

SECTION 31 22 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary grading or ditching to protect the site and adjoining property from water and silt damage.
2. Topsoil Stripping.
3. Grading, excavating, rock excavating, and filling to prepare subgrades for foundations (buildings and structures), walks, pavements, grass areas, landscape areas, and general areas.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. 31 00 01 "SITE PREPARATION AND GENERAL SITE WORK" for layout, protection of existing facilities, protection of vegetation, utility locates, and utility protection.
2. 32 05 00 "COMMON WORKS FOR EXTERIOR IMPROVEMENTS" for import fill, import backfill, geotextile specifications.

1.2 REFERENCE SPECIFICATIONS AND DOCUMENTS

A. Georgia Department of Transportation (GDOT)

1. Department of Transportation, State of Georgia Standard Specifications, Construction of Roads and Bridges, 2013 Edition. Unless otherwise noted, conform with GDOT Standard Specifications where referenced.
2. GDOT Test Procedures (GDT), where referenced.

B. American Society for Testing Materials (ASTM)

1. ASTM D422 - Particle Size Analysis of Soils.
2. ASTM D423 - Test for Liquid Limit of Soils.
3. ASTM D424 - Test for Plastic Limit and Plasticity Index of Soils.
4. ASTM D1556 - Test for Density of Soil In Place Sand Cone Method.
5. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification).
6. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
7. ASTM D698 - Standard Test Methods For Moisture-Density Relations of Soil Using Standard Effort.
8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.3 DEFINITIONS

- ###### **A.**
- Backfill is defined as fill immediately behind foundation elements or retaining walls.

- B. Excavation: Removal of material encountered above subgrade elevations, and to lines and dimensions indicated, or as directed. Excavation may be classified as earth excavation, rock excavation, or subexcavation, or it may be *unclassified* as described below.
1. Unclassified Excavation: Excavation of all material, including rock, regardless of its nature or the manner in which it is removed. All excavation shall be unclassified unless explicitly and otherwise shown on the Drawings, or if unit pay items are provided for Rock Excavation, Earth Excavation, or Subexcavation.
 2. Earth excavation or simply "Excavation": Excavation of all material except for active utilities and rock.
 3. Rock excavation: Excavation of all hard, compacted, or cemented materials that require the use of drilling, blasting or wedging equipment to remove. It shall consist of un-decomposed stone hard enough to ring under a hammer, and the amount of solid stone shall not be less than one (1) cubic yard in volume. If applicable, rock is further defined as follows:
 - a. General Excavation (Mass): Any material occupying an original volume of more than one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds (Caterpillar D-8 or larger).
 - b. Trench Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC 220LC-7; equipped with a short tip radius bucket not wider than 42 inches.
 4. Subexcavation: Authorized additional excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Design Professional or Testing Agency in writing.
- C. Fills: Suitable materials placed to raise existing grades.
1. General area fill: all fill in the general grading area covering banks, hollows, drain ditches, etc.
 2. Pavement fill zone: The zone occupied by materials supporting asphalt or concrete paving supporting vehicular traffic or parking and extending for a distance of 4 feet on each side paving area measured at the finished grade (including gutter pans), thereafter tapering away at a 45° angle. Pavement fill zone for asphalt or concrete pedestrian areas are 2 feet on each side of paving area measured at finish grade and tapering down at a 45° angle.
 3. Structural fill zone: The zone occupied by materials supporting floor slabs, building foundations or other structures and extending for a distance of 10 feet on each side of said structure measured at the finished grade, thereafter tapering away at a 45° angle.
- D. Neat line: The shown, directed or described line or plane defining the limits of work. Work beyond neat line(s) is not subject to payment when included in a unit pay item.
- E. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- F. Trenches:
1. Foundation: The area beneath the bedding.
 2. Bedding: The area above the foundation and below the bottom of the pipe.
 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.

4. Initial backfill: The area above the haunching material and below a plane 18 inches above the top of the pipe.
 5. Final backfill: The area above a plane 18-inches above the top of the barrel of the pipe.
- G. Conserved Topsoil: Excavated soil material, with organics, conserved from grading areas that is suitable for growth of grass, cover crops, or planting areas. Identification and use of all conserved topsoil is subject to approval by the Testing Lab or Design Professional. Refer to 32 05 00 "COMMON WORKS FOR EXTERIOR IMPROVEMENTS" for definition of Furnished Topsoil.
- H. Unsuitable Soils:
1. Existing undisturbed soils which are determined by the Testing Laboratory or Design Professional to be unsuitable for use as fill in a particular application for reasons other than moisture or water content.
 - a. Water saturated soils, regardless of the source of the water (rainfall, storm runoff, ground water or other sources) shall not be considered as unsuitable.
 - b. Dewater or dry out water saturated soils to the extent necessary to satisfy the requirements for fill.
 - c. The Contractor is solely responsible for the scheduling and sequencing of the work. If necessary, to maintain the Contractor's schedule, wet soils shall be removed and replaced with suitable fill to replace water saturated soils. The removal and replacement of water saturated soils shall be performed at the Contractor's expense.
 2. In general, existing undisturbed soils that are highly organic or highly plastic (classified as Class IV Roadway Material per Georgia DOT Standard Specification Section 810) may be classified as unsuitable depending on application.
 3. Fill material placed on site by the Contractor, regardless of whether fill is on-site or off-site borrow, cannot by its nature, be classified as unsuitable soils.
 - a. Materials placed as fill shall not be classified as unsuitable soils regardless of conditions encountered, since only suitable soils shall be used as fill.
 - b. Fill shall be placed, compacted and tested as required by the Contract documents.
 - c. The Contractor shall be responsible for maintaining compacted fill, in condition and at compaction levels required, until improvements (site and/or building) are placed on fill.
 - d. Should compacted soil be disturbed or become water saturated the Contractor shall be responsible for conducting whatever work is necessary to restore to the soils to the specified criteria at no cost to the Owner.
 4. Water Saturated Soils: Should soils become saturated the Contractor shall, at his/her expense and as part of the scope of this Contract, perform activities necessary to mediate and / or replace water saturated soils as required to obtain suitable fill as required by the Testing Agency or Design Professional.

1.4 UNIT PRICES

- A. Rock Excavation: Unit prices for rock excavation include replacement with approved materials. Measurement of rock excavation shall be based on the volume of rock actually removed, measured in its original position, but not to exceed the following (payment neat lines).
1. 2.0 ft outside of concrete forms other than at footings.

2. 1.0 ft outside of concrete forms at footings.
 3. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 4. 6 inches beneath bottom of concrete slabs-on-grade.
 5. 6 inches beneath pipe in trenches, and 2.0 ft wider than pipe but not less than 3.0 ft wide.
- B. Subexcavation: Unit prices for subexcavation shall include replacement of unsuitable material with geotextile for separation and approved backfill material. Volumetric measurement of subexcavation is based on neat line quantities as directed or approved by the Design Professional or Testing Agency.
- C. Import Fill Material: Unit prices for import fill (structural fill, general fill when shown and not including any fill material for rock excavation or subexcavation) shall include disposing of any unsuitable material, procuring fill materials and transporting them to the site.
1. Unless otherwise specified in the General Conditions, when mass measurements are shown on the bid form, measurement of additional import material are based on weight tickets for material delivered to the site and incorporated into the work.
 2. Unless otherwise specified in the General Conditions, when volume measurements are shown on the bid form, measurement shall be based on volumes measured by surveying the installed volume of fill.

1.5 SUBMITTALS

- A. Product data for materials, including but not limited to: geotextiles, utility line markers, import fill material, control density backfill.
- B. Quantities of stripped and stockpiled topsoil. Provide report within 48 hours of stockpiling.
- C. Shoring, bracing and shielding plans and calculations certified by a Registered Professional Engineer registered in the State of Georgia.
- D. Settlement monitoring reports for structural fills.
- E. Backup for unit cost documentation, that may include:
 1. Survey and computed quantities for Rock Excavation.
 2. Delivery tickets (tonnage) for import fill incorporated into the Work.
- F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earthwork operations including blasting. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

- A. Earthwork Testing and Inspection Services: The Owner will engage a qualified independent Testing/Inspection Agency to perform Earthwork Testing as described in this Section.
- B. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare an informational blasting plan reporting the following:
 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that

will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.
3. Pre-excavation photos or videotape.

1.7 SITE CONDITIONS

A. Protection:

1. Limit grading and filling operations to within the defined clearing limits, work zones, or limits of disturbance. Do not disturb the existing terrain or trees outside these lines.
2. Fill material placed against drainage structures or back-filled around utility pipes shall be placed and compacted by methods which will not cause any damage. Any damage which does occur shall be repaired or replaced by the Contractor at the Contractor's expense.
3. Graded Areas: Any settlement or washing that occurs prior to acceptance of the work shall be repaired and grades re-established to the required elevations and slopes. Fill to required subgrade levels any areas where settlement occurs.

B. Hazardous Materials:

1. No soil found on site or transported to the site which is contaminated with material containing asbestos, PCB's, radon, gasoline, fuel oil, or other fossil fuels, shall be used for fill, backfill or landscape topsoil.
2. Notify Design Professional of any contaminated soil found on site. Any contaminated soil found on site shall be removed and disposed of in a lawful manner.

1.8 COORIDINATION AND SCHEDULING

- A. Notify the Design Professional a minimum of 48 hours prior to the beginning of any excavation, filling, or grading.
- B. The Contractor is solely responsible for the scheduling and sequencing of the work. If necessary, to maintain the contractor's schedule, removed wet soils dewater and dry out sufficiently for its application, or remove and replace with suitable fill. The dewatering or removal and replacement of water saturated soils shall be performed at the contractor's expense.

PART 2 - PRODUCTS

2.1 FILL OR BACKFILL MATERIALS

- A. The soil used for fill or backfill material shall be free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- B. Fill or backfill for paving areas or supporting buildings shall have a maximum dry density exceeding 90 pounds per cubic foot (pcf).
- C. Where specified use Graded Aggregate Base (GAB) as backfill or structural fill: Refer to 32 05 00 "Common Works for Exterior Improvements" for material properties.

- D. Structural Fill: Soil Classification Groups SM, ML, CL; SW, SP, SC, SP-SM, SP-SC (ASTM D 2487). Additionally Class I or Class II (but excluding Class IIB4) Roadway Materials (GDOT Section 810.01) are also acceptable for Structural Fill.
1. Structural fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
- E. Permeable Backfill: Unless shown otherwise, provide a minimum of 2 horizontal feet of permeable backfill material behind retaining structures consisting of gravel, crushed rock, natural sands, manufactured sands, or combinations of these materials conforming to the following gradation:

Sieve Size	Percent Passing
3/4 inch	100
3/8 inch	0-100
No. 100	0-8
No. 200	0 -3

Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

- F. General Fill: Includes soils suitable for structural fill as well as other onsite non organic and non expansive soils that are approved by the Design Professional or Testing Agency that will form a stable and dense mass with or without confinement.

2.2 UTILITY EARTHWORK MATERIALS

- A. Foundation Material: Unless otherwise specified, Crushed stone meeting GDOT Standard Specification 800.01, Group 1 (limestone, marble, or dolomite), or Group II (quartzite, granite, or gneiss). Stone size is between No. 57 and No. 4, inclusive.
- B. Utility bedding and backfill: Unless otherwise shown bed pipes from trench bottom to one foot above pipe.
1. Unless otherwise shown pipe bedding and backfill shall consist of: sand, gravel, crushed aggregate, or native free draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
 2. Cement sand slurry shall be provided with 1 sack of concrete per cubic yard of mixture.
 3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

2.3 LINE MARKERS

- A. 2" width minimum, 5 mil tape thickness with non-ferrous detectable aluminum backing and shall be printed with the description that the relevant utility is "buried below". Line marker colors according to APWA corresponding to the utility type as follows:
 - 1. Gas lines- yellow
 - 2. Power – red
 - 3. Communications - orange
 - 4. Sanitary – green
 - 5. Water - blue

2.4 GEOSYTHETICS

- A. Refer to 32 05 00 "Common Works for Exterior Improvements" for material properties of geotextiles for separation and stabilization.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Construction Survey: Refer to 31 00 01 "Site Preparation and General Site Work" for layout and survey requirements. Provide construction staking as required for drives, parking, walks and other site improvements. Protect benchmarks, monuments and other reference points.
- B. Clear and grub the area of vegetation and obstructions.

3.2 EROSION CONTROL AND SEDIMENT CONTAINMENT SYSTEMS:

- A. Adhere to the "Land Disturbance Construction Activity Sequence" as defined in the Erosion and Sediment Control Plans.
- B. Temporary Grading and Drainage: Provide effective drainage for the entire site at all times. Divert watersheds by ditching or embankments to prevent encroachment of surface water in excavations. No impoundment of water will be permitted except as provided. The Contractor is fully responsible for all water damage to the site and to the installed work.
- C. Refer to 31 25 00 "EROSION AND SEDIMENT CONTROLS" for additional grading operation requirements and storm drainage system installation requirements.

3.3 CONSERVED TOPSOIL

- A. After all demolition, clearing and disposal is completed, strip from the top of the existing ground all topsoil from all areas to be graded.
- B. Prior to stockpiling of topsoil, screen topsoil via a mobile mechanical screening machine with a 1/2inch size sieve.
- C. Stockpile topsoil in designated or approved locations with proper drainage and where it will not interfere with the work. After topsoil has been stockpiled, quantify the stockpiled volumes. Report quantities to the Owner, Architect, and Site Design Professional within 2 days of completing stockpiles.

3.4 GENERAL GRADING REQUIREMENTS

- A. Perform exterior grading to provide smooth transitions to and between the proposed contours and spot elevations shown on Drawings.
- B. In all cases, grade to a sufficient pitch to drain water.
- C. Perform earthwork as required to establish finished grades as indicated on drawings. Grades not otherwise indicated shall be uniform levels of slopes between points where elevations are given or between such points and existing finished grades.
- D. Excess Cut Material: If quantity of grading material is in excess of quantities necessary to provide finish grade elevations indicated on drawings or if excavated material is deemed unsatisfactory for use as compacted fill, excess material shall be spread onsite as indicated on the Plans or as directed by the Owner and/or Design Professional. Excess material that cannot be spread on site shall be hauled off site and disposed of legally. Hauling and disposal of excess cut material is performed at the Contractor's expense.
- E. Insufficient Fill Material: If quantity of grading material is insufficient to achieve subgrade elevations, Contractor shall obtain additional fill material of specified quality from an off-site source. Obtaining and hauling of additional fill material is performed at the Contractor's expense.
- F. Import Fill Material for Areas Determined to be Unsuitable: If the Testing Agency or the Design Professional determines that onsite excavated or grading materials are unsuitable for use as compacted fill for a given application, then import fill material shall be obtained from an off-site source. Import fill material shall conform to specifications for the given application. Disposing of unsuitable material, and providing, hauling of import fill material shall be performed by change order based on the unit prices included within the contract.
- G. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value. All moisture conditioning necessary to permit compaction to the specified density is performed at the Contractors expense.
- H. Slope subgrade to provide positive drainage within all underdrain systems. Unless shown otherwise on the Drawings, subgrade minimum slope to underdrain collection systems is 0.5%.
- I. Subgrade Elevation Tolerance: Cut, place, compact fill and rough grade entire project area to within 0.10 feet above or below design subgrade elevations.

3.5 EXCAVATION AND EMBANKMENT SAFETY

- A. Comply with all Federal, State, and Local safety laws and regulations pertaining to trenching, excavation, bracing and shoring that includes but is not limited to:
 - 1. OSHA Excavation Standards, 29 Code of Federal Regulations (CFR) Part 1926, Subpart P- Excavations.

- B. If conflict exists between safety laws, regulations, and contract requirements including these specifications, apply the most stringent requirements or standards.
- C. Protect all excavations and embankments against collapse. Where possible, excavations over 4 feet high shall be made at a slope not steeper than 1.5H:1V or where the soil is very sandy or wet the slope should be no steeper than 2H:1V.
- D. Barricade trenches, ditches, pits, sumps and similar Work outside the barricaded working area with chain link fence and in accordance with OSHA standards and requirements.
- E. Where it is not possible to provide a safe slope, temporarily support all banks and excavations and maintain secure until permanent support has been provided.
- F. Where ditches or trenches that are over 4 feet deep, provide cross bracing and shoring to prevent collapse.
- G. Provide bracing, shoring, or shielding systems designed by a Georgia Registered Professional Engineer experienced in such designs. The design drawings shall show the work and sequence in its entirety and be submitted to the Design Professional prior to commencing the work.
- H. Remove shoring upon completion of Work, or when no longer need, unless otherwise required by authorities having jurisdiction over the Work.

3.6 DEWATERING

- A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
- B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- C. Maintain groundwater a minimum of 3 feet below the bottom of any excavation associated with a foundation. Maintain all excavations free of standing water at all times.
- D. Remove all mud caused by standing water from any excavation before the placing of permanent material.
- E. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
- F. No untreated sediment laden water from dewatering operations shall be allowed to enter surface water or a storm drainage system or a permanent stormwater pond.

3.7 TRENCH EARTHWORK

- A. General:
 - 1. Conform with the most stringent requirements of these specifications, the Plans, of Utility providers, and of local agency permitting authorities. Requirements may include, but are not limited to: depth of cover, minimum

trench width, bedding material, pipe zone backfill, and compaction requirements.

2. Detection wire: Bury continuous and unbroken wire directly above non-metallic piping at a distance not to exceed 12 inches above top of pipe. Terminate wire in junctions (manholes, vaults, boxes) with a minimum of 3 feet of wire coiled, remaining accessible in each manhole.
3. Line Markers: During back filling of utility lines, furnish and install continuous underground-type plastic line marker, located directly over buried utility lines at 12" below finished grade. Under pavements and slabs, bury tape 6" below top of subgrade.
4. Do not exceed 100 feet of open trench in advance of pipe laying, unless approved otherwise by the Design Professional.

B. General Trench Excavation:

1. Saw cut concrete or bituminous paving for trench excavation.
2. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns
3. Excavate trenches to the required depth or elevation allowing for placement of the pipe and bedding to the dimensions shown on the Drawings.
4. Grade bottom of trenches, no larger than necessary, to accommodate bell holes and other joints and junctions to provide uniform bearing along the pipe.
5. At the direction of the Testing Agency or Design Professional, remove unstable or unsuitable material shall be removed from the bottom of the trench and backfilled in accordance with Article – "SUBEXCAVATION".
6. When rock is encountered, excavate to allow a minimum of 6 inches of clearance between rock and any part of the pipe barrel or structure (manhole, vault) and backfill with granular bedding material.
7. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footings.
8. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Pipe material / use	Cover depth (below finish grade)
Steel Pipe	24 inches
Copper Water Tube	18 inches
Cast-Iron Pressure Pipe	36 inches
Plastic Pipe (other than waste)	30 inches
Tanks or other structures	36 inches
Soil, Sewer & Storm Drain	18 inches (min.) and as required for proper pitch and traffic load. Plastic pipe shall have a min. 18" cover.
Irrigation Pipe	12 inches (Non-pressure) 18 inches (Pressure)

C. Utility Trenches (except sanitary and storm sewer):

1. Excavate to a width as necessary for sheeting and bracing and proper performance of the Work.

2. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
 3. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.
 4. Do not install backfill until required inspections and testing is completed.
 5. Bed and provide initial backfill in accordance with the Drawings, and authorities having jurisdiction.
 6. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.
- D. Sanitary and Storm Sewer Trenches:
1. The maximum trench width below a plane 6 inches above the top of pipe is:
 - a. 24 inches for pipe diameters of 12 inches or less.
 - b. Equal to the sum of the outside diameter of the pipe plus 2 feet for pipe diameters greater than 12 inches.
 2. Excavate the trench width to allow for the proper compaction of haunching and initial backfill material.
 3. Excavate the width of trench above a plane 6 inches above the top of pipe as necessary for proper performance of the work including any sheeting, bracing, or shielding.
 4. Bed bottom of pipe on suitable undisturbed soil or as otherwise shown on the Plans.
 5. In haunch areas of plastic pipe, install granular fill bedding material up to the springline of the pipe.
 6. Install initial backfill in lifts not to exceed 6 inches loose, compacted to 98% of modified proctor and to a minimum depth of 12 inches above the top of pipe. Unless otherwise specified or required by authorities having jurisdiction, immediate backfill material is as follows:
 - a. Class 1- Granular fill.
 - b. Class 2- Suitable existing earth material (default).
- E. Final Fill
1. Once outside of the initial backfill area, continue backfilling to reach subgrade elevation as follows:
 - a. For utility trenches in paving and building areas: Provide structural backfill in 6 to 8" loose lifts, compacted to 98% of standard proctor (ASTM D 698), and within $\pm 3\%$ of optimum moisture. Except that for structural backfill within 12 inches of subgrade, provide in 4" loose lifts and compact to 98% standard Proctor (ASTM D 698).
 - b. Where required, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.
 - c. For utility trenches in general fill areas or grading areas: Provide general fill in 6"-8" loose lifts, compacted to 98% of standard proctor (ASTM D 698) and within $\pm 3\%$ of optimum moisture to reach subgrade elevation.
 2. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Division 32 "FLEXIBLE AND RIGID PAVING REPAIR".

3.8 EXCAVATION

- A. Excavate to lines, elevations, dimensions, and depth as indicated on the drawings.
- B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required. Excavation bottoms shall be level and free from loose material.
- C. Machine drill excavation for round footings to size and depth indicated. Provide a collar, casing, or other adequate protection to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- D. Excess Excavation: If excavations for foundations or footings of any kind are carried by the Contractor, without proper authorization, below the indicated or specified levels they shall be backfilled at the expense of the Contractor as follows:
 - 1. In the areas of excess excavation in rock or under structure footings, the excess excavation shall be back filled, at the Contractor's expense, with material as determined by the Testing Agency.
 - 2. In the areas of excess excavation in other areas, backfill with approved structural or fill material and constructed in accordance with the fill articles in this Specification.
- E. Earth Excavation:
 - 1. **Surface Preparation in excavated areas for foundations:** scarify and uniformly recompact the upper 24 inches of soils intended to support building foundations and floor slabs to 98% of Standard Proctor (ASTM D 698). In confined areas such as utility trenches, utilize portable compaction equipment and lifts of 3 to 4 inches to achieve the required compaction.
 - 2. **Surface Preparation in excavated areas for paving areas:** scarify and uniformly recompact the upper 12 inches of soils to 98% of Standard Proctor (ASTM D 698). In confined areas such as utility trenches, utilize portable compaction equipment and lifts of 3 to 4 inches to achieve the required compaction.
 - 3. **Surface Preparation in infiltration areas, planting bed areas:** unless otherwise shown, scarify and uniformly recompact the upper 12 inches of soils intended for planting areas or infiltration to 75-80% of Standard Proctor (ASTM D 698) to prevent settlement but still allow for infiltration and plant growth.
 - 4. Do not excavate to full depth when freezing temperature may be expected. Protect excavation bottom from frost if placing of concrete or gravel is delayed. All footing excavations shall be free of pin roots.
- F. Rock Excavation:
 - 1. When potential rock is encountered, remove overburden soils and notify the Testing Lab or Design Professional prior to **any** rock excavation. The Testing Lab or Design Professional shall approve and classify all rock excavation. Once classified, survey grading sections of existing rock surface. When rock is completely removed, survey new grading sections to determine the quantity of rock removed within neat line limits.
 - 2. Perform all blasting in accordance with local ordinances, and obtain necessary permits where required.
 - 3. Rock that is excavated is the property of the Contractor and shall be removed from the site. Except that, as allowed by the Contract Documents or as approved in writing by the Testing Agency or Design Professional, rock may be

incorporated into the Work if it is processed appropriately or meets material specifications.

4. Decomposed rock and similar material removable by tractor drawn ripper or power machinery smaller than defined for rock excavation is classified as earth excavation.

3.9 PROOFROLLING

- A. Proof roll surfaces when specified to check for pockets of soft material in areas associated with buildings and pavements.
- B. Proof rolling subgrades within $\pm 3\%$ of optimum moisture or as approved by the Design Professional. In all cases, proof roll subgrades free of surface water which may promote degradation of an otherwise acceptable subgrade.
- C. Proof roll with a loaded 20-ton dump truck, or other pneumatic-tired vehicle of similar size and weight, operated at 2 to 3 mph. For large areas such as parking lots, proof roll with 2 complete coverages in each of two perpendicular directions.
- D. Perform proof rolling under the observation of the Testing Agency or Design Professional. Provide notification 48 hours in advance of all proof rolling operations. Undercut (or subexcavate) Any areas which "pump" or permanently rut under the wheels of the loaded truck and undercut (subexcavate) to a depth and extent directed or confirmed by the Design Professional or Testing Agency.

3.10 SUBEXCAVATION

- A. Perform subexcavation below existing ground elevations or subgrade elevations, as and when directed by the Testing Agency, to correct areas with unsuitable bearing capacity or materials.
 1. Remove and dispose of unsuitable soils to the extents and depth as directed by the Testing Agency.
 2. Level and clear the bottom of the sub excavation of loose material.
 3. Place separation geotextile with all seams overlapped at least 2 feet or as directed by the Testing Agency.
 4. In paving and foundation areas, backfill with GAB (Graded Aggregate Base) in 6 to 8 inch loose layers and compact to at least 98% of Modified Proctor.

3.11 FILLING AND BACKFILLING

- A. STRUCTURAL FILL –BUILDING AND RETAINING WALLS
 1. Construct structural fills in areas supporting buildings and retaining walls to establish design subgrades.
 2. Provide fill materials as specified in Part 2- Products. If excavated materials from the project site are not of required quality or sufficient quantity, import additional materials as necessary.
 3. Schedule construction of structural fill as early as possible in order to allow settlements of underlying soils to occur before building and retaining wall construction commences.
 4. Surface Preparation for fill: Bench areas to receive fill to a minimum of 12 ft width, remove all loose material, and proof roll prior to beginning fill operations.
 5. Place structural fill material in 6 to 8 inch loose lifts at a moisture content at the time of compaction within 3% of the optimum moisture content. Unless

otherwise shown, compact to a minimum of 98% of Standard Proctor (ASTM D 698). Compact the upper 24 inches to 100 percent of Standard Proctor.

B. STRUCTURAL –BACKFILLING

1. After concrete has been placed, forms removed and concrete work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish debris or other waste material from excavations prior to backfill placement.
2. Before placing any backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or damp proofing against damage during backfilling operations with required protection board. Remove bracing as backfill operations progress.
3. Install each layer of material not to exceed thickness of 6 inches, unless otherwise required.
4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished.
5. Carefully backfill walls. Do not utilize heavy equipment within 10 feet of any retaining wall. Use hand tampers to compact within the 10 foot backfill zone.
6. Install wall backfill before installing railings and fences on walls.
7. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep hole opening. Provide an 8 inch square section of galvanized or aluminum screen with a minimum wire diameter of 0.03 inch and install at the backside of each weep hole before installing the backfill material.
8. If a reviewed, approved drainage matting system is provided in lieu of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

C. STRUCTURAL FILL – PAVED DRIVE, WALKS, AND PARKING AREAS

1. Load, haul, place, grade, and compact all necessary structural fill to establish design grades as shown.
2. Surface Preparation for fill: Bench to a minimum of 12 ft widths, all loose material removed, and proof roll prior to beginning fill operations.
3. Place structural fill material in 6 to 8 inch loose measure lifts with moisture content at the time of compaction within 3% of optimum. Compact to a minimum of 95% of Standard Proctor (ASTM D 698). Compact the upper 12 inches to at least 98% of Standard Proctor.
4. Proof roll completed subgrade when within 0.1 feet of final subgrade elevation.

D. GENERAL AREA FILL

1. Load, haul, place, grade, and compact all necessary general area fill in general grading area, covering banks, hollows, drain ditches, etc.
2. Place fill material in 6 to 8 inch loose lifts, compacted to a minimum of 90% of Standard Proctor (ASTM D 698) and within +- 3% of optimum moisture. Except that in landscaping, planting bed areas, and infiltration areas unless otherwise specified or shown, compact the upper 12 inches of soil to 75 to 80% of standard proctor.

3.12 STRUCTURAL FILL SETTLEMENT MONITORING

- A. Perform settlement monitoring in areas supporting buildings and drive/parking areas that are supported on structural fill with depths that exceed 10 feet. Owner's Geotechnical Engineer shall define areas to receive settlement monitoring
- B. Perform settlement monitoring using settlement pins installed as determined in the field by the Owner's Geotechnical Engineer. Utilize a surveyor registered in the State of Georgia to establish elevations at each marker a minimum of 2 times per week until the Owner's Geotechnical Engineer determines that settlement has reached negligible levels. Contractor shall anticipate that settlement monitoring will continue for a minimum of 30-45 days after fill has been placed and compacted.
- C. Refer to the Subsurface Geotechnical Engineering Report for Settlement Pin Detail
- D. Remove all settlement markers at the conclusion of the monitoring period and at the direction of the Owner's Geotechnical Engineer.

3.13 TESTING

- A. All failing tests or retests are the responsibility of the Contractor.
- B. Minimal testing requirements for Owners Quality Assurance are summarized below. Contractor may elect to collect additional samples and perform additional tests or prepare additional specimens for testing at its sole discretion in accordance with their own quality control program.
 - 1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Verify soil bearing capacity assumptions. Provide recommendations to the Design Professional regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Design Professional extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 - 2. Provide characterization and classification, testing of all general fill, and subgrade materials as follows:
 - a. Classification: 1 per material type/source
 - b. Atterberg Limits: 1 per material type/source
 - c. Grain size distribution
 - d. Moisture – Density (ASTM D698 Standard Proctor for fine grained material, ASTM D1557 Modified for coarse grained): 1 per material type/Source (except structural fill).
 - 3. Characterization and classification of import structural, import pavement area fill, and import trench backfill shall be sampled and tested at their designated sources a rate of 1 test per 250 CY of import if total quantity is greater than 1000 CY. If less than 1000 CY, sample and test a rate of 1 test per 100 CY. Perform field density and moisture tests (ASTM D6938, GDT 21 ,59). Other test methods based on material type may be proposed and are subject to approval by the Design Professional. Perform and report field density tests at the minimum frequencies listed below.
 - a. Building Slab: 1 test for each type of soil type on excavated surfaces. 1 test per compacted fill layer each 2500 sq.ft. of area.
 - b. Footings- Foundation: 1 test for each layer or type of soil present. In compacted fill layers, perform one test per 100 feet of footing length.

- c. Paving Area Fill: 1 test per layer for every 2 feet of fill each 5,000 sq.ft. of area.
- d. General Area Fill: 1 test per every 2 feet of fill for each 10,000 sq.ft. of area.
- e. Utility trench spread footing or retaining wall: 1 test per 2 feet of fill per 50 linear feet of trench.
- 4. For import and export of materials, submit bills of lading or equivalent documentation to the Design Professional on a daily basis.

3.14 MAINTENANCE AND PROTECTION

- A. Maintain subgrade, in condition and at compaction levels required, until improvements (site and/or building) are completed.
 - 1. Should subgrade or fill materials be disturbed or become water saturated, restore to the specified criteria as verified by the Design Professional.
- B. Provide additional fill material, remove excess material, or redistribute material, should grades be changed from erosion or construction activities.

3.15 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION