SECTION 31 23 16

GENERAL EXCAVATION

PART 1 - GENERAL

1.01 General excavation shall consist of removing and satisfactorily disposing of all materials taken from within the limits of the work contracted: i.e., the material lying between the original ground line and the established excavation limits.

1.02 Conduct all excavation operations in accordance with the applicable requirements of erosion control as shown on the drawings and specifications and as required by local authorities.

1.03 Complete all clearing and grubbing operations for excavation areas before starting excavation operations. The contractor shall be responsible for and shall take all necessary precautions to protect and preserve any and all existing structures, culverts, pipelines, conduits, wires, subdrains, or parts thereof that may be affected by his operations. He shall, at his own expense, satisfactorily repair or replace any damaged part of any such structure, culvert, pipeline, conduit, wire, or subdrain that may result from his operations or negligence during the life of the contract.

1.04 Strip and stockpile all topsoil in cut and fill areas.

1.05 At all times during construction, maintain the area so that it will be well drained.

1.06 CLASSIFICATION

A. Without regard to the materials encountered, all general excavation shall be unclassified. It shall be distinctly understood that any reference to rock, earth, or any other material on the drawings is not to be taken as an indication of classified excavation or the quantity of rock, earth, or any other material involved.
   1. The bidder must draw his own conclusions as to the conditions to be encountered.

1.07 SUBGRADES

A. Where rock is encountered in the excavation, remove it to the depth below grade required by the drawings, with no points of rock projecting above this depth. Leave the final surface of the rock so that complete drainage will be provided and so that no water will be pocketed at any point. When rock is encountered in bioretention areas, rock must be over excavated by 24”, and the resulting cavity backfilled with washed #2 or #3 crushed stone.

B. In cut sections, compact subgrades for all areas to be paved, including structure grade slabs, in accordance with the requirements of Section 31 24 00, Embankment, to a minimum depth of 6 inches. When the material in place does not contain enough moisture for proper compaction to be obtained, thoroughly scarify and break the subgrade to a minimum depth of 6 inches increase the moisture content, and then compact the subgrade. For material that is unstable because of moisture but is otherwise suitable for the subgrade, either scarify, allow to dry, and compact or else remove and use for refill or embankment. Manipulation to speed drying will be permitted.

1.08 USE OF EXCAVATED MATERIALS

A. Salvage topsoil from within the limits of excavation and embankment, and store it in stockpiles. Before removing topsoil, clear the area of all weeds, brush stumps, stones and other debris. Remove topsoil only from areas to be excavated and filled. Take care to avoid mixing subsoil or other unsuitable material with the topsoil. Located stockpiles at locations approved by the A/E.

The contractor may elect to spread the topsoil directly on the areas designated to receive the topsoil without stockpiling.

B. Rocks and boulders may be placed in embankments provided the embankments are deep enough to provide 12 inches or more soil cover over such rocks or boulders in grassed areas. Do not place boulders larger than ½ cubic yard beneath structure areas.

C. Do not waste excavated material in excess of that required for normal embankment construction within construction limits except when and as specifically directed or approved by the A/E.

D. Material wasted beyond the construction limits may be placed on approved sites obtained by the contractor at no cost to the owner. Material may be wasted on-site only with the Owner's approval; all waste material is to be moved to a permitted off-site location.

E. Furnish the A/E with copies of a written agreement with the owner of the property where the waste sites are located, approval of the owner(s) of any utilities within the proposed waste area, and approvals from regulatory agencies, including NPDES Construction Stormwater permits.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 31 23 16.13

UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1 - GENERAL

1.01 The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the A/E, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris and/or other objectionable matter as well as any buildings and/or structures that the drawings and/or the A/E specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the A/E.

B. In certain areas, it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the A/E. In no case shall the contractor damage or remove such growth without written permission from the owner.

C. If the area to be excavated is occupied by trees, brush or other vegetable growth, clear such growth and grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the A/E. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the A/E. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.02 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until

suitable material is encountered as determined by the geotechnical engineer. The geotechnical engineer shall verify the material encountered is unsuitable prior to removal. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with material approved by the engineer up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be AASHTO M 43 #67 crushed stone bedding. Remove no material considered unsuitable without written consent from the geotechnical engineer and approved by the A/E.

3.03 ROCKS AND BOULDERS

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and therefore no separate payment will be made.

B. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

C. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such a depth. Then backfill the space below grade with AASHTO M 43 #67 crushed stone bedding, tamp to the proper grade, and make ready for construction. For brick or monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer.

3.04 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches, or for other purposes shown on the drawings, or directed by the A/E shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the contractor as specified below at no additional cost to the owner. The geotechnical engineer shall determine if materials removed by excavation are suitable for other purposes or are waste materials.

B. Waste materials may be deposited in spoil areas at locations approved by the A/E. Do not leave in unsightly piles, but instead spread in uniform layers, neatly level, and shape to drain. Seed or sod as specified in Section 329219, Seeding and Sodding. If no spoil areas are identified, waste materials shall be removed off-site at no additional cost to the Owner.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workmanlike condition, as described below.

D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payments shall be allowed.

3.05 EXCAVATION FOR TRENCHES, MANHOLES AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, storm drainage, conduits and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling

and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The contractor may, if he chooses, use a motor-powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

C. Make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the A/E on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed and the pipe material used. For Flexible pipe (HDPE, PVC, CMP, DIP, etc.), the minimum trench width shall be equal to the following formula: 1.25d + 12 inches, where “d” represents the outside diameter of the pipe in inches. For rigid pipe (RCP, HERCP, RCAP, etc.) the minimum trench width stall be determined by the formula: d + 2(d/6) or d + 12 inches, whichever is larger, where “d” represents the outside diameter of the pipe. Trench widths shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where “d” represents the internal diameter of the pipe in inches. The banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and non-parallel planes provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the contractor and may be cause for the A/E to require that stronger pipe and/or a higher class of bedding be used at no cost to the owner.

D. For all pipe (flexible and rigid), over excavate trench bottom a minimum of 6 inches and provide a minimum of 6 inches of ASTM D2321, Class I, non-plastic crushed stone bedding (AASHTO M43-05 Gradations #5, #6, #56, #57, or #67).

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. Bed all manholes, inlets and other incidental structures with a minimum of 6 inches of ASTM D2321, Class I, non-plastic crushed stone bedding (AASHTO M43-05 Gradations #5, #6, #56, #57, or #67), or as specified in the drawings. For structures with a base area of 50 sq. ft. or greater (i.e. 7-foot diameter, 7 ft. x 7 ft. square, etc.) bed with a minimum of 12 inches of ASTM D2321, Class I, non-plastic crushed stone bedding (AASHTO M43-05 Gradations #5, #6, #56, #57, or #67), or as specified in the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or ASTM D2321, Class I, non-plastic crushed stone bedding (AASHTO M43-05 Gradations #5, #6, #56, #57, or #67) approved by the A/E.

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the A/E deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or property, and in compliance with OSHA regulations for trench safety.

I. Excavation for manholes and other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.06 SHEETING, SHORING AND BRACING

A. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing grounds. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressure exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring and bracing, which are considered an incidental part of the excavation work.

B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less that 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces by a shoring system, sloping of the ground, or some equivalent protection.

C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring and bracing are to be done. The sheeting, shoring and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the A/E. However, such approval does not relieve the contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring and bracing.

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the A/E.

E. Do not leave sheeting, shoring or bracing materials in place unless this is called for by the drawings, ordered by the A/E, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring or bracing as specified herein.

G. The contractor may use a trench box, which is prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.07 THE DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the A/E. Provide appropriate filtration of pumped discharged to comply with State and Federal regulations. Give special attention to excavations for those

structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift. Pipe installation shall be performed in the dry.

3.08 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the A/E and the geotechnical engineer.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 3:1 unless otherwise directed by the A/E.

C. Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The takings of materials from borrow pits for use in the construction of backfill, fills or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

E. The Contractor is responsible for paying all costs and obtaining any permits required for the opening of any borrow pits associated with the project.

3.09 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the A/E or municipality. For flexible pipe installations (HDPE, PVC, CMP, DIP, etc.) place 6” AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone bedding (non-plastic) material on suitable subgrade loosely in the middle 1/3, compacting to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in the outer thirds. Install haunch backfill material on each side of the pipe, from the bottom of barrel to the spring line of pipe with AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material, working materials into the haunch areas to remove voids and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts. Install initial backfill material from the spring line to the top of pipe with AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts. When installing flexible pipe in paved areas, final backfill shall be excavatable flowable fill (maximum 100 psi @ 28 days) to the bottom of asphalt binder, or AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts to pavement subgrade. When installing flexible pipe in un-paved areas, final backfill shall be select native material, the top 6 inches shall be topsoil, natural, fertile, friable, productive soil, free from toxic substances, stones, weeds, roots, clay and clods as a base for seed/mulch, planting beds, or sod. Thoroughly and completely tamp and/or compact each layer (as noted above) into place before placing additional layers. Minimum cover for flexible pipe systems shall be 12 inches for pipe 18 inches in diameter or less, 24 inches for pipes 18 inches to 36 inches, 34 inches for pipes 42 inches to 48 inches, and 42 inches for pipes 54 inches to 60 inches when groundwater is present in the trench. When groundwater is not present, then minimum cover shall be 12 inches as measured to the bottom of flexible

(asphalt) or top of rigid (concrete) pavement for pipes up to and including 48 inches, and 24 inches for pipes 54 inches to 60 inches.

B. For rigid pipe installations (RCP, HERCP, RCAP, etc.) place 6" AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone bedding (non-plastic) material on suitable subgrade loosely in the middle 1/3, compacting to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in the outer thirds. Install haunch backfill material on each side of the pipe, from the bottom of barrel to the spring line of pipe with AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material, working materials into the haunch areas to remove voids and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts. In paved areas, install initial backfill material from the spring line to the top of pipe with AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts. When installing rigid pipe in paved areas, extend initial backfill material to the top of pipe and install final backfill of excavatable flowable fill (maximum 100 psi @ 28 days) from the top of pipe to the bottom of asphalt binder, or AASHTO M 43 #5, #6, #56, #57, or #67 crushed stone (non-plastic) material and compact to 95% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts to pavement subgrade. When installing rigid pipe in un-paved areas, initial backfill shall be select native material, free from toxic substances, rock larger than 2 inches, soil classified as SW, SP, GW, GP, GM, SM, ML, CL, MH, GC, or SC according to the Unified Soil Classification System (USCS) or A1, A2, A3, A4, A5, or A6 according to AASHTO M145 soil classification and compacted to 90% Standard Proctor maximum dry density per ASTM D698 (SPD) in maximum 6-inch lifts. When installing rigid pipe in un-paved areas, final backfill shall be select native material, the top 6 inches shall be topsoil, natural, fertile, friable, productive soil, free from toxic substances, stones, weeds, roots, clay and clods as a base for seed/mulch, planting beds, or sod. Thoroughly and completely tamp and/or compact each layer (as noted above) into place before placing additional layers. The maximum dimension of individual stones in final backfill shall not exceed 4 inches. Minimum cover for rigid pipe systems shall be 12 inches to finished grade and contractor must ensure that pipe bells are below pavement subgrade. Install pre-manufactured plastic pipe plugs in all pipe lift holes, all pipe shall be laid with the lift holes located at the crown of the pipe.

C. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

D. If earth material for backfill is, in the opinion of the A/E, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the A/E considers too wet or otherwise unsuitable.

E. Wherever excavation has been made within areas that will remain landscaped or grassed or within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing TDOT Section 903.05, Type A, Grading D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the owner accepts the project.

G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

H. Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

I. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the A/E.

J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the A/E's requiring that the contractor's other activities be suspended until backfilling and clean-up operations catch up with the pipe laying.

K. Ensure backfilling and compaction operations are performed around and under the haunches of the pipe.

L. Compaction Requirements: Under buildings and two times the depth of pipe beyond, and under roads and two times the depth beyond the shoulder, compact to 98% maximum density in accordance with ASTM D698, Standard Proctor Maximum Dry Density or in accordance with the geotechnical investigation, whichever is more stringent. In all other locations, compact to 95% maximum density, except in landscape areas, compact to 90%.

3.10 MAINTENANCE

A. Seed, straw and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the owner.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the A/E. Continue such maintenance until final acceptance of the project, or until the A/E issues a written release.

3.11 SLOPES

A. Neatly trim all open cut slopes, and finish to conform either to the slope lines shown on the drawings or the directions of the A/E. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

END OF SECTION