

CHAPTER 2 EARTHWORK

2.1 **SCOPE:**

Earthwork shall consist of all necessary site clearing and grubbing, excavation and backfill for structures and trenches, site grading, grassing and restoration, as well as related work as shown on the plans and as specified herein.

2.2 **GENERAL:**

All earthwork shall be confined to the construction area as shown on the plans, and shall be done in an approved manner with proper equipment. Earthwork shall be suspended during rain and inclement weather, or when unsatisfactory field conditions are encountered, unless otherwise directed by the ENGINEER. At all times during construction, the CONTRACTOR shall maintain proper drainage in the construction area, and shall take all measures necessary for erosion and sediment control.

- A. Classification of earthwork: All excavation will be unclassified, for payment purposes, unless otherwise specified.
- B. Existing Utilities: CONTRACTOR shall take every precaution to protect existing utility services from damage during construction operations. If damage occurs, the OWNER of the utility shall be notified immediately and repairs shall be made promptly at the CONTRACTOR'S expense. All repair work shall be satisfactory to the ENGINEER and the OWNER of the utility. When interruptions of existing utilities occur, temporary service shall be provided as approved by the ENGINEER and OWNER of the utility.

2.3 **CLEARING AND GRUBBING:**

- A. General:
 - 1. The CONTRACTOR shall consult with the OWNER and ENGINEER prior to beginning clearing, and a full understanding is to be reached as to procedure. The CONTRACTOR shall then conduct clearing and grubbing operations in strict accordance with these agreements.
 - 2. The CONTRACTOR'S operations shall be conducted with full consideration of all proper and legal rights of the OWNER, adjacent property OWNER'S and the public, and with the least possible amount of inconvenience to them.
- B. Construction Sites: The work shall consist of clearing and grubbing within the limits of construction sites, road rights-of-way and elsewhere as indicated or necessary to complete the work, except pipelines. All trees, stumps, roots, shrubs and brush shall be removed as required for construction. Stumps and roots shall be grubbed and completely removed. The resulting depressions shall be filled with suitable material placed and compacted in accordance with Chapter 3, "Grassing and Site Restoration". Sound trees and shrubs, which do not interfere with construction, shall remain in place and shall be adequately protected from damage. Cleared and grubbed material, including debris and rubbish, shall be completely burned or otherwise disposed of as directed by the ENGINEER.
- C. Pipelines: Clearing and grubbing along pipelines shall be done prior to pipe installation, and shall be confined to the right-of-way limits as specified below. Adjacent property outside the right-of-way limits shall be protected against damage. All trees, stumps, roots, shrubs, and brush shall be removed as required for construction. Stumps and roots shall be grubbed and completely removed. Sound trees and shrubs, which do not interfere with

construction, shall remain in place and shall be adequately protected from damage. Cleared and grubbed material, including debris and rubbish, shall be disposed of as directed by the ENGINEER; burning within pipeline rights-of-way will not be allowed.

1. Trees 6-inches and larger in diameter shall be trimmed into normal 63-inch lengths, unless otherwise directed by the property OWNER. The logs shall be neatly stacked along the edge of the right-of-way in accessible locations for the property OWNER'S use.
 2. Limits of the pipe-laying operation shall be confined to the right-of-way. The width of clearing shall be held to a minimum and shall be no more than specified on the plans, without written consent of the ENGINEER.
- D. Structures: Minor structures shall be removed and disposed of as directed by the ENGINEER.
- E. Burning: Burning of Cleared Material shall be accomplished in strict compliance with all applicable local, state and federal regulations pertaining to open burning and smoke abatement.

2.4 STRUCTURE EXCAVATION AND BACKFILL:

- A. General: Excavations shall be in compliance with current OSHA regulations. Structure Excavation shall be made to the elevations, slopes and limits shown on the plans. Bottom of excavations shall be level and in firm, solid material; where soft or otherwise unsuitable material is encountered, such material shall be removed and replaced with properly compacted earth material, stone or flowable fill, as directed by the ENGINEER. Topsoil and other excavated material suitable for fill or backfill shall be stockpiled on the site for future use. Excess material and unsuitable material shall be properly disposed of. Excavated areas shall be kept free of water during construction. Where necessary, excavations shall be protected by shoring, sheeting, cofferdams or other suitable methods. Where earth will stand, footing trenches may be cut to the exact size of the footings; otherwise, forms shall be used.
1. Unauthorized or excessive excavation shall be corrected by providing properly compacted earth backfill, stone or Class C concrete, as directed by the ENGINEER, at the CONTRACTOR'S expense.
 2. Wherever excavation for a foundation extends below the water table or where specifically indicated on the plans, a 12-inch layer (unless otherwise noted) of crushed stone or gravel shall be spread and compacted in the excavation bottom prior to placing the foundation. Crushed stone or gravel shall conform to ASTM C33, Size 57. A non-woven filter fabric, Mirafi 140N or equivalent shall be placed beneath the stone layer.
 3. An adequate dewatering system shall be provided at all structure excavations and elsewhere as directed by the ENGINEER. The system shall be capable of removing any water that accumulates in the excavation and maintaining the excavation in a dry condition while construction is in progress. The surface of the ground shall be sloped away from the excavation or piping provided to prevent surface water from entering the excavation. Disposal of water resulting from the dewatering operation shall be done in a manner that does not interfere with normal drainage, and does not cause damage to any portion of the work or adjacent property. All drains, culverts, storm sewers and inlets subject to the dewatering operation shall be kept clean and open for normal surface drainage. The dewatering system shall be maintained until backfilling is complete or as otherwise directed by the ENGINEER. All damages resulting from the dewatering operation shall be repaired by the CONTRACTOR to the satisfaction of the

ENGINEER and at no cost to the OWNER.

4. Limit of structure excavation, for payment purposes, shall be 3 FT from the outside wall line of structures. Material removed beyond this limit to facilitate work shall be at the CONTRACTOR'S expense.
- B. Backfill Around Structures: Backfill around structures shall be placed as soon as possible, but not until construction below finish grade has been completed and accepted, underground piping and other utilities have been properly installed and tested, forms have been removed, and the excavation cleaned of trash and debris. Foundations and walls shall be braced and supported as required to withstand the forces imposed by the backfilling operation. Care shall be taken to protect piping and other utilities during backfill.
1. Backfill shall consist of suitable material from the excavation free of roots, wood, other vegetable matter, trash, debris, frozen material, rocks larger than 4 inches in any dimension, and other objectionable material. Backfill shall be brought to the indicated finish grade and sloped to drain away from walls. Backfill shall be placed in 8-inch layers and thoroughly compacted as specified below. Any subsequent settlement that may occur during the construction period shall be corrected.
 2. Excessively wet, porous, spongy or mucky material shall be removed from around structures prior to placing backfill. No such material shall be used for backfill.
 3. Unless otherwise directed by the ENGINEER, liquid-retaining structures shall not be backfilled until tested for leakage and accepted. All structures shall be protected against damage or flotation prior to placing backfill.

2.5 TRENCH EXCAVATION AND BACKFILL:

- A. Pipe Bedding and Backfill Material: Select material shall be material free of large stones, hard lumps, frozen matter, organic material, debris and other objectionable material. If necessary, suitable material shall be provided by the CONTRACTOR from other sources at CONTRACTOR'S expense. All material from the excavation unsuitable for bedding and backfill shall be removed and disposed of by the CONTRACTOR. Angular Material shall be crushed stone or gravel conforming to ASTM C33, Size No. 57, with size range of ¼ to ¾-inch.
- B. Trench Excavation: ALL EXCAVATION SHALL BE IN COMPLIANCE WITH CURRENT OSHA REQUIREMENTS. Trenches for pipe and other utilities shall be excavated true to line and grade. Unless otherwise indicated or specified, trenches shall be of a depth to provide a minimum cover of 3 FT over the top of pipelines.
1. Sidewalls of trenches shall comply with current OSHA requirements. Unless otherwise specified, trenches shall be between 12 and 18 inches wider than the outside diameter of the pipe, plus sheeting where necessary. Pavement shall be cut 12 inches wider than the required trench width on each side. For gravity sewer lines the maximum trench width shall be up to a level 12 inches above the top of the pipe or shall be as noted on the plans. Sheeting or shoring shall be used where necessary.
 2. Where soil conditions preclude vertical walls, the trench width shall be as specified above with the upper part of the trench limited to the least possible width greater than that specified. Where excessive trench widths are necessary, or where directed by the ENGINEER, sheeting or shoring shall be used to support trench walls.
 3. Pressure Pipelines: For pressure pipelines, prepare trench bottoms as follows:
 - a) Trench bottoms shall be graded to provide uniform and continuous bearing for the pipe along its entire length. Bell holes shall be provided for completion of joints. No ridges, sags or undercutting will be allowed.

- b) If approved by the ENGINEER and subject to suitable soil conditions, trenches may be excavated a few inches below the established subgrade and backfilled to subgrade with select material, well compacted and graded to provide uniform and continuous bearing for the entire length of pipe. Bedding material shall be well compacted up to the springline of the pipe, shovel sliced and shaped so that the load is supported throughout the entire length of pipe barrel and not at the pipe bells. Bell holes shall be provided for completion of joints.
 - c) In rock or other unyielding material, excavation shall be made at least 6" below the established subgrade and the trench backfilled to subgrade with select material. Bedding material shall be well compacted up to the springline of the pipe, shovel sliced and shaped so that the load is supported throughout the entire length of pipe barrel and not at the pipe bells.
 - d) Where material at subgrade is unstable, soft and incapable of supporting the pipe, trenches shall be excavated below subgrade to a depth as required by soil conditions, and backfilled to subgrade with angular material. The material shall be compacted and graded to provide a stable foundation and uniform bearing for the pipe. Bedding material shall be well compacted up to the springline of the pipe, shovel sliced and shaped so that the load is supported throughout the entire length of pipe barrel and not at the pipe bells.
 - e) Debris encountered in trench excavation for water and other pipelines shall be removed for the overall width of the trench. It shall be removed to a depth of 6" below the bottom of the pipe for pipes smaller than 24" in size; 8" below the bottom of the pipe for pipes 24" to 36" in size; and 12" below the bottom of the pipe for pipes larger than 36" in size, if debris extends to such depth.
4. Pipe on Grade Pipelines: For gravity sewer lines, prepare trench bottoms as follows:
- a) Trenches shall be excavated below the established subgrade as required to provide for preparation of flat trench bottoms in strict accordance with the trench bedding details as shown. Pipe backfill shall be #57 stone unless specifically noted on the plans or where directed by the ENGINEER.
 - b) Angular material consisting of #57 stone shall be used for sewer pipe bedding. Excavation below pipe shall be to a minimum depth of 4" or as required to obtain suitable pipe foundation. Overcutting of the trench shall be bedded with crushed stone. Bedding material shall be well compacted up to the springline of the pipe, shovel sliced and shaped so that the load is supported throughout the entire length of pipe barrel and not at the pipe bells. Angular material shall meet the requirements of the SCDOT specification 406.08. Stone size shall be No. 57. The use of fossil limestone will not be allowed.
 - c) Soft, unstable or otherwise unsuitable material encountered below the normal bedding depth shown on the plans shall be removed and backfilled with crushed stone. All such unsuitable material shall be disposed of by the CONTRACTOR. The depth of cut below the normal bedding depth shall be kept to a minimum, but shall be as required to provide a suitable pipe foundation as directed by the ENGINEER.
5. Trenches shall be kept free of water during pipe installation. Water shall be removed from trenches and disposed of by the CONTRACTOR to the satisfaction of the ENGINEER.
6. Where required, and as approved by the ENGINEER, sheeting, shoring and bracing shall be used to comply with current OSHA requirements and to prevent injury to personnel and caving of trench walls. Sheeting, shoring and bracing shall be left in

place until the trench is refilled to a safe limit. A trench box may be used if trench widths do not exceed the maximum indicated in the pipe bedding details.

- C. Trench Backfill: Trench Backfill shall progress as rapidly as pipe laying and testing will permit. The remainder of the backfill material shall be placed as specified below. No debris or rocks larger than 2 inches in any dimension shall be used in this portion of the backfill.
1. Paved Roads and Streets: Backfill shall be flowable fill, which shall extend beyond pavement edge at least 4 feet.
 2. In unpaved roads / shoulders within 5' of the tread line, backfill shall be placed in layers not more than 8 inches thick, and thoroughly compacted with mechanical tampers to 95% of maximum as determined by the Standard Proctor test (ASTM D698) or Modified Proctor test (ASTM D1557, Method A). On road shoulders, the top 18 inches of the trench shall be filled with well-compacted fill.
 3. For cross-country lines, outfall lines and at other locations where damage to the system or property will not occur, backfill shall be placed in 12-inch layers and compacted with mechanical tampers. The upper 3 FT portion of the backfill may be compacted by rolling with wheeled equipment.
 4. Tops of trenches shall be flush with existing ground elevation. The CONTRACTOR shall, promptly correct all settlement below finish grade occurring as a result of construction. Trenches shall be protected against scour due to surface drainage.
 5. Backfilling around manholes shall, in general, conform to the requirements for backfilling trenches, except that backfill shall not be placed around manholes until all mortar has properly set.
 6. CONTRACTOR shall correct any future settlement within the warranty period.

2.6 SITE GRADING:

Site grading shall conform to the lines and grades indicated by the finish contours on the plans. Where topsoil, pavement, aggregate surfacing, and other items are shown, rough grade shall be finished to such depth below finish grade as necessary to accommodate these items. All areas where structures are to be built on fill shall be stripped to such depth as necessary to remove turf, roots, organic matter and other objectionable materials.

- A. Excavation: Excavation shall be made to the exact elevations, slopes, and limits shown on the plans.
- B. Fill: Material to be used for fill shall be classified as "ML" (low plasticity silts), "SM" (silty sands), or better, in accordance with the Unified Soil Classification System. Fill material shall exhibit a plasticity index of less than 20 and a standard Proctor maximum dry density greater than 90 pounds per cubic foot. Fill shall not contain organic material, debris, or rock larger than 6 inches in any dimension.
 1. Where fill is to be placed all existing vegetation, roots and other organic matter down to 12 inches below grade shall be stripped and disposed of as directed.
 2. Fill shall be placed in successive layers of not more than 8 inches loose thickness. Each layer shall be spread evenly and compacted as specified below before the next layer is placed.
 3. Rock shall not be incorporated in fill sections supporting pavement or structures. Rock shall be evenly distributed. Rock larger than 4 inches in any dimension will not be allowed in the top 12 inches of fills or slopes. Voids between rock material shall be well filled with suitable fill material, and all rock shall be covered with at least 6 inches of fill material.

4. Where natural slopes exceed 3:1, horizontal benches shall be cut to receive fill material. Slopes of less than 3:1 and other areas shall be scarified prior to placing fill.
 5. Borrow material, as required, shall be obtained from the work site or other acceptable source, at the CONTRACTOR'S expense.
- C. Compaction: Unless otherwise noted, each layer of fill and backfill and the top 12 inches of existing sub grade material in cuts shall be compacted by approved equipment as specified below. The degree of compaction and the density shall be determined by the Standard Proctor test (ASTM D698) or by the Modified Proctor test (ASTM D1557, Method A).
1. Min. Compaction of Max. Dry Density at Optimum Moisture Content
 - a) Fill or cut under structures and backfill adjacent to structures - 98%
 - b) Top 8 inches of fill or cut under pavement or aggregate surfacing - 98%
 - c) Fill and backfill for highways or shoulders within 5 inches of travel surface - 95%
 - d) Fill and backfill in other areas - 90%
 2. Material too dry for proper compaction shall be moistened by suitable watering devices, turned and harrowed to distribute moisture, and then properly compacted. When material is too wet for proper compaction, operations shall stop until such material has sufficiently dried.
 3. All compaction tests, including additional tests required due to failure of materials and work to conform to the specified requirements, shall be done at the CONTRACTOR'S expense. Compaction tests shall be conducted by an independent testing agency acceptable to the ENGINEER. The CONTRACTOR shall be responsible for correcting all deficiencies in the work at his expense. Compaction testing shall continue until test results are satisfactory to the ENGINEER. Copies of all test results shall be promptly submitted to the ENGINEER.
 4. Tests shall be made in randomly selected locations as follows:

<u>Material</u>	<u>Frequency</u>
Fill and backfill	1 per layer (lift) per 1000 sq. ft.
Sub grade (cuts)	1 per layer (lift) per 2500 sq. ft.
Road Crossings	1 per layer
- D. Dressing Off: All cuts, fills and slopes shall be neatly dressed off to the required grade or subgrade, as indicated on the plans.
- E. Cleanup: Cleanup of the site shall be made upon completion of grading work or any major part thereof. Unless otherwise noted, excess or surplus material shall be wasted and dressed off on the site, or adjacent thereto, to the ENGINEER'S satisfaction. Excess or surplus material wasted in off-site spoil areas shall be spread and leveled as directed.
- F. Topsoil Placement: Topsoil shall consist of a natural friable loam, occurring usually in a surface layer 6 to 18 inches thick, and free of roots, grass, weeds, stone and other foreign matter. Topsoil may be obtained from the graded area, if available, and stockpiled for future use. Otherwise, the CONTRACTOR shall provide topsoil from other sources at his own expense. All topsoil shall be acceptable to the ENGINEER. Topsoil shall be placed on the entire graded area as shown on the plans, or as directed by the ENGINEER. Topsoil shall be distributed to a depth of 4 inches, measured loose, and dressed off neatly to finish grade, with all debris removed.

END OF SECTION