall be inert to commonly encountered chemicals and hydrocarbons, be mildew and rot resistant, and conform to the physical properties noted in the Alabama Handbook for Erosion Control, Sediment

Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

F. Curb Inlet Protection:

1. Installation and maintenance shall be per the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

G. Floating Turbidity Barrier:

1. Installation and maintenance shall be per the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas (latest version).

3.04 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Contractor shall make a visual inspection of all sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas or into the vent trench, Contractor shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Silt Fences

a. Sediment deposits must be removed when deposits reach approximately one-half the height of the barrier.

b. Should the fabric on a silt fence decompose or become ineffective, the fabric shall be replaced promptly.

c. Make other repairs as necessary to ensure that the fence is filtering all runoff drained to the fence.

END OF SECTION

SECTION 31 62 24
MICROPILE (ROCK ANCHOR)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Includes furnishing all labor, equipment and materials and performing all operations necessary for the installation of the micropiles, a.k.a. rock anchors.

B. The Contractor shall examine the site, the Drawings, the soil borings, and other data to determine all conditions under which the piling system will be installed. The lengths of the piles shown on the Drawings are estimated from the soil boring data. The Engineer shall determine the actual bottom elevations of the micropiles after the load test or tests have been completed.

1.02 RELATED SECTIONS

A. 01 33 00 – Submittal Procedures
01 40 00 – Quality Requirements
03 30 00 – Cast in Place Concrete

1.03 SYSTEM DESCRIPTION

A. The micropile system shall consist of hollow bars, which are continuously threaded with the special Titan thread to allow the bars to be cut to any length (standard length = 10') and spliced with Titan couplers. The bars shall be made out of special fine grain, high alloy, and seamless steel tubing. The steel quality and the thread type deformation shall meet and exceed the physical properties and requirements of ASTM A 615, Grade 75 steel bars.

B. The system shall be an IBO (grout injection bored) system that improves the surrounding ground due to continuous tremi-grout injections during the rotary or rotary/percussion drilling.

C. The cement grout pressure shall be injected through the hollow Titan bar and exit through venturi holes in the side and or bottom of the sacrificed drill bits.

D. The procedure shall stabilize the drill hole, mix and penetrate the surrounding soil with cement, carry the cuttings from around the Titan bar, ensure corrosion protection, and stabilize and improve the surrounding soil. This method shall provide the same or better grout to soil friction values as pressure or post-grouting methods.

1.04 QUALITY ASSURANCE

A. Testing, Laboratory Inspection and Field Supervision:

1. All cement grout used in conjunction with the micropile work shall be in accordance with the requirements outlined in Section 03 33 00,

2. The Titan micropile system shall be installed under the direct supervision of a qualified inspector, employed by the Contractor and approved by the Engineer.

3. The Contractor shall deliver to the Owner and Engineer the written approval by the testing laboratory of the Titan micropile installations prior to the start of the above grade construction.

4. An accurate record shall be kept of each micropile as installed. Records shall show top and bottom elevations, drilling time, amount of heavy grout used, size of Titan bar, type and diameter of drill bit used and any other pertinent data. Records shall be made and signed by the project foreman/ superintendent and the inspector, and distributed to the proper authorities on a daily basis.

B. Subsurface Soil Data: A subsurface soil investigation was made for this site and is bound herein, and is for the use of the micropile contractor as to the soil and water conditions that may be encountered at the site; refer to specifications. The report is not guaranteed as representing all conditions that may be encountered. Each bidder is cautioned that it is his responsibility to notify the Engineer if any change of conditions is encountered.

C. Installer Qualifications: The Titan micropile installer must be prequalified prior to bidding/installation of the micropile system.

PART 2 – PRODUCTS

2.01 DRILLING

A. Hydraulic rotary or rotary/percussion drill shall be sized for the various sizes of bars, bits and drilling conditions. Rotation = 80 to 120 RPM- left and/or right hand turn. Torque of 300 Nm. Percussion energy to be maximum of 84 Joule.

2.02 GROUTING MIXER AND PUMP

A. A high-shear mixer with separate holding tank and water and cement dosing system shall be used to assure continuous grouting independent from mixing.

B. Pump with at least 50 to 200 L/Minute volume and minimum 250 psi pressure capability, (preferable 1500 psi) shall be used to complete the work. To record the grout volume and pressure, an auto monitor may be used.

2.03 STRESSING JACK FOR TESTING

A. Provide a calibrated hollow ram jack and pressure gauge with a load capacity of at least the ultimate capacity of the TITAN bar. Dial gauges shall be used for monitoring the movement of the pile/anchor and the elongation of the bar during testing.

2.04 MATERIALS

A. Hollow TITAN Bars and Accessories: All parts are shown in the CTS TITAN/IBO Parts-List. Standard length of bar = 10'. Check technical data for each bar size used (TITAN bar meets and exceeds ASTM A 615 requirements).

2.05 DRILL BITS

A. Standard crosscut bit for soft rock, loose sand and gravel. Clay bit for clay and dense sand, carbide bit for harder rock and boulders. Other drill bits are available; consult Con-Tech Systems Ltd. the supplier.

2.06 GROUT

A. Grout mix shall be a neat cement grout, using Portland Cement Type I, II, or III, mixed with a water/cement ratio W/C = 0.7 for drilling and flushing and with W/C-0.45 for final grout. Final grout shall have a minimum 28-day strength of 4,000 psi. Acceptance of grout with strengths varying from those indicated, to be ultimately determined by the ability of the nails and/or piles to carry the loads. No additives are required.

PART 3 – EXECUTION

3.01 PREPARATION

A. Equipment

1. Drilling Equipment: Install flushing head (grout swivel) onto striker bar and fix with holder to prevent turning. Connect grout hose to swivel and grout pump. Select grout hose to withstand grouting pressure. Check rotation of drill hammer. For breaking loose from flushing head swivel, a tool shall be used to prevent the hollow Titan bar form turning.

2. Grouting Equipment: Make sure that water and/or cement dosing gauges are functional and place screen on top of holding tank. Set water cement ratio (W/C). Place water first into mixer before placing cement.

B. Materials: Select proper drill bit. Have required amount of Titan bars counted and stored on dunnage next to the drill hole ready with one (1) coupler placed on each bar. The first bar shall be equipped with the drill bit. Verify that the hollow bars are free of dirt inside to prevent blockage during grouting.

3.02 INSTALLATION

A. One-Step Drilling/Flushing/Grouting:

1. Connect hollow bar to swivel and thread on drill bit.
2. Mix sufficient flushing grout (W/C=0.7) and pump into holding tank.
3. Start pumping to assure that grout will exit drill bit.
4. Start rotary drilling while pumping grout continuously out of the holding tank. Grout in holding tank to be agitated throughout. Grout shall flush constantly out of the drill hole.
5. Generally advance rotary drilling no faster than 3 to 4 feet per minute. Rotation speed approximately 60 to 120 RPM. If harder ground, boulders or rock is encountered, use top hammer as well. It is good practice and to achieve higher friction values, work hollow bars in and out several times for each 10-foot length of nail or pile installed. If rock is encountered change grout to water flushing.
6. When final depth is reached, change water to cement ratio to 0.45, under constant rotation and working hollow bars in and out 5'to 10', pump final grout to replace flushing grout.
7. For test nails and piles or to prevent drag on piles, install a plastic or steel pipe over the hollow bar in the upper length, as determined by the project Geotechnical Engineer. The pipe can be drilled in with the last hollow bars or pushed into soft grout body. An alternate method for sacrificial test soil nails or test piles shall be to flush out the upper grout.

3.03 TESTING

A. Conduct load tests on 50% of all production piles on drawings. Test procedures shall be in accordance with ASTM D3689 tension or ASTM D1143 compression quick load test.

END OF SECTION