
02200 - EARTHWORK

(Last revised 3/27/14)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

Part 1 – General	Earthwork Volume Measurement	Select Material Classification
Part 2 – Products	E&S, NPDES Requirements	Soil Stab Fabric - Placement
Part 3 – Execution	Geotextile Fabric	Structures-Excavation
Backfill/Compaction of Walls	Geotextile Fabric - Products	Subgrade Preparation
Blasting – Insurance Require'ts	Lift Thicknesses	Testing – Frequency
Cleanup	NCDOT Select Mat'l Classes	Topsoil - Definition
Clearing and Grubbing	Passing Tests-What Constitutes a	Traffic Control
Density Requirements	Quality Assurance vs Quality Control	Tree Root Protection
De-Watering	Rock Definition-Open Excavation	Unclassified Excavation - Def
Dust Control	Rock Excavation	Undercut Excavation, Definition

PART 1 - GENERAL**1.1 GENERAL**

- A. The Contractor shall furnish all labor, materials, tools, equipment, and perform all work and services for all site clearing, site excavation, grading and embankment, excavation, filling and backfilling for structures, such as drainage structures, curb and gutters, sidewalks, driveways, pavements, including borrow, hauling, wetting, rolling and other operations pertaining thereto within the clearing limits, complete all as shown on the contract drawings and in accordance with these Contract Documents and completely coordinated with all other trades.
- B. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- C. All work on state system streets shall conform to the applicable provisions of the N.C. Department of Transportation Standard Specifications for Roads and Structures, latest edition.

Work performed on local government streets shall conform to their applicable standards and specifications except as modified herein.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Requirements and Supplementary Conditions applicable to this specification.
- B. Section 02210 – Trenching, Backfilling, and Compaction of Utilities
- C. Section 02400 – Concrete Pavement, Curb & Gutter, Drives, Sidewalks
- D. Section 02500 – Base Course
- E. Section 02600 - Paving

- F. Section 02700 – Storm Drainage
- G. NCDENR Stormwater Best Management Practices Manual, latest edition.
- H. NCDENR Division of Energy, Mineral and Land Resources, Land Quality Section's *North Carolina Erosion and Sedimentation Control Planning and Design Manual*.
- I. OSHA 29 CFR Part 1910.109, NCDOT Rules for Transporting Explosives, and Town of Wake Forest Inspections Department with regard to blasting.
- J. OSHA 29 CFR 1926 OSHA "Construction Industry Regulations", latest revision.
- K. OSHA Standard 29 CFR Part 1926, "Safety and Health Regulations for Construction," Subpart P "Excavations," Standard Number 1926.650, latest revision.
- L. N.C. Department of Transportation *Standard Specifications for Roads and Structures*.
- M. *N.C. State Building Code*, latest edition.

1.3 SUMMARY

- A. This section includes:
 - 1) Site clearing and grubbing.
 - 2) Stripping and stockpiling topsoil.
 - 3) Excavation and embankment placement.
 - 4) Preparing subgrade for pavement, sidewalk, curb & gutter, and turfed areas.
- B. Construction and materials related to this section but covered elsewhere:
 - 1) Erosion Control: North Carolina Sediment Control Law.

1.4 DEFINITIONS

For the purposes of this specification, the following definitions refer to earthwork that comes under the authority of the Town of Wake Forest as specified within this division and other divisions of this manual.

- A. **Borrow:** Select material, approved by Engineer and meeting these specifications, from an off-site borrow source.
- B. **Classified Excavation:** See [paragraph 1.4.Q, Undercut Excavation](#). See also [paragraph 1.4.P, Unclassified Excavation](#).
- C. **Clearing:** Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees, *shrubs, laps*, other vegetation within the limits of construction, as designated on the plans or as required by the Town's Engineer, except for those indicated to be left standing. Clearing shall also consist of removal, and satisfactory disposal of all down timber, brush, rocks, rubbish, and other material within the limits of construction as

well as the clearing, removal and disposal of all improvements that have been designated to be demolished, or obstructions that interfere with new construction.

- D. **Competent Person:** Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- E. **Contractor:** Refers to a Contractor licensed in the State of North Carolina to perform grading and earthwork construction.
- F. **Easement:** A grant of one or more of the property rights by the property owner for limited use of private land for a public or quasi-public purpose and within which the owner of the property shall not erect any permanent structures except when authorized by the Town. Ownership of the land remains with the second party.
- G. **Fill (in terms of volume):** In terms of volume, fill is defined as a compacted post-construction volume in-place. [See paragraph 3.8 Method of Volume Measurement.](#)
- H. **Grubbing:** Grubbing shall consist of the removal **and disposal** of all **buried** debris, stumps and roots having a diameter of three inches or larger to a depth of at least three feet below subgrade.
- I. **Rock in Open Excavation:** All boulder, solid ledges, bedded deposits, unstratified masses, and conglomerations of material so firmly cemented as to possess the characteristics of solid rock. Rock in open excavations includes removal and disposal on-site of materials and obstructions encountered in general excavation other than trenches and pits that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping. Rock is defined as material which cannot be effectively excavated during general grading with a D-8 or equivalent dozer drawing a new single-tooth ripper. Effective excavation is defined as the ability to remove 10 cubic yards or more of material after one hour of continuous ripping. Typical of materials classified as Rock in Open Excavation are boulders larger than 1-1/2 cubic yards or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
- J. **Rock Excavation for Trenches and Pits:** Rock excavation for trenches and pits includes removal and disposal off-site of materials and obstructions encountered that cannot be practically excavated with a track-mounted power excavator, equivalent to a Caterpillar Model No. 325 or equivalent equipped with new rock teeth. Practical excavation is defined as the ability to remove at least 30 cubic yards during one hour of continuous digging. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.
- K. **Select Fill Material:** Nonplastic material, free of organic material, used as foundation for subbase, shoulder surfacing, fill, backfill, or other specific purposes. [See paragraph 2.2.2. Select Material Classification \(Borrow\).](#)
- L. **Structures:** Incidental buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- M. **Subgrade:** Surface or elevation remaining after completing the excavation, or top surface of a fill or backfill immediately below subbase or topsoil materials, as applicable.
- N. **Topsoil:** A native, imported, or modified soil which is primarily organic in nature, free of rocks, clumps of clayey soils and otherwise friable in texture. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
- O. **Town Engineer:** The Town Engineer or his/her designated representative.
- P. **Unclassified Excavation:** Removal and disposal of any and all material above subgrade elevation or within the 12 inches of existing natural grade, whichever is greater, except solid rock and undercut excavation, located within the limits of construction.
- Q. **Undercut (Classified) Excavation:** Undercut excavation is defined as "all excavation below subgrade elevation or in excess of twelve (12) inches below natural ground, whichever is less." Undercut shall consist of the removal and satisfactory disposal of all unsuitable material. Where undercut excavation to the above stated depth results in a subgrade or slopes of muck, peat, matted roots, etc., the Contractor shall remove such material below the grade shown on the plans or as directed; and areas so excavated shall be backfilled with approved select fill or stone as ordered by the Town's Engineer.
- 1) Filling of undercut areas, unless otherwise authorized by the Engineer, shall be replaced and compacted at the Contractor's expense.

1.5 SUBMITTALS

- A. **Material Test Reports:** Provide from a qualified testing agency test results and interpretation for compliance of the following requirements indicated:
- 1) See [paragraph 1.6.A](#) below regarding Geotechnical Testing Agency Qualifications.
 - 2) Classification according ASTM D2487 of each on-site or borrow soil proposed for backfill, unless otherwise directed by the Town's Engineer.
 - 3) Laboratory compaction curve according to ASTM D698 for each on-site or borrow soil material proposed for fill or backfill.
 - 4) Laboratory compaction curve according to ASTM D1557 for each on-site borrow soil material proposed for fill and backfill.
- B. **Blasting:**
- 1) See Town of Wake Forest Inspections.
- C. **Product Data:**
- 1) Stabilization/Separation fabric: Submit product data and, if requested by the Town's Engineer, a sample of separation fabric and fully document each with specific location or stationing information, date and other pertinent information.

1.6 QUALITY ASSURANCE

- A. **Geotechnical Testing Agency Qualifications:** An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock-definition testing as documented according to ASTM D3740 and ASTM E548. Testing Lab to be AMRL (AASHTO Materials Reference Laboratory) and CCRL (Cement and Concrete Reference Laboratory) certified.

The testing laboratory shall be approved by the Town's Engineer and will be responsible for conducting and interpreting tests. The testing laboratory shall state in each report whether or not the test specimens conform to all requirements of the Contract Documents and specifically note any deviation.

Specific test and inspection requirements shall be as specified herein.

- B. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- C. The Contractor shall comply with applicable requirements of NCDENR Division of Energy, Mineral and Land Resources, *North Carolina Erosion and Sedimentation Control Planning and Design Manual*, latest revisions.
- D. Comply with applicable requirements of NFPA 495, *Explosive Materials Code*, latest revisions.

1.7 QUALITY STANDARDS

- A. For convenience, reference is made in succeeding paragraphs to specific portions of various standards. Also, modifications and additions are made. Neither the reference nor the modifications are intended to de-emphasize any other portion of the standards.
- B. It is the intent of this specification that whenever a procedure or technique is not called out herein, that the industry standard, as represented by ACI, ASTM or other appropriate recommendation, shall be used.
- C. Perform all work in accordance with requirements of local and state codes, with requirements of OSHA, and in accord with federal requirements.
- D. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

American Society for Testing and Materials

ASTM C33	Concrete Aggregates
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft) (Standard Proctor)

ASTM D1556	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb./ft) (Modified Proctor)
ASTM D1883	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D2049	Standard Method of Test for Relative Density of Cohesionless Soils
ASTM D2167	Standard Method of Test for Density of Soil in Place by the Rubber-Balloon Method
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4254	Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
ASTM D4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
ASTM E548	Standard Guide for General Criteria Used for Evaluating Laboratory Competence

American Association of State Highway & Transportation Officials

AASHTO T99	The Moisture-Density Relations of Soils using a 5.5 - pound Rammer and a 12 inch drop.
AASHTO T180	The Moisture-Density Relations of Soils using a 10 pound Rammer and a 18 inch drop.
AASHTO M145	The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

AASHTO T191	Density of Soil In-Place by the Sand-Cone Method
AASHTO T204	Density of Soil In-Place by the Drive Cylinder Method
AASHTO T205	Density of Soil In-Place by the Rubber-Balloon Method

E. **Standard Abbreviations:**

AASHTO	American Association of State Highway Transportation Officials.
ANSI	American National Standards Institute
AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
FS	Federal Specifications
MSDS	Material Safety Data Sheets
NCDENR	NC Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
USACOE	United States Army Corps of Engineers

1.8 PROJECT CONDITIONS

- A. **Demolition:** Demolish and completely remove from the site existing underground utilities indicated on the plans to be removed. Coordinate with applicable utility companies to shut off services if other active utility lines are involved.
- B. **Environmental - Wetlands:** Before crossing or entering into any jurisdictional wetlands, contractor shall verify whether or not a wetlands permit has been obtained for the encroachment and whether special restrictions have been imposed in that permit. Care shall be taken to prevent draining or otherwise destroying non-permitted wetlands. Restore as stated on either the project drawings, the contract documents, and/or as noted in the permit. All crossings, disturbances, and encroachments into wetlands shall be subject to USACOE and NC Division of Water Resources Water Quality Permitting Section approval and permitting requirements and conditions.
- C. **Environmental - Buffer Crossing Requirements:** Before crossing streams or ditches or working within 50 feet of ponds, lakes, or rivers, the Contractor shall verify

whether either the line is exempt or a permit has been obtained to encroach into a nutrient sensitive river basin buffer and if so, to what extent work is permitted to occur. Unless otherwise permitted, shown on the contract drawings, or exempted by NCDENR or other proper authority, water and sewer crossing stream, river, pond, or lake buffers are to be as near perpendicular as possible (the crossing is considered to be perpendicular if it intersects the stream or surface water between an angle of 75 and 105 degrees). Do not disturb more than 40 linear feet (longitudinal) of riparian buffer. When permitted to encroach into zone 1 (the lower 30 feet beside the stream or water), adhere to all of the following minimum, but not necessarily limited to, Best Management Practices in during construction.

- 1) Woody vegetation is cleared by hand. No grading allowed.
- 2) Stumps to remain except in trench where trees are cut. Minimize disturbance to roots in buffer zone.
- 3) Backfill trench with the excavated soil immediately following installation.
- 4) Do not use fertilizer except for the one-time application to reestablish vegetation.
- 5) Minimize removal of woody vegetation, the amount of disturbed area, and the time the disturbed area remains disturbed.
- 6) Take measures to ensure diffuse flow of water through the buffer after construction.
- 7) In wetland areas, use mats to minimize soil disturbance.
- 8) Schedule work in buffers to ensure exposure of denuded surface in the buffer is kept to a minimum.
- 9) Wells: If buffer distance cannot be obtained at either a public or private water supply well, the well is to be abandoned per the requirements of the Wake County Health Department and NCAC 15A Subchapter 2C, Section .0100, *Well Construction Standards*.

D. Geotechnical Investigation

- 1) Where a Geotechnical report has been provided to the Contractor by the Town, the data on sub-surface soil conditions is not intended as a representation or warranty of the continuity of such conditions between borings or indicated sampling locations. It shall be expressly understood that the Town of Wake Forest will not be responsible for any interpretations or conclusions drawn there from by the Contractor. The data is made available for the convenience of the Contractor.
- 2) In addition to any report that may be made available to the Contractor, the Contractor is responsible for obtaining any other soils information he/she feels is necessary for proper evaluation of the site for the purposes of planning and/or bidding the project – at no additional cost to the Town of Wake Forest. However, the Contractor shall provide the Town of Wake Forest with a written request for site access prior to moving on the site.

E. Protection of pavement

Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times. Employ the necessary measures required to meet this requirement.

1.9 SERVICE INTERRUPTION

For service interruption, operation of valves, taps, fire hydrant operation, etc, contact the City of Raleigh Public Utilities Operations Division (at 919.996.2737 between the hours of 7:30 AM and 4:00 PM. After 4:00 PM, call the afterhour's emergency number at 919.829.1930. Provide a minimum of 48 hours notice or desired utility interruption or necessary operation of valves or hydrants.

Refer to the following link regarding service interruption:
<http://www.raleighnc.gov/home/content/PubUtilAdmin/Articles/WaterandSewerFAQs.html>

1.10 COORDINATION

- A. The City of Raleigh Public Utilities Department will be the sole operator of all valves and hydrants within the Town of Wake Forest. Coordinate all utility service interruptions with the City of Raleigh Public Utilities Department.
- B. Coordinate tie-ins to municipal roadway system with the Town of Wake Forest.
- C. When traffic signals, loops, or their appurtenances are likely to be damaged or interfere with construction, coordinate temporary operation with the NCDOT and/or the applicable agency having jurisdiction of the signals. Provide a minimum of 1 weeks' notice prior to anticipated disturbance or interruption. At the discretion of the Town's Engineer, the notice may be required to be published in the newspaper.
- D. Repair of pavement markings: When cuts are made through any paved surface and the cuts extend through the pavement markings, the replaced pavement shall be marked to match the existing.
- E. Benchmark/Monument Protection: Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, they must be replaced at Contractor's own expense by a Licensed Professional Surveyor and to the full satisfaction of Owner/Town of Wake Forest.
- F. Contact "NC One Call" at 811 before digging.



1.11 PUBLIC CONVENIENCE

The contractor shall at all times so conduct his work as to ensure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the Town's Engineer.

Refer to the Town of Wake Forest Noise Ordinance by visiting the following link:
<http://www.wakeforestnc.gov/residents-noiseordinance.aspx>

1.12 TRAFFIC CONTROL

- A. When working within any NCDOT System road or highway, conform to the *Manual on Uniform Traffic Control Devices*, latest revision (MUTCD) as well as the NCDOT *Standard Specifications for Roads and Structures*, latest revision.
- B. Traffic Maintenance shall comply with the latest revision of the NCDOT *Standard Specifications for Roads and Structures*, Division 9 – *Signing* and Division 11 – *Work Zone Traffic Control*, as well as other applicable sections.
- C. A traffic control plan shall be submitted to the Town of Wake Forest Engineering and NCDOT (if applicable) for approval.
- D. When traffic signals or their appurtenances are likely to be damaged or interfere with construction, coordinate temporary operation with the NCDOT or the Town's Engineer. Provide a 1 week notice prior to anticipated disturbance or interruption.
- E. Whenever it becomes necessary to leave a section of trench open after completion of the day's work, the contractor shall provide barricades and lights to protect the public. Operate warning lights during hours from dusk to dawn each day and as otherwise required for inclement weather and visibility.

1.13 EROSION AND SEDIMENTATION CONTROL AND NPDES MONITORING, CONTROLS, AND LIMITATIONS FOR PERMITTED DISCHARGES

Refer to the town of wake forest UDO for erosion and sedimentation control requirements; chapter 12.

<http://www.wakeforestnc.gov/data/sites/1/media/residents/planning/development%20services/currentudo.pdf>

1.14 SAFETY

- A. Ensure full compliance to applicable requirements of OSHA. Refer to 29 CFR 1926 OSHA "Construction Industry Regulations", latest revision.
- B. Comply with local requirements and specific requirements of State of North Carolina with regard to workplace safety.
- C. The contractor shall keep the surface over and along the trenches and other excavation in a safe and satisfactory condition during the progress of the work.

PART 2 - PRODUCTS

2.1 EXCAVATION CLASSIFICATION

- A. All excavation material shall be classified as Undercut (Classified) Excavation, Unclassified Earth Excavation, or Rock.

2.2 SOIL MATERIALS

2.2.1. MATERIAL CLASSIFICATION (ONSITE NATIVE SOILS)

- A. Material, meeting the criteria specified in paragraphs B and C below, may be used for:
 - 1) Roadway embankment
 - 2) Roadway subgrade
- B. **Satisfactory Soils:** ASTM D2487 soil classification group (Unified Soil Classification System) GC, SM, SC, ML, CL, CH and MH or a combination of these group symbols. However CH and MH are permitted provided the soils have a Liquid Limit (LL) of ≤ 60 and a Plasticity Index (PI) of ≤ 30 . Soils shall be free of rock or gravel larger than 3 inches in any dimension, debris, organic matter, waste, frozen materials, muck, roots, vegetation, and other deleterious matter.
- C. **Unsatisfactory soils:** ASTM D2487 soil classification group (Unified Soil Classification System) CH and MH soils having a LL of > 60 and a PI of > 30 , OH, OL, and PT; soils which contain rock or gravel larger than 3 inches in any dimension, debris, organic matter, waste frozen materials, vegetation, and other deleterious matter. Unsatisfactory soils also include satisfactory soils not maintained within $\pm 3\%$ of optimum moisture content at time of compaction, unless otherwise approved by the Town's Engineer.

2.2.2. SELECT MATERIAL CLASSIFICATION (BORROW):

- 1) Select borrow material may be specified for use in:
 - a. Embankment
 - b. Subgrade
 - c. Backfill in undercut
 - d. Foundation conditioning
 - e. Slope and shoulder embankment
 - f. Material placement over fabric
- B. **Select Material Classifications (NCDOT Classes):** Refer to Section 1016 *Select Material* of the NCDOT *Standard Specifications for Roads and Structures* for definitions/classifications of Select Material Classes I through VI.
- C. **Offsite Borrow:**
 - 1) If sufficient satisfactory soil material is not available from onsite excavations, provide borrow material.
 - 2) **Offsite Select Borrow for Structural Fill and Embankment:** Materials shall consist of approved NCDOT Class I, II or III material.

3) See [paragraph 1.4.A Borrow](#) for the definition of borrow.

- D. **Crushed Stone Screenings:** Material shall meet the requirements of Section 1016 of the NCDOT *Standard Specifications for Roads and Structures*, Class II, Type 1.
- E. **Sand:** Material shall meet the requirements of Section 1016 of the NCDOT *Standard Specifications for Roads and Structures*, Class II (USCS group SW or SP) material.

2.2.3. TOPSOIL:

- A. Topsoil meeting the definition prescribed in [paragraph 1.4.N Topsoil](#) obtained either from on-site or an off-site source.

2.3 GEOTEXTILE FABRIC:

2.3.1. Geotextile fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours before or during installation. All geo-fabric to be used within the right-of-way of a Town street must be approved by the Town's Engineer.

- A. **Filter Fabric for Rip Rap:** Filter Fabric for Rip Rap and Rip Rap Beddings shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 2 engineering fabric.
- B. **Soil Stabilization Fabric:** Generally, soil stabilization fabric shall conform to the requirements of Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 4 engineering fabric. However, provide fabric meeting Geotechnical Engineers recommendations for the application and use intended.
- C. **Fabric for Subsurface Drains:** Non-woven needle-punched fabric shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 1 engineering fabric.
- D. **Silt Fence Fabric:** Refer to NCDENR, Division of Energy, Mineral and Land Resources Land Quality Section's *North Carolina Erosion and Sedimentation Control Planning and Design Manual*, latest revision.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1. GENERAL REQUIREMENTS APPLYING TO ALL AREAS

- A. **Construction Staking:** Unless called for otherwise in the proposal or Special Conditions, the contractor is to provide and pay for construction staking in his proposal.

When required to establish either horizontal or vertical alignment, all construction staking is to be provided by the Contractor using the services of a Licensed

Professional Surveyor familiar with construction staking procedures. The cost shall cover all staking required. The Town of Wake Forest is not to be assessed or charged for re-staking costs where damage has occurred to stakes by the Contractor or his Subcontractor or any other agency or person since the project is the responsibility of the Contractor during construction until all applicable site and utility construction has been accepted by the Town of Wake Forest.

The Surveyor will not be responsible for quantity verification. The Town's Engineer or his representative will verify quantities with the Contractor for all work in this contract prior to each billing period. The Town of Wake Forest will accept field measurements by a N.C. Licensed Professional Surveyor for undercut and rock excavation computations.

The drawings may indicate both existing grade and finished grade required for construction of project. Stake out improvements to their established elevations as called for on the plans. Perform other layout work that may be required to construct the facilities.

- B. Erosion Control: Where total disturbance exceeds 1/2-acre, no clearing, grubbing or excavation is to begin until an approved soil erosion and sedimentation permit has been secured and posted on site. Once a permit has been approved and a preconstruction conference has been conducted, the contractor/developer is to adhere to the approved erosion and sedimentation control plan and shall be responsible for containing sediment entirely on the project site. All costs for erosion control measure installation, maintenance, removal and final stabilization shall rest with the contractor/developer.
- C. Contractor shall plan construction to avoid or minimize disturbance to properties adjacent to the road right-of-way or easement.
- D. Access and/or Haul Roads: Any grading or excavation required for equipment travel during the course of construction as well as erosion control, access or haul road removal, restoration, seeding and ground cover shall be provided by the Contractor.
- E. The Contractor shall be responsible for damage to areas or items designated by the Town's Engineer to be protected. Repairs to, replacement of, or reparations for areas or items damaged shall be made to the satisfaction of the Town's Engineer and affected property owners before acceptance of the completed project.
- F. The Contractor shall protect all buildings or structures located along the roadway or easement.
- G. Any fences or mailboxes disturbed by the Contractor shall be repaired to a condition equal to or better than their original condition or to the satisfaction of the Town's Engineer. This may require the use of new material.
- H. Contractor shall obtain written permission from property owners for use of any access other than ones located within public rights-of-way or easements. Written permission shall contain conditions for use and restoration agreements between property owner and Contractor.
- I. All areas disturbed shall be restored to a condition equal to or better than their original condition and shall be graded to drain.

3.1.2. CONSTRUCTION LIMITS

- A. Contractor shall not disturb any areas outside the permitted limits of disturbance contained in this section without express written permission from the Town's Engineer.
- B. The Town's Engineer reserves the right to limit the width of land to be disturbed and to designate on the drawings or in the field certain areas or items within this width to be protected from damage.
- C. **Specific requirements applying to developed subdivision/lots:**
 - 1) Unless directed otherwise by the Town's Engineer, all trees, shrubs, hedges, or other ornamental plantings located outside of the construction limits, easements, or public rights-of-way shall be protected by the Contractor. The Town's Engineer reserves the right to designate certain trees located within the construction limits for protection where deemed desirable.
 - 2) The contractor shall protect all reasonable septic systems or springs located outside the construction limits.
 - 3) Excavated or blasted rock shall be removed from the site unless otherwise ordered by the Town's Engineer.
- D. **Specific requirements applying to undeveloped areas:**
 - 1) In wooded areas, the clearing shall be limited to the easement or right-of-way limits unless indicated differently on the Town of Wake Forest approved construction drawings, in which case, the work shall be confined to the limits defined on the plans. All permanent easements and rights-of-way shall be fully cleared as determined by the Town's Engineer. The Town's Engineer reserves the right to designate certain trees located within the construction limits for protection where deemed desirable.
 - 2) In areas where livestock and pets are kept, the Contractor shall notify property owner prior to commencing work and keep owner advised of progress of work. Fences shall be kept secure at all times and livestock and pets protected from open ditches, machinery, blasting, and other hazards.

3.1.3. PROTECTION OF EXISTING UTILITIES AND UNDERGROUND STRUCTURES

- A. **Protection of Existing Facilities.** Maintain existing utility lines (either overhead or underground), sidewalks, structures, pavement indicated on drawings, or mentioned in specifications, free of damage. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition. Notify Owner utility of any utility damage at once so that emergency measures may be taken to repair the utility. All repairs to utilities damaged by the contractor shall be made by and paid for by Contractor.
- B. See paragraphs 3.1.3.A through 3.1.3.F of specification section 02210 *Trenching, Backfilling and Compaction of Utilities*.

3.1.4. PROCEDURES FOR REPAIRING DAMAGED UTILITY SERVICES

- A. See paragraphs 3.1.4.A through 3.1.4.C of specification section 02210 *Trenching, Backfilling and Compaction of Utilities*.

3.1.5. PROTECTION OF SURFACE FEATURES

- A. Protect structures, above ground utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, sediment deposition, project related sink holes, and other hazards created by operations under this or other related sections.
- B. Whenever the work is planned to occur either on or near an existing paved street, the Contractor shall provide pads or take necessary precautions to protect the pavement from damage by the construction equipment. Pavement damaged by cleated or tracked equipment, or by any other means, shall be repaired by the Contractor at his expense to the satisfaction of the Town's Engineer.
- C. Provide full access to public and private premises, to fire hydrants, at street crossings, sidewalks and other points as designated by the Town's Engineer to prevent serious interruption of travel.
- D. Prevent damage or injury to any fences, surface structures, etc, on or adjacent to the site of the work.
- E. Protect and maintain benchmarks, right-of-way or property monuments, or other established points and reference points, and if disturbed or destroyed, items shall be replaced by a Licensed Professional Surveyor to the full satisfaction of the Town's Engineer and/or the jurisdictional agency.
- F. See [paragraph 1.10, Coordination](#) regarding traffic signals.

3.1.6. PROTECTION OF PERSONS AND PROPERTY

- A. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
- B. The contractor shall not enter upon private property for any purpose without first obtaining permission.
- C. Contractor shall protect carefully from disturbance or damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations, and shall not remove them until directed.
- D. The Contractor shall be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in his manner or method of executing said work, from his non-execution of work, or from defective work or materials, and he shall not be released from said responsibility until the work shall have been completed and accepted.
- E. The Contractor shall, at his own expense, sustain in their places and protect from direct or indirect injury all pipes, poles, conduits, walls, roadways, buildings, and other structures, utilities and property in the vicinity of his work. Such sustaining and supporting shall be carefully done by the Contractor and as required by the Company or party owning the structures or Agency controlling it. The Contractor shall take all

risks attending the presence or proximity of pipes, poles, conduits, walls, thereof and any costs associated will be deducted from any monies due the Contractor. Failure of the Town's Engineer or his/her authorized representative to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

- F. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, the contractor shall restore such property, at his own expense, to a condition equal to or better than that existing before such damage or injury was done. The contractor shall make good such damage or injury in an acceptable manner by repairing, rebuilding or otherwise restoring as directed.

3.2 CLEARING AND GRUBBING

A. **The work includes but is not necessarily limited to:**

- 1) Establishing Clearing Limits
- 2) Protecting Existing Features. The work shall include the preservation from injury or defacement of all vegetation or objects designated to remain.
- 3) Clearing and grubbing
- 4) Salvage
- 5) Stockpiling topsoil and stockpile maintenance
- 6) Disposal of Waste Materials
- 7) Restoration

B. **Timbering:**

- 1) A preconstruction meeting shall be held with appropriate urban forestry personnel (as may be applicable) and the Town prior to any clearing, if required. The Town's Engineer may require tree protection fencing in sensitive areas, where specifically identified trees are desired to be protected, and when required by the landscape ordinance. See also UDO Chapter 8, Tree Protection, Buffers and Landscaping for other requirements.
- 2) **Establish Limits of Clearing:** Prior to clearing the site, the Contractor shall advise his surveyor to establish the clearing limits. Flagging, clearly delineating the limits, shall designate clearing limits. The limits of clearing street rights-of-way shall be the full right of way as a minimum but shall also extend to the toe of either the cut or fill slope when such point extends outside or beyond the right-of-way line.
- 3) **Clearing Easements:** Unless directed otherwise on the plans, clearing limits shall extend to the easement line or right-of-way.
- 4) Trees and shrubs that are to remain within the construction limits will be indicated on the drawings or conspicuously marked on site. Unless otherwise

noted, trees within the construction limits shall become the property of the Contractor and shall be removed from the site.

- 5) See [paragraph 3.1.2 Construction Limits](#).

C. **Protect existing surface and subsurface features:**

- 1) **Protection Devices:** The Contractor shall provide barricades, fences, coverings, or other types of protection necessary to prevent damage to existing improvements, not indicated to be removed, and improvements on adjoining property. Trees and shrubs that are to remain within the construction limits will be indicated on the drawings or conspicuously marked on site.
- 1) **Restoration of damaged items:** Restore any items damaged during construction of the project to their original condition, as acceptable to the Town's Engineer or other authorities having jurisdiction over the item damaged. See also paragraph
- 2) **Tree Protection:**
 - a. **Barrier Protection:** Protect existing trees and other vegetation indicated to remain against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences barricades or guards as required to protect trees and vegetation to be left standing (See standard details 2.93 and 2.94 for tree and shrub protection). *Extremely damaged trees, which could eventually die as a result of the damage, as determined by the Town's Engineer, may be required to be removed at the contractor's expense.*
 - b. **Abraded or scuffed trees:** Trees that are scraped, scuffed or otherwise abraded by the contractor during the construction process, shall have the damaged area of the tree painted with an approved tree paint to protect the tree from insects. See Standard Detail 2.92.
 - c. **Watering Plants:** Water trees and other vegetation, which is to remain within limits of construction, as required to maintain their health during period of construction operation.
 - d. **Root Protection:** Provide protection for roots over 1-1/2 inch diameter that is cut during construction operations. Coat cut faces with emulsified asphalt, or other acceptable coating, especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.
 - e. Repairing or replacing trees and vegetation damaged by construction operations shall be done at no additional expense to the Town of Wake Forest.

D. **Clearing and Grubbing Site:**

- 1) The method of stripping, clearing, and grubbing the site shall be at the discretion of the Contractor.

- 2) **Clearing Site:** Clear site as defined in paragraph a, below. Remove such items offsite at Contractor's expense.
 - a. Clearing Definition: See [paragraph 1.4.C, Clearing](#).
 - b. Marginal Areas: In marginal areas, with the Town's Engineer's permission, remove trees where the following conditions exist.
 - i) Root Cutting: When clearing up to the "clearing limits," the Contractor shall also remove any tree which is deemed marginal such that when the roots are cut a tree could be rendered unstable by the affects of high winds and thus in danger of toppling into either the right-of-way or onto private property.
 - ii) Slender Bending Trees: Where young, tall, thin trees are left unsupported by the clearing operation, and are likely to bend over into the right-of-way, the Contractor, during the clearing operation, shall selectively remove those trees which are located outside and adjacent to the clearing limits and Town right-of-way or easement as well. During the course of construction and during the one-year warranty period, the Contractor shall remove such young trees that overhang into the right-of-way or cleared area. Removal outside of a public right-of-way or easement requires permission from a private property owner. Coordinate owner contact with the Town's inspector.
 - c. Trimming trees and roots: Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- 3) **Grubbing:**
 - a. Grubbing Definition: See [paragraph 1.4.H, Grubbing](#).
 - b. The area within the limits of construction or as designated shall be grubbed of all trees, stumps, roots, brush, undergrowth, hedges, heavy growth of grasses or weeds, debris and rubbish of any nature that, in the opinion of the Town's Engineer, is unsuitable for foundation material.
 - c. Grubbing under areas to be paved and foundations: Completely remove stumps, root mats, buried logs, and other debris protruding through ground surface in their entirety. Such removal shall be made within 5 feet of areas to be paved or structure foundation limits and to a depth of not less than 2 feet below the finished surface of the pavement, unless otherwise directed by the Town's Engineer. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 - d. Nonperishable items that are not deleterious to the project and will be a minimum of 5 feet below the finished elevation of the earthwork or slope of the embankment may be left in place with the approval of the Town's Engineer.
- 4) **Depressions:** To prevent standing/ponding water, fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further

excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

- E. **Repair of Damaged Vegetation:** If damaged by construction operations, trees and vegetation designated to remain shall be repaired or replaced at Contractor's expense in a manner acceptable to the Town's Engineer. When such damage does occur, and the damage does not necessitate vegetation replacement, all rough edges of scarred areas shall be removed and the area repaired in accordance with accepted horticultural practices. The Town's Engineer may require that the tree and/or vegetation damage be repaired as directed by a qualified tree surgeon.

F. **Topsoil Stripping and Stockpiling:**

- 1) **Topsoil Stripping Defined:** Topsoil stripping is defined as organic surface soil found in a depth of not less than 6 inches. For a definition of topsoil, see [paragraph 1.4.N Topsoil](#).
- 2) **Stripping:** Strip topsoil to whatever depths encountered, and in such manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
- 3) Remove the existing topsoil to a depth of 6 inches or to the depth encountered from all areas in which excavation will occur. The topsoil shall either be stored in stockpiles separate from the excavated trench material if the topsoil is to be respread or otherwise disposed of off-site. Topsoil stockpiles shall be graded to freely drain surface water, and shall have a silt fence placed around the base of the stockpile.
- 4) **Tree Protection:** Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to main root systems.
- 5) **Stockpile Maintenance:** Maintain stockpiles and excavations in such a manner as to prevent inconvenience or damage to an existing or proposed structure located either on the project site or on adjoining property. Avoid surcharge or excavation procedures, which can result in heaving, caving or slides.
- 6) **Stockpiling:** Stockpile topsoil in areas either indicated on the plans or at locations that will not interfere with construction and which have been approved by the Town's Engineer. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust. Construct adequate and approved silt fences or other devices to prevent off site deposits of soil to streams etc.
- 7) **Cost:** The cost of stripping is to include all costs for equipment, personnel, stockpiling of material, segregation of topsoil from undesirable material, disposal of undesirable or unusable waste or demolition material, re-spreading of topsoil if applicable, erosion control, dust control, temporary seeding, etc. The cost of rock removal by blasting or other mechanical means (except ripping) is not to be included in the stripping cost.

G. **Disposal:**

- 1) Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times.
- 2) All brush, tree tops, stumps, slash, and debris shall be hauled away from site or otherwise disposed of in a manner acceptable to the Town's Engineer. The contractor shall clean up debris resulting from clearing operations continuously with the progress of the work and remove promptly all salvageable material that becomes his property. Such material is not to be reused in construction. Sale of material at or on the site is prohibited.
- 3) Stumps of trees cut down outside of the excavation area will be removed. Perishable material shall not be disposed of at the construction site.
- 4) **Waste Disposal:** Remove all material of whatever nature, including but not limited to demolition material, pipe, rock, brick, concrete, asphalt, clay, silt, gravel, hard pan, etc. as directed by Town's Engineer and dispose of unsuitable material in either a NCDENR permitted demolition land fill and/or a site which legally can accept earthen fill (i.e. meeting all applicable laws such as erosion control, zoning, etc.). Material, of a compactible nature, which can be re-used as borrow, shall be replaced and re-compacted to the requirements set forth in these specifications. Burning or burying, as a means of waste disposal, is not permitted.
- 5) Unless removed from site for chipping/shredding and recycling, brush, laps, roots, and stumps from trees shall be disposed of in a NCDENR approved and permitted land clearing and inert debris type landfill. Disposal of cleared material shall be in accordance with all local and state laws.
- 6) **Burning:** Contact Tow of Wake Forest Inspections, Office of Fire Inspections. No burning of clearing debris may take place within 1000 feet of a residence. The burning shall be performed on days when the wind is still and not expected to pick up within 24 hours. No burning shall take place on days the US Forestry Service has issued a no burn warning. Prior to beginning the clearing operation, the contractor shall secure a burning permit.
- 7) The Contractor will be responsible for obtaining all applicable permits and paying all fees for the disposal of excess material.

3.3 UNCLASSIFIED EXCAVATION, UNDERCUTTING, BORROW, EMBANKMENT:

3.3.1. CONSTRUCTION METHODS

- A. **Excavation/Protection of Grade:** Excavation shall be performed as indicated on the plans or as directed by the Town's Engineer to the lines, grades, and elevations, and shall be finished to a reasonable smooth and uniform surface. Do not leave depressions or bowls where water can pond. Maintain ditches and drains to provide drainage at all times on the project. Protect graded areas against action of elements prior to acceptance of work. Re-establish grade where settlement or erosion occurs. During the process of excavation, the grade shall be maintained and surface shall be shaped and rolled so that it will be well drained at all times.

When solid rock is incurred in the excavation, the rock shall be removed to a minimum depth of 6 inches below the surface of the subgrade or as directed by the Town's Engineer.

All soft and yielding material, boulders, loose stones, or any other unsuitable materials in the subgrade which will not readily compact shall be removed and replaced with suitable material which shall then be thoroughly compacted. Material unsatisfactory for subgrade foundation shall be removed to a depth specified to provide a satisfactory foundation. The portion so excavated shall be refilled with suitable material obtained from the grading operations or borrow area and thoroughly compacted by rolling. The Town's Engineer must approve material obtained from on site grading operation.

No rock, stone, or rock fragments, larger than 3 inches in their greatest dimension will be permitted in the top 12 inches of the subgrade. No rock, stone, or rock fragments larger than 8 inches in their greatest dimension will be permitted in the remainder of the fill.

For areas that do not require fill, scarify and compact to a depth of 6 inches.

- B. Any manipulation, aeration, and recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the construction operations, and shall be performed by the Contractor at no additional cost to the Town.
- C. Any portion of the subgrade inaccessible to the roller or rolling equipment shall be thoroughly compacted with hand or mechanical tampers.

3.3.2. UNCLASSIFIED EXCAVATION

- A. Scope: The work includes all operations in connection with unclassified excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the project site for construction of the proposed facilities. Unclassified excavation shall include the removal of all earth, concrete, curb and gutter, pavement, rippable rock, hardpan and other materials as may be necessary or called for on the drawings and outlined in these specifications.

All material from excavation, which is considered suitable for re-use by the Town's Engineer, shall be used as embankment fill wherever fill is needed or required. The Contractor shall arrange his work so that the usage of suitable "compactable" excavated material will be possible. Surplus earthen material from unclassified or undercut excavation shall be disposed of offsite at the Contractor's expense.

- B. Prior to beginning grading or embankment operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with these specifications.
- C. Should the Contractor, through negligence or other fault, excavate below the designated grades, he shall replace the excavation with approved satisfactory materials, in an approved method, at his own expense. All material determined unsatisfactory shall be disposed of in waste areas as directed. Topsoil shall not be used in embankments but shall be handled and placed as directed.

- D. The Contractor shall satisfy himself as to the character, quantity, and distribution of all materials to be excavated. No payment will be made for any excavated material that is used for purposes other than those designated.

3.3.3. UNDERCUT (CLASSIFIED) EXCAVATION

- A. **Undercut (Classified) Excavation:** See [paragraph 1.4.Q](#) for definition and compensation for undercut (Classified Excavation).
- B. **Soft subgrade:** If after excavation to subgrade, the material is found to be soft, spongy or unfit for use as subgrade, the unsuitable material shall be removed as directed by the Geotechnical Engineer and the subgrade shall be brought to proper elevation by filling with suitable select borrow placed and densified as directed by the Town's Engineer.
- C. **Stabilization of Soft subgrade with stone:** Where improvement of subgrade is proposed to be stabilized using crushed stone, stabilize subgrade with granular materials as directed by the Geotechnical Engineer.
- D. **Stabilization of soft subgrade with Geotextile:** Where improvement of a soft subgrade is determined to be made by employing a synthetic geotextile, the proposed method of construction, minimum density requirements and material specifications shall be provided by a Geotechnical Engineer for review and approval prior to ordering material. Stabilization of soft subgrade with Geotextile shall also meet the requirements of paragraphs [2.3.1.B – Soil Stabilization Fabric](#) and [paragraph 3.10 – Placement of Soil Stabilization Fabric](#).
- E. **De-Watering:** Where groundwater is expected to be encountered during excavation, provide de-watering system necessary to successfully complete compaction and construction requirements, to prevent softening and disturbance of subgrade below foundations and fill material, and to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope. Employ de-watering specialist for selecting and operating de-watering system. Keep de-watering system in operation until dead load of structure exceeds possible buoyant uplift force on structure. Dispose of groundwater to an area that will not interfere with construction operations or damage existing construction. Install groundwater-monitoring wells as necessary. Slowly shut off de-watering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

De-watering is considered incidental to the cost of excavation.

3.3.4. EMBANKMENTS/STRUCTURAL FILL

- A. **General:** Where existing grades require the use of on-site embankment or structural fill to reach the required section elevation, the Contractor shall deposit suitable approved material from excavated areas. Embankments shall be made of satisfactory soil material free from debris, roots, trash, stones, or other harmful substances, and shall be placed in successive horizontal layers of loose material not more than 8-inches in loose depth for the full width of the cross sections. Each layer shall be spread uniformly and rolled with a mechanical compactor unit suitable for the type soil being densified until the soil is thoroughly compacted in accordance with [Table 2200.1A](#) and [Table 2200.1B](#) of this specification.

- B. **Evaluation of Subgrade:** Prior to placement of compacted fill, the Town's Engineer or his representative shall carefully inspect the exposed subgrade. Any topsoil, organic material still in place, any material that is frozen, wet, soft, loose and/or otherwise undesirable shall be removed and disposed. Afterwards, the Contractor shall proof roll the exposed subgrade, in the presence of the Town's Engineer or his representative. The inspection shall include, but not be limited to, proofrolling the prepared subgrade with a rubber-tired fully loaded dump truck that has a minimum gross weight of at least 20,000 pounds (10 tons) under the observation of a representative of the Town. Any unsuitable materials thus exposed shall be removed and replaced with select material as approved by the Geotechnical Engineer. Provide the necessary amount of select fill compacted to the density requirements outlined in [Table 2200.1A](#) and [Table 2200.1B](#) of this specification. If a bridging lift is required, consult with Town's Engineer for directions before proceeding with placement of bridging lift.

Fill material shall not be placed on frozen ground or areas covered with ice and/or snow or areas with a moisture content above optimum.

- C. **Preparation of Ground Surface for Embankments or Fills:** Before fill is placed, scarify existing grade to a minimum depth of 6 inches. In areas where the existing or proposed ground surface is steeper than one vertical to four horizontal (4:1), plow surface in a manner to bench and break up surface so that fill material will bind with the existing surface.
- D. **Embankment/Fill Construction:**
- 1) **Typical Section Controls:** Construct embankments and fills at the elevations and grades indicated on the plans. Where indicated by typical cross-section on plans, the completed fill shall correspond to the shape of the typical cross section regardless of the method used to show the shape, size, and extent of line and grade of completed work.
 - 2) For the type of material being used, compact material by sheepfoot rollers, pneumatic rollers, vibratory rollers, or by other applicable and suitable equipment as required to obtain the specified density outlined in [Table 2200.1A](#) and [Table 2200.1B](#) of this specification. Control moisture for each layer as necessary to meet requirements of compaction.
 - 3) **Failure of Compactive Efforts:** See [paragraph 3.5.E Failure of Compactive Efforts](#).
- E. **Moisture Control:** Moisture shall be controlled during filling and compaction stages to minimize the chances of failure and degradation of either the soil or subgrade. The material entering the embankment in each of the layers shall be within a tolerance of plus or minus +/- 20% of the optimum moisture content before rolling to obtain the prescribed density. Wetting or drying of the material and manipulation when necessary to secure uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the embankment shall be delayed until the material has dried to the required moisture content. If high moisture is due to negligence of Contractor due to improper drainage, the Town's Engineer may require removal and replacement of material.

- F. **Wet weather excavation/filling:** Construction operations shall not take place during periods of rain, unless the excavated material and/or the fill site is adequately protected from moisture, to prevent excessive moisture build-up in loose soils rendering an otherwise acceptable soil or subgrade unusable. Such carelessness unnecessarily increases construction costs.
- G. **Filling on or over existing Road beds:** When any portion of the embankment is to be constructed over an old road bed or parking lot, with the approval of a Geotechnical Engineer, the existing surface shall be scarified and manipulated as directed by the Geotechnical Engineer.
- H. **Protection of graded surfaces:** During their construction, embankments and/or fills shall be maintained at all times to prevent an accumulation of ponding or standing water.

3.3.5. BORROW (OFF-SITE/ON-SITE)

- A. **General:** Provide the necessary quantities of specified, approved materials for subgrade, structural fill and/or embankment compacted to a density equaling or exceeding that specified in [Table 2200.1A](#) and [Table 2200.1B](#). Unless otherwise designated on the plans and contract documents, the Contractor shall make his own arrangements for obtaining select fill material for borrow and pay all costs involved. Include costs for excavation, loading, hauling, placement, spreading and compaction of select borrow material in original proposal as bid, whether lump sum or unit price. All material shall be approved prior to placement or shall otherwise meet the following paragraph (paragraph 3.3.5.B, *Use of On-Site Excavation As Borrow*).
- B. **Use Of On-Site Excavation As Borrow:** On-site excavation, which is suitable for use as structural fill/borrow in either embankments and/or roadway fill (for areas that have either been undercut or are to be filled), shall be used first. Unless otherwise provided for in the proposal, unclassified excavation suitable to be used as "on-site borrow" (which is excavated from within a 2,500 foot radius of its destination) shall not be paid for as *borrow* but is considered to be incidental to the cost of *unclassified excavation*. Placement of this material shall include all costs associated with placement, spreading, grading and compaction of the material. If the Contractor places more borrow than is required, and thereby cause a waste of excavation, the amount of such waste, unless authorized, will not be included for payment.

3.3.6. PREPARATION OF AREAS TO RECEIVE ASPHALT PAVEMENT OR CONCRETE:

- A. All soft and yielding material, boulders, loose stones, or any other unsuitable materials encountered in the subgrade which will not readily compact shall be removed and replaced with suitable material which shall then be thoroughly compacted. All roots, stumps, and other perishable matter encountered in the preparation of the subgrade shall be removed to a depth of not less than 2 feet below the finished surface of the pavement, unless otherwise directed by the Engineer.
- B. Ensure rock has been removed to a depth of 6 inches below subgrade or as directed by the Town's Engineer.
- C. Areas to be paved: After all excavation, undercutting, and backfilling has been completed, the subgrade shall be properly shaped and thoroughly compacted. The area of the highest degree of compactive effort shall include all areas beneath

pavement and curb and gutter and shall extend at least a minimum of one-foot behind the back of the curb. Compaction shall be in accordance with [Table 2200.1A](#). If the subgrade does not contain sufficient moisture for compaction, it shall be wetted as directed by the Engineer.

- D. Any portion of the subgrade inaccessible to the roller or rolling equipment shall be thoroughly compacted with hand or mechanical tampers.
- E. The Contractor shall then proofroll the exposed subgrade, in the presence of the Town's Engineer or his representative. The inspection shall include, but shall not be limited to, proof rolling the prepared subgrade with a rubber-tired fully loaded dump truck that has a minimum gross weight of at least 20,000 pounds (10 Tons). Proof rolling shall be performed in lengths of not less than one block as measured from center of intersection to center of intersection, from center of intersection to end of cul-de-sac, or 750 linear feet. Any unsatisfactory materials thus exposed shall be removed and replaced with satisfactory select material as approved by the Town's Engineer. Provide the necessary amount of select fill compacted to the density requirements outlined in this specification.

Areas that rut or pump excessively under the wheels of the proof-roller shall be repaired by the developer before the street is paved. Should the developer disagree with the representative of the Town about the need for repairs to the subgrade, the developer or his project engineer may hire a Licensed Professional Engineer to perform CBR tests on the prepared subgrade. If the Engineer certifies that the full width and length of the subgrade will provide adequate support for the design pavement section and the anticipated loading for the design life of the paved area, the area may be paved without making repairs to the subgrade.

- F. Curb and gutter: The subgrade shall be constructed true to grade and cross section as may be shown on the drawings or standard details. All roots, stumps, and other perishable matter encountered at the subgrade shall be removed to a depth of not less than 12 inches below the subgrade. Where such material is encountered, it shall be removed by undercutting, the area filled with select material and compacted. All rock shall be cleared to a depth of 4 inches below the subgrade or as directed by The Town's Engineer.

Excavation to an elevation slightly above finished subgrade shall be completed prior to setting of forms. The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade until the concrete is in place. The subgrade shall be wet down sufficiently in advance of the placing of the concrete to ensure a firm and moist condition.

All subgrade shall be graded and protected to prevent an accumulation of standing water, and consequent subgrade saturation, in the event of rain.

In cold weather, the subgrade shall be so treated, protected, and prepared as to produce a satisfactory subgrade entirely free from frost when the concrete is deposited.

Compaction shall be in accordance with [Table 02200.1A](#).

- G. **Sidewalks and driveway areas:** The subgrade shall be constructed true to grade and cross section as may be shown on the drawings or standard details. In areas where

sidewalks or driveways are to be poured, the following conditions will be observed relating to compaction of the subgrade:

- 1) Where good firm material (original material, not borrow) has been carefully graded, so that no undercutting has occurred, this material shall be considered acceptable subgrade, upon approval by the Town's Engineer.
- 2) Where fill material has been placed, where undercutting has occurred, or where loose or unsuitable material is encountered, such fill or loose material shall be compacted as required by [Table 2200.1A](#), as applicable.
- 3) Where roots, stumps, or other perishable matter is encountered at the subgrade, they shall be removed to a depth of 4 inches below the subgrade and such undercuts shall be treated as specified in the preceding paragraph.

All subgrade shall be graded and protected as to prevent an accumulation or standing water, and consequent subgrade saturation, in the event of rain.

In cold weather, the subgrade shall be so treated, protected, and prepared as to produce and provide a satisfactory subgrade entirely free from frost when the concrete is deposited.

H. **Grading tolerances of finished surfaces:** Earthwork shall conform to the lines, grades, and typical cross sections shown on the plans, standard details, or as established by the Town's Engineer. Changes in grade shall be accomplished by smooth curves.

- 1) Shape subgrade under pavement and curb and gutter to within $\frac{1}{2}$ inch of required subgrade elevations.
- 2) Finish pavement and curb and gutter to within $\frac{1}{4}$ inch of required finish elevations.
- 3) Shape subgrade under sidewalks to within 0.10 foot of required subgrade elevations.
- 4) Finish sidewalks to within 0.10 foot of required finish elevations.
- 5) For all other areas, subgrade and finish elevations shall be within 0.10 foot of required corresponding elevations.

3.3.7. BACKFILL OF CURB AND GUTTER AND SIDEWALKS:

A. Immediately after the removal of forms for curb and gutter, sidewalks and driveways, the space between the back of the curb, sidewalks, and driveways shall be backfilled and smoothed off in a manner to prevent the accumulation of standing water.

3.3.8. FINISHING SLOPES AND SURFACES

A. **Surfacing:** The surface of all areas of earth and other materials shall be finished to a reasonable smooth and compact surface substantially in accordance with the surface lines, cross sections, and elevations or standard details indicated, on the drawings, or

as established by the Town's Engineer in this manual. Changes in grade shall be accomplished by smooth parabolic curves

3.4 STRUCTURES: EXCAVATION AND BACKFILLING

A. General

- 1) General: See Section 02210 - *Trenching, Backfilling, and Compaction of Utilities* for excavation and backfilling for structures (manholes, catch basins, etc.).
- 2) Work includes, but is not necessarily limited to, excavation for structures, head/endwalls, and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
- 3) Obtain fill and/or backfill material necessary to produce grades required. Materials and source to be approved by either a Geotechnical Engineer or the Town's Engineer. Excavated material, approved by Town's Engineer, may also be used for fill and backfill.
- 4) In following paragraphs of this section of specifications, the word "*foundations*" includes footings, base slabs, foundation walls, mat foundations, pile caps, grade beams, piers and any other support placed directly on soil.

B. Requirements for Structures.

- 1) The following requirements shall not supersede the applicable requirements of the latest edition of the NC State Building Code.
- 2) **General.** Do not commence excavation for foundations for structures until the density and moisture content of proposed fill material meets requirements of this specification section.
- 3) Excavate to elevations and dimensions indicated or specified on the plans. Allow additional space as required for construction operations, shoring, and inspection of foundation(s), sheeting and laying back trench to conform to OSHA guidelines.
- 4) **Excavation:** Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, any other materials which may be concealed beneath present grade, as required to execute work indicated on drawings. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Town's Engineer or Geotechnical Engineer.
- 5) **De-watering.** See [paragraph 3.3.3.E, De-Watering](#).
- 6) **Subgrade preparation:** Level off bottoms of excavations to receive foundations, floor slabs, support pads, or compacted fill. Remove loose materials and bring excavations into approved condition to receive concrete or fill material. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 inches and then compact to density stated in this section

of specifications before fill material can be placed thereon. Do not carry excavations lower than shown on plans for foundations except as directed by Geotechnical Engineer. If any part of excavation is carried below the required subgrade depth without authorization, fill from excavated level to subgrade elevation with either concrete of same strength as required for superimposed foundation or crushed stone as directed by Town's Engineer or Geotechnical Engineer. No extra compensation will be made for over-excavation.

- 7) **Subgrade Stabilization:** If the subgrade under foundations, fill material, floor slabs on grade, or support pads becomes frozen, loose, wet, or soft before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved consolidated crushed stone or as otherwise directed by either the Geotechnical Engineer or Town's Engineer.
- 8) **Bedding Requirements for Structures:** See specification Section 02210 *Trenching, Backfilling and Compaction of Utilities*, paragraph 3.5.6.G *Cushioning for Structures* for bedding requirements.
- 9) **Inspections:** Notify the Town's Engineer as soon as excavations are completed in order that subgrade may be inspected. Either a Geotechnical Engineer or the Town's Engineer is to inspect and approve subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under support pads and under retaining wall footings. Subgrade is to be inspected and passed as to being free of undesirable material, being of compaction density required by this specifications, and being capable of supporting superimposed foundation, fill, and loads to be placed thereon. Inspections shall also be made before fill is placed, concrete is poured, formwork is erected, or reinforcing steel is placed. The Geotechnical Engineer or the Town's Engineer shall be given the opportunity to inspect the subgrade both prior to and after subgrade compaction. When a Geotechnical Engineer is employed, he is to notify the Town in writing, with copies sent to Owner and Contractor, that subgrade has been inspected and approved and state what corrective actions were taken, if any, to bring subgrade into an approved condition.
- 10) **Slab construction:** Do not place floor slabs on grade, including equipment support pads, until subgrade has been approved, piping has been tested and approved, reinforcement placement has been provided, and Contractor receives approval to commence slab construction. Do not place floor slabs on grade, including equipment support pads, when temperature of air surrounding the slab and pads is expected to be below 40 degrees F.
- 11) **Protection of Structure:** Prevent new and existing structures from becoming damaged due to construction operations or other reasons. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface water or due to construction operations.
- 12) **Shoring:** See specification Section 02210 *Trenching, Backfilling and Compaction of Utilities*, paragraph 3.5.3, *Trench Protection: Trench Shaping, Bracing & Shoring* for shoring requirements.
- 13) **Drainage:** Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures. Maintain excavations where foundations, floor slabs, equipment support pads or fill

material are to be placed free of water. Provide pumping required to keep excavated spaces clear of water during construction. Should any water be encountered in the excavation, notify Town's Engineer. Provide free discharge of water by trenches, wells, well points, or other means as necessary and drain to point of disposal.

- 14) **Frost Protection:** Do not place foundations, slabs on grade, footings, support pads, or fill material on frozen ground. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved. Protect excavation from frost if placing of concrete or fill is delayed.
 - 15) **Heat Protection.** Do not place concrete on a dry hot subgrade. Sprinkle the base to moisten the subgrade but do not soak.
- C. **Backfilling *inside* of structures: (below foundations, footings, base slabs, floor slabs and equipment support pads):**
- 1) **Fill and Backfill Placement – General (excludes footings):**
 - a. Before placing structural fill, all subgrades are to be free of undesirable material, scarified to a depth of 6 inches and re-compacted to the density specified in [Table 2200.1B](#).
 - b. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed fill material shall known.
 - c. Place fill and backfill material in thin lifts, 6-inches maximum, consistent with the compaction requirements noted above in [Table 2200.1B](#) or as directed by a Geotechnical Engineer.
 - d. Compact material by means of equipment of sufficient size and type that can provide specified density within allowable moisture tolerances. Use hand operated equipment for filling and backfilling next to walls (*see also [paragraph 3.4.E](#) and [paragraph 3.4.F](#) below for additional requirements regarding backfilling against walls*).
 - e. Do not place fill and backfill when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - f. Use vibratory equipment to compact granular material. Do not use water without permission of either a Geotechnical Engineer or the Town's Engineer.
 - 2) **Footing Subgrade:** Footing subgrade may be stepped but not by more than 12 inches per step or sloped at more than 2 percent longitudinally. When subgrade soils or of a granular nature, or when directed by the Town's Engineer, pre-compact subgrade with hand vibratory equipment. Such soils tend to be "fluffed-up" as result of excavation operation. Do not place any fill or backfill material until subgrade has been inspected and approved by either a Geotechnical Engineer or the Town's Engineer as being free of undesirable material and, if applicable, verified to have been compacted to the specified density.

- 3) **Borrow source:** Select borrow material and source shall be approved by Town's Engineer before material is placed. Fill and backfill shall be select structural fill, sand or crushed stone as applicable to the condition and which meets the classification noted in [paragraph 2.2.2.B & 2.2.2.C Select Material Classification \(Borrow\)](#).
- 4) **Granular Fill Under Floor Slabs-on-Grade:** Place all floor slabs on grade on a minimum of 4" of # 57 or # 67 Stone. Compact granular fill to 75 percent relative density as determined by ASTM D4253. See [paragraph 2.2.2.C Select Material Classification \(Borrow\)](#).
- 5) **Vapor Barrier:** Unless called for otherwise on the plans, install a continuous 6-mil vapor barrier under floor slabs on grade as shown on drawings.

D. Backfilling *Outside* of Structures:

- 1) **Application of this section:** This paragraph of these specifications applies to fill and backfill placed outside of structures above the bottom level of both foundations and piping but not under paving. Provide either native compactable fill or structural fill material meeting paragraph 3 of this specification.
- 2) **Fill and Backfill Placement:**
 - a. Place fill and backfill material in thin lifts consistent with compaction requirements.
 - b. Compact material with equipment of proper type and size to obtain density specified within allowable moisture tolerances. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - c. Do not place fill or backfill material when subgrade to receive material is frozen, wet, loose, or soft.
 - d. Use vibratory equipment for compacting granular material. Do not use water unless permission is granted by either a Geotechnical Engineer or the Town's Engineer.

E. Zone of Influence around structural walls/retaining walls:

- 1) Where fill is required outside the exterior limits of foundations, there is a minimum *zone of influence* where the compactive effort would adversely affect the structure without precautions. In that zone, extra care shall be taken to protect or otherwise prevent damage to a structural wall. The *zone of influence* of the compactive effort shall be considered to be, around perimeter of structure, the greater of the following horizontal distances:
 - a. The depth of the fill needed bring the existing grade up to the proposed finished grade, or
 - b. A distance equal to depth of compacted fill measured from the bottom of the footing to the proposed finished surface grade.
- 2) In the *zone of influence*, follow the procedures outlined in paragraph F below.

F. Backfilling Against Structural Walls.

- 1) **General:** Unless a Civil/Structural Engineer or the Town's Engineer allows otherwise, do not backfill and compact around any part of structures until each part has reached its specified 28 day compressive strength and backfill material has been approved. (Higher early-strength concrete may be used to reduce this time if approved by either a Civil/Structural Engineer or the Town's Engineer, but at no additional cost to the Owner).
- 2) **Preparatory to backfilling:** Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work and concrete finishing.
- 3) **Restrained walls:** For walls which are restrained by floors at the top and/or bottom, do not place fill against walls until:
 - a. The walls have reached their 28-day required compressive strength, and
 - b. Either the floor slabs at top and bottom of walls are in place, or
 - c. The walls are braced.
- 4) **Free standing walls:** For free standing walls, do not place fill against walls until:
 - a. The walls have reached their 28-day required compressive strength, or
 - b. The walls are braced.
- 5) **Unbalanced pressures:** To prevent unbalanced pressures, bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

3.5 COMPACTION: SUBGRADE PREPARATION AND COMPACTION REQUIREMENTS

- A. Preparation: See [paragraph 3.3.6 Preparation of Areas to Receive Asphalt Pavement and Concrete](#).
- B. **Confirmation of Initial Geotechnical Report/Design Assumptions (for roadway projects to be turned over to the Town):** Prior to placement of stone base over the subgrade, the Geotechnical Engineer or his representative shall confirm the initial test results and design assumptions by visual classification and hand augur borings. If the visual findings are at variance with the initial testing and design assumptions, recommendations for modifications to the subgrade shall be provided to the designer, the Grading Contractor, and the Town's Engineer. The Town's Engineer shall approve the proposed recommendations prior to incorporation of the measures. See [Table 2200.3](#).
- C. **Minimum Compaction Requirements:** Compaction percentages are percentages of maximum dry density as determined by indicated ASTM Standards. Unless noted otherwise on drawings or more stringently by other sections of these specifications, place and ensure degree of compaction of embankment and borrow materials does not fall below the following percentages of the maximum density at optimum moisture content.

- D. Passing Test: Average of 3 test results meeting the applicable provisions of tables [2200.1A](#) and [2200.1B](#) (below) with no one test failing by more than -2 percentage points. Moisture content tolerance is to be within +/- 2 percentage points of the optimum moisture content unless otherwise specified by the Town's Engineer or Geotechnical Engineer.

Table 2200.1A		
Minimum Compaction Limits		
Location	Density	
Site and Public Roadways		
Embankment/borrow under roadway pavement surfaces, sidewalks, and curb and gutter	Top 12 inches	98% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.
	Up to within 12 inches	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.
Stone Base (other than NCDOT and parking lots)	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	
Roadway Shoulders	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	
Under turf, sodded, planted, or seeded non-traffic areas	85% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	
Pavement Patches over pipe	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99. See also Standard Detail 2.53, Table 2	
Under and Around Piping	See Standard Detail 2.53, Table 2	

Table 2200.1B		
Location	Density	
Building Structures		
Embankment/borrow beneath and within 5 feet of buildings, under foundations, and scarified existing subgrade beneath buildings.	Top 12 inches	100% of the maximum dry density by ASTM D698 (Standard Proctor)
	Up to within 12 inches	95% of the maximum dry density by ASTM D698 (Standard Proctor)
Outside structures next to walls and any other structural exterior member	90% of the maximum dry density by ASTM D698 (Standard Proctor)	
Backfill less than 10 feet from exterior	90% of the maximum dry density by ASTM D698 (Standard Proctor)	

Table 2200.1B	
Location	Density
Building Structures	
retaining walls	

- E. Failure of compactive efforts: If compaction efforts should fail to provide a stable subgrade in accordance with the requirements in [paragraph 3.5.D, Passing Test](#) after subgrade materials have been shaped and brought to optimum moisture, such unstable materials shall be removed to the extent directed by the Geotechnical Engineer and/or the Town’s Engineer and replaced and compacted using new material and must pass compaction test prior to proceeding to the next stage of construction and at no expense to the Town.

The costs associated with excavation and re-compaction of areas that have failed will be the Contractors responsibility.

F. **Compaction Lifts:**

Table 2200.2	
Compaction Lift Thickness of	
Lift Thickness (inches)	Location
6	Inside street rights-of-way
12	Outside street rights-of-way

G. **In-place testing of soils shall be tested based on the following:**

Table 2200.3	
In-Place Density Tests	
Soil Type/Classification	Reference Standard
GW, GP, GM, GC, SW, SP	<ul style="list-style-type: none"> Sand Cone Method (ASTM D1556) Nuclear Method ASTM D2922 [by percentage of Standard Proctor Density according to ASTM D 698]
SM, SC, ML, CL	<ul style="list-style-type: none"> Sand Cone Method (ASTM D1556) Rubber Balloon Method (ASTM D2167) Nuclear Method ASTM D2922 Drive-Tube Method (ASTM D2937) [by percentage of Standard Proctor Density according to ASTM D 698]

H. **Field Testing Limitations:**

- 1) When field density testing is incorporated according to [Table 2200.1A](#) and [Table 2200.1B](#), subgrade adequacy is to be confirmed by proof rolling in the presence of the Town’s Engineer or his representative. In-place field density testing of the street or pad subgrade will not be required.

- 2) In-place field density tests of the roadway or pad subgrade in cut sections (excavation) is not required.
- 3) Testing/adequacy of intermittent undercut areas and repair areas (e.g. around manholes and boxes) that have been backfilled with select fill and compacted will be confirmed by proof rolling.

3.6 TESTING: SUBGRADE COMPACTION TESTING AND CONTROL

A. Testing

Testing of embankment/borrow shall be performed by an independent laboratory approved by the Town and the Contractor. The Contractor shall be responsible for excavation for testing if required.

B. Quality Assurance vs. Quality Control:

Quality Assurance (QA) testing, and the associated cost, is the responsibility of the Town. Quality Assurance testing by the Town is used to confirm that the Contractor is generally performing his/her work in compliance with these specifications.

Quality Control (QC) testing is the necessary and required testing that is to be performed by the Contractor (or Developer) to assure that he/she is meeting and complying with the requirements of these specifications. The developer shall employ a Geotechnical Engineer firm to perform the testing. The associated cost for QC testing is the Contractor's (or Developer's) responsibility. The Contractor (or Developer) is also responsible for all costs associated with corrective work as well as any "re-testing" costs incurred by the Town when the Town's tests (tests for Quality Assurance) results in a "failure" to meet the minimum specified compaction requirements. Provide copies of the tests reports to the Town for verification and record.

Quality Control (QC) testing for Town funded projects: For municipal projects, the Town will employ and compensate a Geotechnical Engineering firm to provide soils testing and inspection services.

A. Quality Assurance (QA):

In the course of placement of embankment fill/borrow or in utility trench backfill, the Town's Engineer may require additional "Field Density Determinations" or compaction tests. Such tests will be at the Town's expense. When compaction tests are called for by the Town, the Town's Engineer will determine the location of the tests and the Town shall engage a qualified testing firm to perform the test. A representative of the Town will observe tests and a copy of the test results and inspection report will be submitted by the testing firm directly to the Town's Engineer. When the tests indicate that the density failed to meet the requirements of Tables [2200.1A](#) and [2200.1B](#) the Contractor shall comply with [paragraph 3.5.E, Failure of Compactive Efforts](#).

Payment for failed QA density tests: For Town funded projects, payment for failed in-place density tests shall be made by the Contractor by deducting the testing cost from the forthcoming retainage. For other projects in which the Town will ultimately

assume ownership and maintenance, the testing costs for failed in-place density tests shall be billed directly to the Contractor.

- C. **Quality Control (QC):** The Contractor shall perform in-field density tests in accordance with [Table 2200.4](#), below. Inspection reports shall be submitted by the testing firm directly to the Town’s Engineer. See [paragraph 3.5.D, Passing Test](#).
 - 1) All test results shall be provided to the Town’s Engineer as they become available from the testing agency.
 - 2) All Projects: In the absence of a pre-construction Geotechnical investigation, the Geotechnical testing firm is to perform laboratory tests (ASTM D698, Standard Proctor) to establish a moisture-density relationship for all materials that are proposed to be used as fill. Where borrow is proposed to be used from an NCDOT certified pit, the contractor may forgo this requirement provided copies of the test reports are furnished to the Town.
 - 3) Contractor shall give a 24-hour notice to Geotechnical [testing firm](#) for subgrade testing, subgrade confirmation, or inspections.
 - 4) **Minimum Compaction Testing Frequency:**

The following testing frequency shall be employed on both Town funded projects and projects proposed to be turned over to the Town for maintenance and/or ownership.

Table 2200.4	
Testing Frequency	
Location	Frequency
Buildings and structures	1 test group ^a for every 5,000 square feet
Road	1 test group ^a for every 300 feet of road
Parking Lots	1 test group ^a for every 10,000 square feet
Unpaved areas	1 test group ^a for every 20,000 square feet
Pipe Trenches in Roadways	See Table 2210.2 of Specification Section 02210
Proof Roll	Entire surface area to be paved
Exception: Where additional tests are required to determine the extent of unacceptable compaction (having been determined by the initial QA/QC test).	

^aOne test group consists of compaction tests on each layer of fill and backfill material.

- D. **Site access for testing:** Ensure Town, at all times, has immediate access to the site for the testing of all soils related work. Ensure excavations are in a safe condition for testing personnel.

3.7 BLASTING: EXCAVATION BY BLASTING/USE OF EXPLOSIVES

3.7.1. BLASTING:

Contact the Town of Wake Forest inspections department.

3.7.2. DISPOSAL OF ROCK

Excavated rock shall be hauled off the site at the Contractor's expense. Borrow required to replace excavated rock shall be provided by the Contractor and shall be included in the unit price bid for rock excavation. No blast rock refuse or boulders shall be used as backfill in any part of the site unless otherwise approved by the Town's Engineer. Where rock has scattered over adjoining property as a result of blasting, the Contractor shall remove the rock and restore the area to its original condition at no cost to the Town.

3.7.3. PAYMENT

Mass rock excavation shall be paid for by the cubic yard of material removed. No payment shall be made for "over-excavation." The volume removed shall be determined by cross-sectioning both the "pre-blast" and "post-blast" surfaces and determining the volume between the two by the average-end-method. See [paragraph 1.4.1, Rock in Open Excavation](#) for Rock definition.

3.8 METHOD OF VOLUME MEASUREMENT

A. Method of Measurement

Contractors are required to furnish accurate counts of all excavation and/or fill moved which is to be paid for under a unit price Contract. The volumes shall be measured by either truck count or cross-section, whichever method is approved by the Town's Engineer or stated in the proposal and/or bid documents. When a truck count is used, the Town's Engineer or his representative shall verify the count independently or employ one of the other following methods verify and account for volumes.

1) Tally Method:

Excavation: When unclassified excavation or undercut volumes are to be counted by the *truck tally method*, "swell" is to be incorporated into the truck volume in the amount of 15%. Unless otherwise agreed to or justified by a Geotechnical Engineer, the following pay volumes are to be used for either unclassified or undercut excavation:

Tandem:	13 CY
Tri-axle:	15 CY

Borrow: When either off-site or on-site borrow is to be counted by the truck tally method, "shrinkage" is to be incorporated into the truck volume (shrinkage of truck volume placed compared to compacted fill volume) utilizing the following pay volumes:

Tandem:	10 CY
Tri-axle:	12 CY

Loading Truck: A qualified truck load is one that is loaded up to within approximately 6" of the top of the dump bed, prior to dumping.

2) Average-End-Method:

Excavation and fill can be computed using the average-end-method. When used, this method is to be employed using the existing contours shown on the Contract

Drawings and the Contractors actual surveyed finished contours (surveyed by a licensed Surveyor). In so doing, the finished contours are to be plotted at the same scale as the original drawing and a transparency furnished to the Engineer for comparison to design grades. The volume computations are also to be submitted along with the Surveyor's seal and a certification as to the volumes measured.

The Contractor, at his discretion and with the prior approval of the Engineer, may survey the "stripped" site (the site after topsoil has been removed) and compute the volumes based on the stripped site and the "designed" finished grade as shown on the Contract Drawings. As before, a transparency to the same scale and the Surveyors computations and certification are to be submitted to the Engineer for comparison and verification.

3) **Volume Formulas:**

Unless otherwise approved, the following formulas are to be used in computing cut and fill:

Fill Formula

Net Fill = Raw Fill Vol. - Unclassified X (1 - Shrink Factor) + Strip Vol. - Undercut Fill placed in Fill Slopes X (1 - Shrink Factor) - Pavement Section or Building Floor Pad

Cut Formula

Net Cut = Raw Cut - Strip Vol. + Pavement Section or Building Floor Pad

4) **Wasting of excess excavation, undercut or topsoil as fill**

As a standard practice, it will be assumed that all undesirable material, such as undercut excavation, excess topsoil or unclassified excavation, is to be placed in roadway fill slopes wherever possible as long as approved by the Town's Engineer. However, in no case shall such material be placed inside the zone of structural influence of buildings, roadways or roadway structures.

On Town projects, with permission of the Town's Engineer and subject to the rules governing solid waste material regulated by NCDENR, undercut excavation and excess topsoil or unclassified excavation may to be placed in roadway fill slopes and landscape berms before having to haul the material off-site. Off-site wasting of such material is to be a last resort.

Stumps shall not to be wasted in roadway fill slopes or on other public works projects or easements without the written permission of the Town's Engineer.

In site computations, unless approved otherwise by the Engineer, these undesirable volumes are to be counted as "fill" up to the volume reasonably possible for such use on the site adjusted for shrinkage.

5) **Fill, in terms of volume, defined:** Fill is defined as a compacted post-construction volume in-place.

3.9 RIP RAP AND RIP RAP BEDDING PLACEMENT

Placement of Rip Rap and Rip Rap Bedding shall conform to Section 876 – *Rip Rap* of the *NCDOT Standard Specifications for Roadways and Structures*, latest revision.

3.10 PLACEMENT OF SOIL STABILIZATION FABRIC

Placement of soil stabilization fabric shall conform to the requirements of Section 270 – *Fabric for Soil Stabilization* of the *NCDOT Standard Specifications for Roadways and Structures*, latest revision and in accordance with the recommendations and directions of the Town's Engineer and/or a Geotechnical Engineer for the application and use intended.

3.11 SUBSURFACE DRAINAGE SYSTEMS

See Section 2630 – *Storm Drainage* and Section 02210 – *Trenching, Backfilling, and Compaction of Utilities* for both materials and construction requirements regarding subsurface drainage systems.

3.12 DUST CONTROL

The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved roads, haul roads, access roads, disposal sites, borrow and materials sources and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

The Contractor shall be required to sprinkle with water or to apply dust-allaying materials. Dust control is considered incidental and shall be carried out at the Contractor's expense.

3.13 CLEANUP AND RESTORATION OF SITE

- A. During the progress of the work, the Contractor shall keep the premises and the vicinity of the work clear from unsightly and disorderly piles of debris. Suitable locations shall be specified for the various construction materials and for debris. The materials shall be kept in their storage locations, except as needed for the work and debris shall be promptly and regularly collected and deposited in the specified location.
- B. Upon completion of grading operations, the Contractor shall fine grade the site, removing all surplus excavated material, leaving the area free from surface irregularities. He shall dispose of all surplus material, dirt, and rubbish from the site and shall keep the site free of mud and dust to the satisfaction of the Town's Engineer. The Contractor may be required to sprinkle the street to prevent dust nuisance and/or sweep the street to remove mud or debris.
- C. When working on the shoulders of paved roads, the Contractor shall keep the pavement clean of all loose earth, dust, mud, gravel, etc., and shall restore roadway shoulders and ditches as required by either the NCDOT or the right-of-way owner.
- D. After all work is completed, the Contractor shall remove all tools and other equipment, leaving the site free, clean, and in good condition.

- E. The Contractor shall keep the surface over and along the roadways and other graded areas in a safe and satisfactory condition during the progress of the work.
- F. No area shall be disturbed until an Erosion Control Permit has been obtained and a preconstruction conference conducted. Once the site has been stabilized, the Contractor shall remove all erosion control measures and stabilize disturbed areas as required by the approved plans/permit.
- G. Work is only to be performed within a dedicated easement or right-of-way. No disturbance of private property shall be permitted without first obtaining written permission from the property owner.

3.14 SALVAGE OF USEABLE MATERIALS

All materials such as iron castings, paving blocks, brick, pipe and etc., removed during excavation that is useable on this project shall be used after approval of its use by the Town's Engineer or the applicable owner of the street right-of-way. Such material shall be stockpiled on site. Unnecessary abuse and damage to these items shall be the Contractors responsibility and the cost of replacement may be deducted from the retainage.

End of Section 02200

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