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PROJECT MANUAL

for the

LAKE NORMAN STATE PARK – CAMPGROUND EXPANSION & IMPROVEMENTS

Lake Norman State Park
Troutman, NC

for the

NORTH CAROLINA DIVISION OF NATURAL AND CULURAL RESOURCES

VOLUME 2

BID SET
October 1st, 2019

SCO: 16-14408-01A
Code: 46614
Item: 4A17

Project No.: 1740
Bid Date: _____
Copy No.: _____

CAMPGROUND EXPANSION & IMPROVEMENTS
LAKE NORMAN STATE PARK

Cover
Project Manual Sheet with Seals

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DIVISION 06

HEAVY TIMBER CONSTRUCTION

SECTION 061301 – SITE TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies exterior timber framing members. Timber decking is also included.

B. Types of timber construction specified in this Section include the following:

1. Camp Site border timbers.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and installation instructions for required Work, covering timber fabrication process, treatments, and accessories.

1. Submit certification by treating plant for required treatments that comply with specified standards.

C. Samples 48 inches long, full width and depth, showing range of variation to be expected in appearance of timber including any required treatment and finishing.

D. Shop drawings showing full dimensions of each member and layout of entire timber system. Show details of connections, connectors, and other accessories.

1.4 QUALITY ASSURANCE

A. Standards: Comply with American Institute for Timber Construction AITC 108, "Standard for Heavy Timber Construction."

B. Grading Timber: Provide timber graded by a recognized agency, with rules and service complying with requirements of American Lumber Standards Committee and PS 20, "American Softwood Lumber Standard."

1. Timbers making contact with concrete, gravel or soil shall have a 0.4 minimum ground contact rating.
2. Do not apply inspection service grade mark on timber shown as exposed in the work and with transparent finish. Submit certificate of grade compliance, obtained from grading agency with each shipment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Time delivery and installation of timber work to avoid extended on-site storage, and to avoid delaying work of other trades.

B. Keep timbers protected during fabrication, delivery, storage, handling, and erection.

PART 2 - PRODUCTS

2.1 TIMBER FRAMING

A. General: Comply with grading rules of grading agency for species of timber used:

1. SPIB--Southern Pine Inspection Bureau.

B. Timber Species: Southern Yellow Pine.

C. Timber Grade: For the species used, comply with following grade (or grades, if more than one specified at Fabricator's option), for borders, beams, stringers, posts and other members as shown:

1. SPIB Grade: No. 1 Timbers.

E. Moisture Content: Provide timber dried to a maximum moisture content of 19 percent and include in grade marking or certification of grade.

F. Dressing: Provide timber that has been dressed on four sides (S4S) at mill, prior to grading. Comply with grade sizes.

G. End Sealer: Manufacturer's standard, transparent, colorless wood sealer, which is effective in retarding the transmission of moisture at cross-grain cuts.

H. Penetrating Sealer: Manufacturer's standard, translucent, penetrating wood sealer, which will not interfere when applying wood stain and transparent finish, or paint finish as indicated for the Work.

I. Connectors, Anchors, and Accessories: Provide fabricated structural steel (ASTM A 36) shapes, plates and bars, welded into assemblies of types and sizes indicated, with steel bolts (ASTM A 307), lag bolts, and other fasteners, as required.

1. Finish each assembly and fastener unit with hot-dip zinc coating (ASTM A 153).

J. Species to be used in various locations:

1. Camp Site Borders

2.2 FABRICATION

A. Member Design: Member sizes and shapes as shown are based on specified allowable stresses and indicated loadings.

B. Camber: Fabricate horizontal and inclined members (units of less than 12-to-12 slope) with natural convex bow (crown) up, so as to provide camber in the work.

C. Fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

1. Machine sand exposed surfaces to remove planing or surfacing marks, finishing with No. 80 grit sand paper.

D. Shop Fabrication: Where treatment of timber work is indicated, fabricate members (cutting, drilling, surfacing and sanding) prior to treatment to the greatest extent possible.

E. Preservative Treatment: Pressure treat fabricated members as noted on drawings with waterborne solution for above-ground use, complying with AWPA C2.

1. Provide water repellent additive in preservative solution.

F. Seal Coat: After fabrication and surfacing of each unit, apply a saturation coat of penetrating sealer on surfaces of each unit, except for treated wood where the treatment included a water repellent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Erect framing true and plumb. Provide temporary bracing as required to maintain lines and levels until permanent supporting members are in place.

B. Install miscellaneous steel connectors, anchors, and accessories as indicated.

C. Install decking with end joints located over bearings as indicated.

D. Cutting: Avoid extra cutting after fabrication.

1. Coat cross cuts with end sealer.

E. Handle and temporarily support members to prevent visible surface damage.

F. Repair damaged surfaces and finishes after completing erection, or replace damaged members, as directed, where damage is beyond satisfactory repair.

END OF SECTION 061301

DIVISION 12

INTERIOR PUBLIC SPACE FURNISHINGS

SECTION 129300 - SITE FURNISHINGS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Site and Site Furnishings and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
   1. Picnic Tables
   2. Accessible Picnic Tables
   3. Fire Rings
   4. Accessible Fire Rings
   5. Lantern Posts
   6. Park Signage – Camp Site & Accessible Parking

1.2 SUBMITTALS (Not Applicable)

1.3 QUALITY ASSURANCE

A. All materials and Work shall be in accordance with the State Codes and Specifications and other criteria herein specified.

B. Substitutions: Unit(s) to be considered equal to those specified herein this Section shall be reviewed and approved by the Owner, in writing, prior to the Bid Date. No substitutions shall be allowed after the Bid Date.

1.4 COORDINATION

A. Contractor shall coordinate the installation of all furnishings in this Section with all other related Work of this Contract.

B. Contractor shall be responsible for verifying the dimensions and required hardware of the furnishings prior to commencing installation Work.

C. Contractor shall coordinate furnishing footings with utility locations. Note potential conflicts to the Owner.

1.5 STORAGE AND HANDLING

A. Furnishings shall be stored as necessary to prevent damage and shall be in new condition when ready for installation. It shall be the responsibility of the Contractor to install “factory condition” furnishings.

PART 2 – PRODUCTS

2.1 MATERIALS/ITEMS/EQUIPMENT

A. PICNIC TABLES:
1. CORRECTION ENTERPRISES 8’ Picnic Table, Model # 61-0460-00
2. Finish: Galvanized / Polywood
3. Representative

Correction Enterprises
2020 Yonkers Road
MSC 4240
Raleigh, NC 27699-4240
Phone: (919) 716-3600
Fax: (919) 716-3975

Units to be provided by Owner and installed by Contractor.

B. ACCESSIBLE PICNIC TABLES:
1. CORRECTION ENTERPRISES 8’ Picnic Table, Model # 61-0470-00
2. Finish: Galvanized / Polywood
3. Representative

Correction Enterprises
2020 Yonkers Road
MSC 4240
Raleigh, NC 27699-4240
Phone: (919) 716-3600
Fax: (919) 716-3975

Units to be provided by Owner and installed by Contractor.

C. FIRE RINGS:
1. CORRECTION ENTERPRISES 32” Diameter Fire Ring (Model # 61-0600)
2. Finish: Black Iron
3. Representative:

Correction Enterprises
2020 Yonkers Road
MSC 4240
Raleigh, NC 27699-4240
Phone: (919) 716-3600
Fax: (919) 716-3975

4. Units to be provided by Owner and installed by Contractor.

D. ACCESSIBLE FIRE RINGS:
1. PILOT ROCK 32” Diameter Fire Ring (M-32/17 Accessible Campfire Ring)
2. Finish: Black Iron
3. Representative:

Pilot Rock
R.J. Thomas Mfg. Co. Inc.
PO Box 946
Cherokee, IA 51012-0946
Phone: (800) 762-5002

4. Units to be provided by Owner and installed by Contractor.

E. LANTERN POSTS:
1. CORRECTION ENTERPRISES 8', 1-1/2 OD Lantern Holding Post (Model # 61-0660)
2. Finish: Galvanized
3. Representative:

Correction Enterprises
2020 Yonkers Road
MSC 4240
Raleigh, NC 27699-4240
Phone: (919) 716-3600
Fax: (919) 716-3975

4. Units to be provided by Owner and installed by Contractor.

F. SIGNAGE – CAMP SITE POSTS & NUMBERS:
a. 5', 6 x 6 Camp Site Post & Number (to be produced by the Parks & Recreation Sign Shop)
b. Finish: Rough Sawn Treated Timber
c. Representative:

NCDCR
Division of Parks and Recreation
Lake Norman State Park
759 State Park Road
Troutman, NC 28166

d. Units to be provided by Owner and installed by Contractor.

G. SIGNAGE – ACCESSIBLE PARKING SIGNAGE:
a. Accessible Parking Signage
b. Finish: Signs - High-Grade Reflective, .080 aluminum
Post – Galvanized, Heavy Gauge U-Channel (8' Min.)
c. Representative:

stopsignsandmore.com
1-888-931-1793
or approved equal

d. Units to be provided by Owner and installed by Contractor.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which site furnishing units are to be installed and remedy any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner or Landscape Architect.

3.2 INSTALLATION

A. *Install, picnic tables, fire rings, lantern posts and Accessible Parking Signage per manufacturer's installation instructions/details and/or details provided on drawings. Install and bury Camp Site Posts & Numbers 24" in depth so that 36" remains above finish grade.*

Each item is to be staked or marked in the field for approval by the Owner. Do not install any site furnishing until each location has been approved.

1. Unit(s) shall be provided by owner and located as directed by the Contract Specifications. Field verify exact locations with Owner's Representative or Landscape Architect prior to installation.
2. Erect and install Unit(s) in accordance with the Manufacturer's instructions and recommendations. Install unit(s) plumb, accurately, and in the correct orientation and relationship with other site furnishings, elements and/or paving as shown on the Contract Drawings.
3. Install footings, anchorages and/or mounting hardware, as applicable, in strict accordance with Manufacturer's instructions, and as directed by the Owner or Landscape Architect.

3.3 PROTECTION

A. Protect installed furnishings against damage throughout the duration of the construction period, complying with Manufacturer's directions.

B. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of the work. Paint exposed areas with paint or other material as supplied by the Manufacturer of the damaged Unit. Apply to thickness recommended by paint manufacturer.

END OF SECTION 129300

DIVISION 31

EARTHWORK

SECTION 31 05 05 DEMOLITION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work of this section consists of removal and disposal of structures, old pavements, abandoned pipelines, and other obstructions as designated, including salvaging of materials and backfilling of resulting trenches, holes and pits. Also included is all work, which relates to explosives including receiving, handling, transporting, storing, distributing, priming, loading, firing, and disposal.

1.02 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 of the Specification and Addenda apply to this section.

PART 2: NOT USED

PART 3: EXECUTION

3.01 DEMOLITION

A. BITUMINOUS PAVED AREAS

Scarify and completely remove. Resultant material may be utilized in bottom portion of areas to receive fill. No pieces shall be left exposed in the fill slopes. If material is used in any portion of the new construction, layers shall be a maximum of 8" and separated by minimum 6" layers of earth. Water and compaction requirements are specified under other sections. No compaction is required for materials used for obliteration work outside the limits of new construction.

B. REMOVAL OF CONCRETE SURFACES AND STRUCTURES

Concrete designed for removal, break into pieces and use for rip-rap. Volume, minimum 0.5 cubic foot; 75% of pieces shall be between 1.5 and 2.0 cubic feet. Stockpile at designated locations.

C. PIPE REMOVAL

Remove pipe, exercising care to avoid breaking or damaging. Store pipe to be re-laid as directed.

3.02 EXPLOSIVES

A. LEGAL REQUIREMENTS

Comply with all applicable Federal, State, and local laws and regulations pertaining to the use, storage, and handling of explosives. It is the intent of these specifications to comply with such laws and regulations. In the event of inconsistencies between these specifications and the laws and regulations, the laws and regulations take precedence, subject to final determination by the Engineer.

B. PROTECTION

The Contractor shall exercise the utmost care not to endanger life and property. Make proper use of blasting mats and other protective devices adopting whatever additional precautions are deemed necessary to prevent damage to trees, shrubs, other landscape features, buildings, utilities, monuments, and other structures. Make every effort to prevent damage to the natural and the constructed surroundings. Should damage occur, make restoration as required by the Engineer.

C. PERSONNEL

One competent, experienced person shall be specifically designated in charge of explosives. The designated person must present certification to the Engineer that he has successfully completed a course in the handling and use of explosives, given by an accredited institution such as the U.S. Bureau of Mines, DuPont, or other explosive manufacturing company. He shall exercise careful supervision of all work related to the use, storage, and handling of explosives. Permit only a minimum number of competent, experienced men, consistent with efficient operation, to handle explosives. Exclude anyone demonstrating carelessness, incompetence, or inexperience from further handling of explosives.

D. GENERAL REQUIREMENTS

The Contractor shall give special attention to the following specific rules:

1. Locate magazines in accordance with the American Tale of Distances for Storage of Explosives and only at sites approved by the Engineer.

2. Magazines shall be bulletproof, fireproof, burglarproof, weather resistant, constructed with adequate screened ventilation and dry wood floors. Countersink all nails exposed to the interior of magazines.

3. Do not store detonators with other explosives but in separate magazines.

4. Magazines shall not be provided with artificial heat or lights.

5. Securely lock magazines.

6. Mark magazines and roads in area with appropriate caution and danger signs.

7. Clear blast area of unnecessary personnel and equipment before delivery of any explosives to the site.

8. Keep no more than a one-day supply of explosives at or near the work site. Keep explosives in approved portable magazines in locations approved by the Engineer.

9. Use only wooden tamping bars for charging explosives into drill holes.

10. Do not use electricity from light of power circuits for firing shots unless the electrical connection to the circuit is made within an enclosed switch box securely locked with switch in open position.

11. Provide a positive warning system to give adequate warning in every direction immediately prior to firing explosives. Guard all access points to the blast area to halt personnel and vehicles a safe distance from the blast. Maintain intercommunication between guards and person firing the blast assuring the blast area is clear prior to firing.

12. Provide special signs or signals at all access points including a warning to turn off radio transmitters whenever electrical detonators are used.

3.03 DISPOSAL

A. Dispose of debris from demolition operations in an approved and satisfactory manner.

END OF SECTION

SECTION 31 10 05 WASTE MATERIAL DISPOSAL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of the disposal of waste and debris in accordance with the requirements of these specifications. Waste will be considered to be all excavated, grubbed or removed materials, which are not utilized in the construction of the project.

PART 2: NOT USED

PART 3: EXECUTION

3.01 GENERAL REQUIREMENTS

A. Waste shall be disposed of in areas that are outside of the project area and provided by the Contractor, unless otherwise required by the plans or special provisions or unless disposal within the project area is permitted by the Engineer.

B. The Contractor shall maintain the earth surfaces of all waste areas, both during the work and until the completion of all seeding and mulching or other erosion control measures specified, in a manner which will effectively control erosion and siltation.

C. The following requirements shall also be applicable to all waste or disposal areas other than active public waste or disposal areas:

1. Rock waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practical, and shall be covered with a minimum 6" thick layer of earth material either from the project waste or from borrow.

2. Earth waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practicable, but in no case will slopes steeper than 2:1 be permitted.

3. Construction debris, grubbed debris and all broken pavement and masonry shall be covered with a minimum 6" thick layer of earth waste material from the project or borrow. The completed waste area shall be shaped as required above for disposal of earth waste.

4. Seeding and mulching shall be performed over all earth or earth covered waste areas. The work of seeding and mulching shall be performed in accordance with Section 32 92 19 – Seeding and Mulching.

5. Where the Engineer has granted permission to dispose of waste and debris within the project, the Engineer will have the authority to establish whatever additional requirements may be necessary to insure the satisfactory appearance of the completed project.

   Disposal of waste or debris in active public waste or disposal areas will not be permitted without prior approval by the Engineer. Such disposal will not be permitted when, in the opinion of the Engineer, it will result in excessive siltation or pollution.

END OF SECTION

SECTION 31 11 00 CLEARING AND GRUBBING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Clearing and grubbing shall consist of the removal and satisfactory disposal of all trees, brush, stumps, logs, grass, weeds, roots, decayed vegetable matter, posts, fences, stubs, rubbish and all other objectionable matter resting on or protruding through the original ground surface and occurring within the construction limits or right-of-way of any excavation, borrow area, or embankment.

PART 2: NOT USED

PART 3: EXECUTION

3.01 GENERAL

A. Clearing and grubbing operations shall be completed sufficiently in advance of grading operations as may be necessary to prevent any of the debris from the clearing and grubbing operations from interfering with the excavation or embankment operations. All work under this section shall be performed in a manner which will cause minimum soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

1. Clearing:

a. The work of clearing shall be performed within the limits established by the plans, specifications, or the Engineer.

b. Clearing shall consist of the felling and cutting up, or the trimming of trees, and the satisfactory disposal of the trees and other vegetation together with the down timber, snags, brush and rubbish occurring within the areas to be cleared. Trees and other vegetation, except such individual trees, groups of trees, and vegetation, as may be indicated on the plans to be left standing, and all stumps, roots and brush in the areas to be cleared shall be cut off six inches above the original ground surface.

c. Individual trees and groups of trees designated to be left standing within cleared areas shall be trimmed of all branches to such

heights and in such manner as may be necessary to prevent interference with construction operations. All limbs and branches required to be trimmed shall be neatly cut close to the whole of the tree or to main branches, and the cuts thus made shall be painted with an approved tree wound paint. Individual trees, groups of trees, and other vegetation, to be left standing shall be thoroughly protected from damage incident to construction operations by the erection of barriers or by such other means as the circumstances require.

d. The Engineer will designate all areas of growth or individual trees which are to be preserved due to their desirability for landscape or erosion control purposes. When the trees to be preserved are located within the construction limits, they will be shown on the plans or designated by the Engineer.

e. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. When such damages occur, all damaged areas shall be repaired, removed or otherwise resolved utilizing generally accepted practices at the Contractor's expense.

2. Grubbing:

a. Grubbing shall consist of the removal and disposal of all stumps, roots and matted roots from all cleared areas, except as herein specified.

b. In embankment areas, when the depth of embankment exceeds 3'-6" in height sound stumps shall be cut off not more than 6" above the existing ground level and not grubbed. Unsound or decayed stumps shall be removed to a depth of approximately two feet below the natural ground surface.

c. All depressions excavated below the natural ground surface for or by the removal of stumps and roots shall be refilled with suitable material and compacted to make the surface conform to the surrounding ground surface.

3. Disposal of Cleared and Grubbed Material:

Saw logs, pulp wood, cord wood or other merchantable timber removed incidental to clearing and grubbing shall become the property of the Contractor. All combustible matter shall be deposited at locations approved by the Engineer. Combustible matter may be burned or may be disposed of as stated above. Debris shall not be burned unless written permission or permit is issued by the Fire Marshall having jurisdiction in the area if applicable. The Contractor shall adhere to all limitations and conditions set forth in the permit. Burning shall be done at such time and such manner as to prevent fire from spreading and to prevent any damage to adjacent cover and shall further be subject to all requirements of State or Federal Governments pertaining to the burning. Disposal by burning shall be kept under constant attendance until all fires have burned out or have been extinguished.

END OF SECTION

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for buildings, structures, slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase and base courses for concrete walks, and pavements and asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Divisions 22, 23, 26 and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
4. Division 31 Section "Clearing and Grubbing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above and below-grade improvements and utilities.
5. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
6. Division 32 Section "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 SITE CONDITIONS

A. Site Information: Unless otherwise indicated in the Contract Documents, no subsurface test results are available for this project. Test borings and other exploratory operations may be undertaken by the Contractor at their own expense, provided such operations are acceptable to the Owner and authorities having jurisdiction.

B. The Contract Documents may contain a Geotechnical Report in the appendix of these documents. When that is the case, all recommendations contained in the Geotechnical Report shall be implemented by the Contractor as described in that document.

C. Where boring logs and related information are included in the Geotechnical Report, this information depicts approximate subsurface conditions only at these specific locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those reported at the boring locations. It is expressly understood that neither the Owner nor the Engineer will be responsible for interpretations or conclusions drawn from the boring data by the Contractor. The data are made available for the convenience of the Contractor. Additional test borings and other exploratory operations may be undertaken by the Contractor at his own expense provided such operations are acceptable to the Owner and authorities having jurisdiction.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Cohesionless Materials: Include poorly and well graded gravels (GP and GW) and poorly and well graded sands (SP and SW). Cohesionless soils are generally regarded as free draining.

F. Cohesive Materials: Clayey gravels (GC), clayey sands (SC), lean clays (CL), fat clays (CH), silts (ML and MH), and organic (GM) and silty sands (SM) will be considered cohesionless only when the fines have a plastic index of 0. Otherwise they will be considered cohesive.

G. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated for footings, foundations, pipework and other construction as shown on the Drawings.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or changes in the Work as appropriate.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

K. Select Backfill: Backfill and fill material that is transported to the site from outside the project limits, and which meets the soil requirements specified herein as satisfactory materials. Material excavated in conjunction with the construction of this project cannot be considered as "select backfill" for payment purposes.

L. Structures: 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. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Flowable Fill (Controlled low-strength material), including design mixture.
3. Warning tapes.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency: A geotechnical testing firm will be selected by the Owner to provide construction material testing services as required for the project.

B. All work associated with this Section shall comply with latest edition of the North Carolina Department of Transportation, Standard Specifications for Roads and Structures where those requirements are more stringent than those specified herein.

C. All work associated with this Section shall comply with the latest edition of the North Carolina Department of Environment and Natural Resources, Erosion and Sediment Control Planning and Design Manual.

D. Comply with all pollution control rules, regulations, ordinances, and statutes which apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.

E. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Engineer determines that it is necessary to use calcium chloride or more effective dust control, furnish and spread the material, as directed, and without additional compensation.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer.

C. Utility Locator Service: Notify appropriate utility locator services for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until tree and plant-protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Borrow material shall be selected to meet the requirements and conditions of the particular fill for which its use is intended. Sand clay soils shall be capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash, and other deleterious material. Unless specifically provided, no borrow shall be obtained within the limits of the project site without written approval. Borrow shall meet the same requirements as other onsite materials as specified herein.

C. The Contractor shall place only borrow material that has been specifically identified as acceptable for this section, unless otherwise directed by the Engineer.

D. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, CL, ML, and SM according to ASTM D 2487 or Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of masonry, rock or boulders larger than 4 inches in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetation, and other deleterious matter, unless otherwise specified.

1. Organically contaminated soils must be removed from the area of grading operations. At the discretion of the Engineer, topsoil within the area to be stripped shall be stockpiled in a convenient area, selected by the Engineer, for later use in planting areas. All topsoil shall be graded by the Engineer as suitable and shall be stockpiled separately as directed by the Engineer in the field.
2. Soft or excessively yielding material shall be removed and replaced with inert controlled fill.
3. All roots, organic matter, trash, debris, and other unsuitable materials that may find their way into otherwise acceptable fill material shall be removed during the dumping and spreading operations.
4. Fill material shall have a minimum laboratory dry weight, ASTM D-698, of at least 100 pounds per cubic foot unless specifically exempted from this requirement by the Engineer.

E. Unsatisfactory Soils: Soil Classification Groups GC, SC, OL, CH, MH, OH, and PT according to ASTM D 2487 and Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups, unless otherwise specified.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

F. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

I. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

J. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

L. Pipe Bedding: Narrowly graded washed crushed stone or crushed gravel meeting the requirements of ASTM D 448, aggregate grading size 57.

M. Sand: ASTM C 33; fine aggregate.

N. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.

4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 FLOWABLE FILL (CONTROLLED LOW-STRENGTH MATERIAL)

A. Flowable Fill (controlled low-strength material) shall meet the requirements of NCDOT Standard Specifications for Roads and Bridges, (latest revision). Flowable fill shall have a minimum 28-day compressive strength of 125 psi and shall be mixed such that cement content is 100 to 150 pounds per cubic yard, air content is less than 35 percent and slump is between 7 and 9 inches.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with

Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility companies.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

D. Do not commence earth moving operations until temporary erosion and sedimentation control measures, as shown on the plans, as specified herein or as may be required by authorities having jurisdiction are in place.

E. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Shape the subgrade as indicated on the drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

F. After removal of all existing topsoil, debris, and other undesirable material, the areas which are to receive fill, which have been cut to the desired grade, or which are at the approximate required subgrade elevation without additional earthwork, should be proofrolled to locate any soft or yielding area. Proofrolling shall be done as described below.

G. Any soft or excessively yielding material revealed by the proofrolling shall be removed and replaced with inert controlled fill. The Engineer shall be the sole judge of what constitutes soft or excessively yielding material.

H. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 CUTTING CONCRETE OR ASPHALT SURFACE CONSTRUCTION

A. All pavement cutting and repair shall be done in accordance with the requirements of authorities having jurisdiction. Cuts in concrete and asphaltic concrete shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be performed with a concrete saw in a manner which will provide a clean groove the complete thickness of the surface material along each side of the trench and along the perimeter of cuts for structures.

B. Concrete and asphaltic concrete over trenches excavated for pipelines shall be removed so that a shoulder not less than 12 inches in width at any point is left between the cut edge of the surface and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

C. Pavement or other surfaces removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

D. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives,

walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts.

3.3 DEWATERING

A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

B. All excavations for concrete structures or trenches that extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation.

C. The Contractor is responsible for obtaining any required permits or permissions necessary for the disposal of groundwater that is removed. Any discharged groundwater shall be clean and free of sediment.

D. The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

E. The Contractor shall take special care to prevent the siltation of streams and remove all organically contaminated sediment, saturated soil, and other undesirable material from existing watercourses.

F. Prevent surface water and ground water from entering or accumulating in trenches and other excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Do not use excavated trenches as temporary drainage ditches. Divert water from these areas without causing damage to adjacent property.

G. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

3.4 EXPLOSIVES

A. Where blasting is permitted, it shall be done only by qualified personnel and in accordance with all requirements of authorities having jurisdiction. The Contractor shall be responsible for any damage done to adjacent structures, properties, or to persons, by reason of the blasting or other earthwork operations. The Contractor shall also be responsible for damage to other site improvements including, but not limited to embankments and cut areas, and sewer, water, gas or other underground lines which may result from blasting or earthwork operations. All such damage shall be repaired and made good by the Contractor in a timely manner.

B. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

C. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

D. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

E. Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

3.5 EXCAVATION, GENERAL

A. Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation to comply with the requirements of governing authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

E. Widening of cuts or flattening of cut slopes will not be required in rock or material which required ripping. When rock is unexpectedly encountered, any widening or flattening already begun shall be transitioned to leave the cut with a pleasing and safe appearance.

F. Unclassified Excavation: Excavate to subgrade elevations regardless of the character, nature or composition of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate and shape the surface of areas under walks to indicated lines, grades, elevations, subgrades and cross sections, with the finish surface not more than 0 inches above or 1 inch below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.

B. Excavate and shape the surface of areas under pavement to indicated lines, grades, elevations, subgrades and cross sections, with the finish surface not more than 1/2 inch above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

C. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Perform all excavation of every description and of whatever substance encountered so that the pipe can be laid to the indicated gradients, lines, depths, and elevations shown on the drawings.

B. Except where tunneling is indicated on the drawings, is specified, or is permitted by the Engineer, all trench excavation shall be open cut from the surface.

C. No more trenches shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

D. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be controlled, such that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

E. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe. Cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation except where future surface elevations are indicated on the drawings.

F. Excavate trenches to uniform widths to provide a maximum trench width no greater than the pipe outside diameter plus 24 inches (12 inches on either side of pipe). Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Do not widen trenches by scraping or loosening materials from the sides.

G. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.
2. For pipes and conduit to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.
3. For trench bottoms in poor soils excavate and remove unstable or unsuitable soil to a width and depth, as directed by the Engineer, and refill with a thoroughly compacted gravel bedding.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

H. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

I. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

3.9 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

C. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

D. Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not less than 6 inches below the bottom of the structure or pipe. Not more than ½ inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

E. Proof-roll subgrade below structures, slabs, pavements and other areas as directed by Engineer. Proofrolling shall be done with at least four (4) overlapping passes of a heavy-duty flat wheel vibratory roller, at least 20 tons, or by its approved equivalent.

F. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction (longest dimension of Project). Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

G. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation consists of the removal of materials beyond indicated lines, grades, or elevations without the specific direction of the Engineer.

B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Additional concrete to fill unauthorized excavations shall be placed, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

C. For pipe trenches and elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Unless otherwise specified or indicated on the drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill on frost, snow, ice or frozen or muddy material. Remove previously frozen material before new backfill is placed. Start backfilling as soon as practicable after the pipes have been laid, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, and proceed until its completion.

B. With the exception mentioned below in this paragraph, do not backfill trenches at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights, and barricades, and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own

expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

C. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than 5 feet. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.

D. Zone Around Pipe: Place bedding material to the level shown on the Drawings and work material carefully around the pipe to insure that all voids are filled, particularly in bell holes. For backfill up to a level of 2 feet over the top of the pipe, use only selected materials containing no rock, clods or organic materials. Place the backfill and compact thoroughly under the pipe haunches and up to the mid line of the pipe in layers not exceeding 6 inches in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot above the pipe in layers not exceeding 6 inches and compact to a maximum density of at least 100 percent as determined by ASTM D698.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Tamping: Deposit and spread backfill materials in uniform, parallel layers not exceeding 12 inches thick before compaction. Tamp each layer before the next layer is placed to obtain a thoroughly compacted mass. Furnish and use, if necessary, an adequate number of power driven tampers, each weighing at least 20 pounds for this purpose. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval of the Engineer, be compacted by the use of suitable rollers, tractors, or similarly powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

G. Follow the measures described herein to ensure the optimum moisture content of the backfill material prior to placement in the trench. Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.

H. Compact backfill in pipe trenches to the maximum density as shown on the drawings, or as specified herein.

I. Flowable Fill (Controlled Low-Strength Material): Place initial backfill of flowable fill to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

J. Place and compact final backfill of satisfactory soil to final subgrade elevation.

K. Install warning tape directly above utilities as shown on the Drawings.

3.14 SOIL FILL

A. After a stable, non-yielding surface has been established, the surface of the area to be filled shall be scarified with a disc or harrow to a depth of 4 to 6 inches. An initial 3-inch layer of fill

material shall then be spread over the scarified surface and the entire area compacted as specified below.

B. No fill shall be placed on any area until that area has been inspected and approved by the Engineer. Fill shall not be placed mud, frost, snow or ice. Fill materials shall be spread in uniform horizontal layers not exceeding 8 inches in uncompacted thickness. Alternating layers of cohesive and granular fill soils shall not be permitted. Spreading and compacting of fill material should be started at the lowest portion of the site. All fill must be placed in horizontal layers. Sloping fill planes will not be permitted. Fill material shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form.

C. Keyways shall be provided at the toe of each fill slope as shown on the drawings. As each layer of fill meets the natural grade of a slope, a bench, approximately 7 to 8 feet wide, shall be cut into the existing grade with each layer of newly placed fill. If rock is encountered at the face of the natural grade, the original ground shall be cut in vertical steps of 4 to 5 feet and a horizontal bench cut into the rock at the top of each vertical increment. A horizontal plateau, approximately 15 to 20 feet wide, should be provided in the existing slope at vertical intervals of roughly 25 feet. Subsurface drains shall be installed at the toe of the slope and wherever springs or excessive seepage are encountered. Drains should be led to the outside face of the embankment and the water picked up and carried away in such a manner as to avoid softening the embankment or its toe, or producing erosion gullies.

D. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.15 SOIL MOISTURE CONTROL

A. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction. This may require aerating the material if it is too wet or the addition of water if it is too dry. If additional water is required, it should be uniformly distributed through the use of approved water wagons, and shall be thoroughly incorporated into the material by means of discs or other suitable mixing equipment. Care shall be taken to avoid trapping water within the fill.

B. Where, in the opinion of the Engineer, proposed fill material is too wet to permit drying in a reasonable length of time, the Engineer may reject the material and it must be removed from the work area.

C. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

D. Method “C” of the Standard Proctor test of moisture density relationship test, ASTM D 698 or AASHTO T99, shall be used to determine the maximum laboratory dry density and the optimum moisture content of the material which is to be used for fill.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place satisfactory backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place satisfactory backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. Take care to prevent wedging action of backfill against structures.

C. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done. Use the best of the excavated materials in backfilling within 2 feet of the structure.

D. When existing ground surface has a density less than that specified under the subsection entitled “COMPACTION” for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

E. After compaction, all fill will be tested in accordance with Method "C" of ASTM D-698, unless specified otherwise. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:

UNPAVED AREAS	Compact Full Depth to 92%
DRIVES AND PARKING	Top 24” - 100%
TRENCH BACKFILL (PAVED AREAS)	Compact full depth to 100%
TRENCH BACKFILL (UNPAVED AREAS)	Compact full depth to 95%
ALL OTHER BACKFILL	Compact full depth to 95%

F. The above compaction requirements are to be satisfied for all soil and weathered or soft rock fills. Weathered or soft rocks are those that can be broken down and disintegrated under normal compaction procedures and equipment.

G. At the close of each day's work, or where work is to be interrupted for a period of time, the surface of the site shall be shaped to drain freely, and sealed. If after a prolonged rainfall, the surface of the area to be filled or cut is too wet to work properly, the unsuitable material shall be removed to expose workable soil. The wet material removed may be dried and reused. Construction traffic shall be controlled so as to prevent rutting of graded areas and to avoid over-rolling of any section.

H. All cut areas shall be rolled and compacted to produce a compaction equal to that of the filled area. If soft or yielding material is encountered in cuts, or fills as a result of trapping water, over-rolling or improper control of construction traffic, and cannot be satisfactorily stabilized by moisture control, compaction or other means approved by the Engineer, the unstable material shall be excavated to the depth required by the Engineer. The excavation shall then be filled with suitable compacted material in accordance with the requirements outlined above.

3.17 GRADING

A. Elevations shown on the plans are finished ground unless otherwise noted. Grading shall be maintained in such a manner as to provide free surface drainage away from structures and throughout the site at all times without any ponding of water.

B. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

C. Provide ditches and swales to the cross sections and grades shown on the drawings. Cut ditch subgrades 4 inches below the grades shown and provide 4 inches of topsoil where the plans call for seeding or sodding of the ditch. Keep ditches and swales free of accumulations of debris or washed in material until final acceptance of work by the Engineer.

D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

E. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage

backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.19 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape base course to required crown elevations and cross-slope grades.
4. Place base course 6 inches or less in compacted thickness in a single layer.
5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

A. The services of qualified soils testing personnel may be engaged by the Owner for the making of tests to determine the moisture-density relationships, relative densities, plastic and liquid limits and suitability of materials for compaction and for inspection and control of the site preparation, selection, placing and compaction of the fill. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. A copy of the testing personnel's daily field report including results of in-place density and moisture content tests should be forwarded to the Owner and the Engineer at the end of each working day.

B. The Contractor shall cooperate fully with the testing personnel so as to permit proper inspection and control of the work without unnecessary delays.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

A. Do not operate tractors, bulldozers or other power operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.

B. Restore all surfaces, including lawns, grassed, and planted areas that have been injured by the Contractor’s operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. During construction and until final acceptance, the Contractor shall construct temporary or permanent earth berms along the outer edges of the top surface of the embankment, construct temporary ditches, shape the embankment surface to provide for the drainage of surface runoff along and throughout the length of the embankments, and use any other methods necessary to maintain the work covered by this section so that the work will not contribute to excessive soil erosion. The Contractor shall construct brush dikes, or install temporary or permanent slope drains or other drainage features to assist in controlling erosion.

E. Slides and overbreaks which occur prior to final acceptance of the project due to natural causes shall be removed and disposed of by the Contractor as directed by the Engineer.

F. Where slides or overbreaks occur due to negligence or carelessness on the part of the Contractor, the Contractor shall remove and dispose of the material at no cost to the Owner.

G. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

H. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

I. All embankments shall be brought to the grade and cross section shown on the plans or established by the Engineer, prior to final inspection and acceptance by the Engineer.

3.23 MAINTENANCE

A. The Contractor shall be responsible during construction and until final acceptance for the maintenance of all embankments, ground covers and other surfaces made under the Contract.

B. The Contractor shall protect and maintain erosion and sedimentation controls during earth moving operations and shall remove said measures upon completion of earth moving operations and the satisfactory establishment of permanent or temporary ground covers.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property unless otherwise required by the plans or special provisions or unless disposal within the project area is permitted by the Engineer.

B. Concrete that is painted must be disposed of in accordance with requirements and regulations of the North Carolina Department of Environment and Natural Resources (NCDENR) Solid Waste Section. Prior to disposal of painted concrete, the Contractor shall submit a written certification to NCDENR that the paint on the concrete is not lead-based. Certification that paint on concrete is not lead-based paint is required prior to management as inert debris. Lead-based paint is defined by federal statute (Title X of the Housing and Community Development Act and the Toxic Substances Control Act, by reference). Concrete that is painted with lead-based paint, or paint that has not been certified to the satisfaction of the NCDENR Solid Waste Section to be below the federal standard to be considered lead-based paint, must be disposed of at a properly permitted construction and demolition landfill or a permitted municipal solid waste landfill.

C. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

D. The Contractor shall maintain the earth surfaces of all waste areas, both during the work and until the completion of all seeding and mulching or other erosion control measures specified, in a manner which will effectively control erosion and siltation.

E. The following requirements shall also be applicable to all waste or disposal areas other than active public waste or disposal areas:

1. Rock waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practical, and shall be covered with a minimum 6 inch thick layer of earth material either from the project waste or from borrow.
2. Earth waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practicable, but in no case will slopes steeper than 2:1 be permitted.
3. Construction debris, grubbed debris and all broken pavement and masonry shall be covered with a minimum 6-inch thick layer of earth waste material from the project or borrow. The completed waste area shall be shaped as required above for disposal of earth waste.
4. Seeding and mulching shall be performed over all earth or earth covered waste areas. The work of seeding and mulching shall be performed in accordance with other sections of these Contract Documents.
5. Where the Engineer has granted permission to dispose of waste and debris within the project, the Engineer will have the authority to establish whatever additional requirements may be necessary to insure the satisfactory appearance of the completed project.

END OF SECTION 312000

SECTION 312001 - FINISH GRADING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Finished Grading, including surface drainage swales as shown in the Contract Drawings, and as specified herein this Section.

B. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 015639 – Temporary Tree and Plant Protection
   2. Section 312000 – Earth Moving
   3. Section 329219 – Seeding and Mulching
   4. Section 329300 – Exterior Plants.
   5. Section 329301 – Landscape Planting Accessories.

1.3 SITE CONDITIONS

A. Existing Conditions: For protection of existing trees to remain, refer to Section 015639 “Temporary Tree and Plant Protection”.

B. Upon award of contract, Contractor is to review and verify conditions received and report immediately any discrepancies to the Owner in writing.

C. Dust Nuisance: Contractor shall assume full responsibility for alleviation or prevention of dust as a result of Work under this Section.

D. Excessive rock, dead or declining vegetation, trash, debris, or other items that has accumulated shall be removed from the Project Site by the Contractor, and as directed by the Owner or Landscape Architect, prior to completion of Finish Grading operations.

E. Work under this Section shall be performed only during the period when beneficial and optimum Finish Grading results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure or cause compaction, Finish Grading operations shall be suspended until the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.
   1. Soil moisture level prior to Finish Grading shall be no less than 75% of field capacity.

1.4 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications for all items indicated herein this Section:
   1. Licensed General or Landscape Contractor, in the State of North Carolina.

a). Engage an experienced, licensed Contractor who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
b). Installer's Field Supervision: Contractor shall maintain an experienced, full-time landscape supervisor/superintendent at the Project Site during times that landscaping operations identified herein the Contract are in progress.

1.5 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Complete Finish Grading prior to installation of Turf and Plants in each area graded.

B. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to adequate Finish Grading operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Owner or Landscape Architect for further direction.

D. Perform Finish Grading operations only when weather and soil conditions are suitable in accordance with locally accepted practices.

E. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that the following items have been completed prior to commencement of Finish Grading:
1. Installation of (stockpiled) topsoil and soil preparation, including debris removal.
2. Incorporation of soil amendments.

3.2 INSTALLATION

A. Finish Grading:
1. Provide Finish Grades for natural runoff of water without low spots or pockets. Accurately set flow line grades at a two-percent (2%) minimum gradient, unless otherwise noted in the Contract Drawings.
2. Finish Grades shall be smooth, even, and on a uniform plane with no abrupt changes, pits, or undulations of the surface. Slope grades uniformly between given spot elevations.
3. Finish Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or inlets.

4. Tops and toes of slopes shall be gently rounded or feathered to produce a gradual and natural-appearing transition between relatively level areas and slopes.
5. Minor adjustments to drainage swales, berms, edge conditions, slopes etc. of less than +/- 0.02' shall be made at the direction of the Landscape Architect to bring the finish grades into compliance with the design intent.

B. Tolerances:
1. Planting areas, including areas planted with turf grasses, shall have an established finish grade true to adjacent paving.
2. Hold Finish Grades in landscape planting areas below top of adjacent pavement, headers, curbs, or walls, as follows:
   a). Shrub, Vines and Groundcover Areas: Three inches (3").

END OF SECTION 312001

SECTION 312230 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work covered by this section consists of the construction of a base composed of an approved aggregate material hauled to the site, placed on the site, compacted, and shaped to conform to the lines, grades, depths, and typical sections shown on the plans or established by the Engineer.

B. Related Sections:

1. Division 31 Section “Earth Moving”.
2. Division 32 Section “Bituminous Paving”.
3. Division 33 Section “Water Valves and Appurtenances”.
4. Division 33 Section “Sanitary Sewer Pipe and Appurtenances”.
5. Division 33 Section “Drainage Materials”.

1.3 PERFORMANCE REQUIREMENTS

A. The work under this section consists of furnishing all materials, labor, equipment, incidentals and services required for the complete installation of aggregate base course materials in the locations shown on the drawings and as specified herein.

B. All work in connection with installing aggregate base course materials shall comply with all current requirements of authorities having jurisdiction. The Contractor is responsible for being familiar with and adhering to these requirements.

C. The Contractor shall inspect the locations of the proposed work associated with this Section and shall familiarize themselves with the conditions under which the work will be performed, and with all necessary details and the suitability of their equipment and methods for the work required. The omission of any installation details which may not appear within the Contract Documents shall not relieve the Contractor of full responsibility for completing the work as necessary.

D. Construction shall be done in such a manner that will not interfere with the operation of any street, highway, railway, or other facility nor weaken or damage any embankment or structure. Barricades and lights shall be furnished and maintained to safeguard traffic and pedestrians as required by authorities having jurisdiction until such time as the operation has been completed.

1.4 SUBMITTALS

A. Product Data and certificates: For all aggregate base course materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall utilize methods of handling, hauling, and placing which will minimize segregation and contamination of the aggregate used for the base course. If segregation occurs, the Engineer may require that changes be made in the Contractor's methods and may also require remixing of the aggregate to achieve the proper mixture. No additional compensation will be made for remixing, additional equipment, or other measures necessary to provide the coarse aggregate base course specified. Aggregate which becomes contaminated with foreign materials to the extent that the base course will not serve its intended use shall be removed and replaced by the Contractor at no additional expense to the Owner. The above requirements will be applicable regardless of the type of aggregate placed and regardless of prior acceptance.

1.6 COORDINATION

A. For all work within the Department of Transportation right-of-way, the Contractor shall notify the appropriate office of the Department of Transportation at least 72 hours prior to beginning construction.

1.7 WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and materials for one (1) year following final acceptance by the Owner.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Aggregate base course materials shall consist of crushed stone or uncrushed gravel, or other similar material having hard, strong, durable particles free of adherent coatings meeting the requirements of the NCDOT Standard Specifications for Roads and Structures, latest edition for the project-specific use of the aggregate.

B. The Contractor shall furnish aggregate base course material produced in accordance with the requirements indicated herein for Type A, aggregate unless otherwise specified in the special provisions.

C. All aggregates shall be from approved sources. Sources will not be approved unless the material has satisfactory soundness and satisfactory resistance to abrasion. Satisfactory soundness will be considered to be a weighted average loss of not greater than 15 percent when subjected to five (5) alternations of the sodium sulfate soundness test in accordance with AASHTO T104. Satisfactory resistance to abrasion will be considered to be a percentage of wear of not greater than 55 percent when tested in accordance with AASHTO T96.

D. Aggregates shall be handled in such a manner as to minimize segregation

E. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the ground surface shall be firm, smooth, and well drained. A cover of at least 3" of aggregate shall be maintained over the ground surface in order to avoid the inclusion of soil or foreign material. Stockpiles shall be built in such a manner as to minimize segregation. When it is necessary to operate trucks or other equipment on a stockpile in the process of building the stockpile, it shall be done in a manner approved by the Engineer.

F. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart, or else separated by suitable walls or partitions, to prevent the mixing of the aggregates.

G. Any method of stockpiling aggregates which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has been operated, and failure of such samples to meet all grading requirements for the aggregate will be considered cause for discontinuance of such stockpiling procedure.

H. Gradation: All standard sizes of aggregates shall meet the gradation requirements when tested in accordance with AASHTO T27.

2.2 WATER

A. Water, if used in construction, shall be potable water, free from oil and other deleterious matter.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. The subgrade shall be dry and cleaned of all foreign substances prior to constructing the base course.

B. The surface of the subgrade shall be prepared as specified in Section 312000 "Earth Moving" based on the specified use of the aggregate base course.

3.2 PLACEMENT OF STONE BASE

A. The aggregate material shall be spread on the subgrade to a uniform loose depth and without segregation.

B. Where the required compacted thickness of base is 10 inches or less the base material may be spread and compacted in one layer. Where the required compacted thickness of base is more than 10 inches, the base material shall be spread and compacted in two (2) or more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4 inches.

C. Each layer of material shall have been sampled, tested, compacted, and approved prior to placing succeeding layers of base material or pavement. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. The minimum compaction for each layer shall be 100% standard proctor.

D. No base material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment.

E. The maximum speed of trucks hauling or traveling over any part of the subgrade or base shall be five (5) miles per hour.

3.3 QUALITY CONTROL

A. Weather and Temperature Limitations:

1. Coarse aggregate base course shall not be placed during rainy weather or on wet or frozen subgrade.
2. Stabilized aggregate base courses shall not be constructed when the atmospheric temperature is below thirty-five (35) degrees F. when measured in the shade away from artificial heat.
3. Any areas of completed base course that are damaged by elements such as rain, sleet, snow, hail, or freeze/thaw conditions shall be reconditioned, reshaped, and compacted in accordance with the Drawings and these Specifications.

B. Tolerances:

1. After final shaping and compacting the base, the Engineer will check the surface of the base for conformance to grade and typical section and will determine the base thickness.
2. The thickness of the base shall be within a tolerance of ±1/2-inch of the base thickness required by the plans.

C. Maintenance:

1. Where the base material is placed in a trench section, the Contractor shall provide adequate drainage through the shoulders to protect the subgrade and base until such time as shoulders are completed.

2. The Contractor shall maintain the surface of the base by watering, machining, and rolling or dragging when necessary to prevent damage to the base by weather or traffic.

1. Where the base or subgrade is damaged, repair the damaged area; reshape the base to required lines, grades and typical sections; and recompact the base to the required density at no cost to the Owner.

END OF SECTION 312230

SECTION 31 23 00 EXCAVATING, BACKFILL, AND COMPACTING FOR UTILITIES & STRUCTURES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, material, equipment, and supplies, and shall perform all earthwork for installation of utilities including excavation and backfill, pavement removal, sheathing, bracing, shoring, pumping or bailing, dewatering, restoration and cleanup; all as indicated, specified and/or necessary to complete the work.

B. Any reference to NCDOT standard specifications was obtained from "Standard Specifications for Roads and Surfaces" published by the North Carolina Department of Transportation dated February 10, 2006. Unless otherwise noted, the most current date published applies.\

C. Excavation for this project will be Classified excavation. Any earthwork that does not conform to earth excavation as defined in the 31 23 00- Grading specification shall be paid for per unit prices established in section 01 22 00 of the specifications.

C. Related Work: Reference the following specifications for related work:

31 32 00	Site Stabilization
32 01 00	Restoration of Surfaces

PART 2: PRODUCTS

2.01 MATERIALS

A. Fill Material shall be classified as ML-low plasticity silt or better by the Unified Soil Classification System and tabulated below:

	UNIFIED CLASS	DESCRIPTION
CLASS I	GW	¼”- 1 ½” well graded stone including coral, slag, cinders, crushed stone & shell
CLASS II	GP	Coarse gravel, poorly graded
	SW	Coarse sands, well graded
	SP	Coarse sands, poorly graded
CLASS III	GM	Silt-y, sandy gravel
	GC	Clay-y, sandy gravel
	SM	Silt-y sands
	SC	Clay-y sands
CLASS IV	ML	Inorganic silts and fine sands

B. Backfill material shall exhibit a plasticity index of less than 20, and Standard Proctor maximum density at optimum moisture greater than 90 pounds per cubic foot.

C. The following materials are unacceptable:

	UNIFIED CLASS	DESCRIPTION
CLASS IV	CL	Inorganic clays- low plasticity
	MH	Inorganic elastic silts
	CH	Inorganic clays- high plasticity
CLASS V	OL	Organic silts
	OH	Organic clays
	PT	Highly organic soil

D. Washed Stone: Stone material where indicated shall be crushed stone or gravel of strong, durable nature and shall conform to standard size No. 57 per NCDOT Section 1000.

E. Concrete: Minimum 28-day compressive strength of 3000 psi.

PART 3: EXECUTION

3.01 EXISTING FACILITIES

A. Existing Utilities Shown on the Drawings: It shall be the Contractor's responsibility to conduct the work in such a manner as to avoid damage to or interference with any utilities services shown on the drawings. If such damage, interference, or interruption of service shall occur as a result of his work, then it

shall be the Contractor's responsibility to promptly notify the Engineer of the occurrence and to repair or correct it immediately, at his own expense, and to the satisfaction of the Engineer and the Owner of the Utility.

B. Existing Utilities Not Shown on the Drawings: It shall be the Contractor's responsibility to exercise all reasonable precaution in the performance of the work to avoid damage to or interference with any utilities services, even though not shown on the drawings. If such damage, interference, or interruption of service shall occur as the result of this work, then the Contractor's responsibility will be the same as stipulated in Paragraph 3.1.A above.

3.02 EXISTING STREAMS

Exercise reasonable precaution to prevent the silting of streams. Provide at Contractor's expense temporary erosion and sediment control measures to prevent the silting of streams and existing drainage facilities. The Contractor shall size structures and conform fully with the North Carolina Sedimentation Pollution Control Act.

3.03 CLASSIFIED EXCAVATION AND BACKFILL – GENERAL REQUIREMENTS

A. Pavement, gutters, sidewalks, aprons and curbs which will be disturbed by excavation shall be removed and disposed of as a part of ordinary excavation. That which is to be removed shall be cut or sawn along clean straight lines from that which is to remain. Remove enough such that a minimum of twelve inches of undisturbed earth remain between the excavation and that which is to remain.

B. Where required, and as approved by the Engineer, sheeting and bracing shall be used to prevent injury to persons, caving of trench walls and to conform with all governing laws and ordinances. Sheeting and bracing shall be left in place until the trench is refilled to a safe limit. The top portion may then be removed, but the lower portion shall remain undisturbed.

C. It is the responsibility of the Contractor to provide an adequate dewatering system where required. The system shall be capable of removing any water that accumulates in the excavation and maintaining the excavation in a dry condition while construction is in progress. The surface of the ground shall be sloped away from the excavation or piping provided to prevent surface water from entering the excavation. Disposal of water resulting from the dewatering operation shall be done in a manner that does not interfere with normal drainage, and does not cause damage to any portion of the work or adjacent property. All drains, culverts, storm sewers and inlets subject to the dewatering operation shall be kept clean and open for normal surface drainage. The dewatering system shall be maintained until backfilling is completed or as otherwise directed by the Engineer. All

damage resulting from the dewatering operation shall be repaired by the Contractor to the satisfaction of the Engineer and at no cost to the Owner.

D. The Contractor shall erect, maintain, and safeguard temporary bridges, walkways, or crossings where it is necessary to maintain traffic. Where trenches are open in the vicinity of pedestrian or vehicular travel lanes, suitable carriers will be constructed and maintained and the work will be further protected from sunset to sunrise with a sufficient number of lights or flares to fully protect the public from accidents on account of construction. The Contractor shall maintain at a minimum a single lane of traffic during all construction activities at all times. The Contractor shall provide flaggers as necessary to safely direct and accommodate traffic during construction.

E. If the specified depth for foundations proves insufficient to reach firm ground, the Engineer shall be notified and will furnish instructions for proceeding with the work.

F. Rock, wherever used as a name for excavation material, shall refer to any naturally occurring material that cannot be removed with a Caterpillar D-9 or equal, equipped with a properly fitted single tooth ripper, or removed by a Caterpillar 225 backhoe or equal, equipped with rock teeth that requires for its removal drilling and blasting, or wedging or sledging and barring. Where rock excavation is necessary, the Contractor shall excavate the same as near the neat lines of the trench as practicable and he shall take all due precautions in the pursuance of the work. He will be held strictly responsible for all injury to life and to public and private property.

1. Rock shall be removed from the excavation to the following limits:

    a. Trenches: The diameter of the pipe plus 8 inches on each side, extending 6 inches below the pipe wall and bell.

    b. Structures: 12 inches beyond the vertical plane of the structure on all sides and on the bottom only to the depth necessary for proper installation.

G. Blasting: Prior to commencing any blasting operations the Contractor shall notify the Engineer and either the Local Fire Department - Fire Prevention Section or the County Fire Administrator (as applicable) and obtain blasting permits as required. The Contractor must furnish proof (certification) of insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

All blasting operations shall be conducted in strict accordance with any and all decrees, rules, regulations, ordinances, laws as may be imposed by any regulatory body and/or agency having jurisdiction over the work relative to handling, transporting, use and storage of explosives. Blasting shall be done only by competent, and experienced men whose activities shall be conducted in a workmanlike manner. Satisfactory information must be provided to the Engineer, that the blaster meets or exceeds the qualifications enumerated in OSHA Regulations Part 1926, Subpart U, Section 1926.901 - Blaster Qualifications.

The Contractor shall protect all structures from the effects of the blast and repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

1. Overburden: Undisturbed overburden may be deemed adequate in lieu of matting but only after the actual depth of the undisturbed overburden has been determined and adjudged sufficient by the Engineer. Under no circumstances will loose or fill overburden be adequate without the use of weighted mats.

2. Permission to Blast: The Contractor shall not be allowed to blast before 9 a.m. or after 3 p.m. without approval of the Engineer and Owner. Blasting will not occur within any rights-of-way maintained by any agency (D.O.T., R.R., Gas, Owner, etc.) without specific approval of the controlling agency and only in accordance with their respective requirements (as exceeded herein). The Contractor shall be held responsible for any and all injury to persons or damage to public or private property.

3. The Contractor shall not use excavated rock as backfill material. Dispose of rock which is surplus or not suitable for use as rip rap.

4. Monitoring: The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set. Following review by the Engineer regarding the proximity of permanent structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.04 TRENCH EXCAVATION AND BACKFILL

A. TRENCH EXCAVATION

1. General: Perform all excavation of every description and of whatever substance encountered so that the pipe can be laid to the alignment and depth shown on the Drawings.

2. Brace and shore all trenches, where required, in accordance with the rules and regulations, promulgated by the Department of Labor, Occupation Safety and Health Administration, "Safety and Health Regulations for Construction".

3. Make all excavations by open cut unless otherwise specified or indicated on the Drawings.

4. Width of Trenches: Excavate trenches sufficiently wide to allow proper installation of pipe, fittings and other materials and not more than 18" clear of pipe on either side at any point. Do not widen trenches by scraping or loosening materials from the sides.

5. Trench Excavation in Earth: Earth excavation includes all excavation of whatever substance encountered. In locations where pipe is to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.

6. Trench Excavation in Fill: If pipe is to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.

7. Trench Bottom in Poor Soil: Excavate and remove unstable or unsuitable soil to a width and depth, as directed by the Engineer, and refill with a thoroughly compacted gravel bedding.

8. Bell Holes: Provide bell holes at each joint to permit the joint to be made properly and to provide a continuous bearing and support for the pipe.

B. TRENCH BACKFILL

1. General: Unless otherwise specified or indicated on the Drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill on frozen material. Remove previously frozen material before new backfill is placed. Start backfilling as soon as practicable after the pipes have been laid, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, and proceed until its completion.

2. With the exception mentioned below in this paragraph, do not backfill trenches at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights, and barricades, and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

3. Material: The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. Both are subject to the approval of the Engineer. Do not place stone or rock fragments larger than 4" in greatest dimension in the backfill. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than 5 feet. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.

4. Zone Around Pipe: Place bedding material to the level shown on the Drawings and work material carefully around the pipe to ensure that all voids are filled, particularly in bell holes. For backfill up to a level of 2 feet over the top of the pipe, use only selected materials containing no rock, clods or organic materials. Place the backfill and compact thoroughly under the pipe haunches and up to the mid-line of the pipe in layers not exceeding 6" in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot above the pipe in layers not exceeding 6" and compact to a maximum density of at least 100 % as determined by ASTM D0698.

5. Tamping: Deposit and spread backfill materials in uniform, parallel layers not exceeding 12" thick before compaction. Tamp each layer before the next layer is placed to obtain a thoroughly compacted mass. Furnish and use, if necessary, an adequate number of power driven tampers, each weighing at least 20 pounds for this purpose. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similarly powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

6. Wet the material by sprinkling, if necessary, to insure proper compaction by tamping (or rolling). Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.

7. Trench Compaction: Compact backfill in pipe trenches that is under pavement to the maximum density of soil material compacted at optimum moisture content to 95% and with the last 2' being 98%. Compact backfill in pipe trenches that is not under pavement to the maximum density of soil material compacted at optimum moisture content to 95%.

3.05 STRUCTURE EXCAVATION AND BACKFILL

A. STRUCTURE EXCAVATION

1. Structure Excavation shall be made at the locations shown on the plans and to the exact subgrade required. Bottom of excavations shall be level and in firm, solid material, with soft material or voids treated as specified. Excavated areas shall be kept free of water during the construction period. Where earth will stand, footing trenches may be cut to the exact size of the footings; otherwise, forms shall be used. Where necessary, sides of excavations shall be shored and sheathed, or cofferdams built, as required for protection of the work and personnel.

2. Wherever excavation for a foundation extends below the water table or where specifically indicated on the plans, washed stone shall be placed to a minimum thickness of 12 inches, unless otherwise shown or as directed by the Engineer, prior to placing the foundation. The washed stone shall be

compacted to 90% of maximum as determined by the Standard Proctor test (ASTM D698).

3. If the specified depth for foundations proves insufficient to reach firm ground, the Engineer shall be notified for furnishing instructions and proceeding with the work.

B. STRUCTURE BACKFILL

1. Structure Backfill shall be done with material free from large clods, frozen earth, organic material or any foreign matter, and shall evenly and carefully be placed and tamped in horizontal layers. Compaction equipment specifically designed for these purposes must be present and operational at the job site and shall be utilized throughout to obtain uniform compaction. The degree of compaction and the density shall be determined by the Standard Proctor Test (ASTM D698), with compaction requirements as follows:

Percent of Maximum Density at Optimum Moisture	Location
98	Top 24" of fill beneath pavement and structures.
95	24” or deeper beneath all roads and driveways, full depth under sidewalks and undercut backfill for structure excavation.

2. No backfill shall be placed against a structural wall until all connecting structural members are in place. It shall be the Contractor's responsibility to provide compaction to such a degree that subsidence after placing shall not be detrimental to the stability or appearance of the structure, adjacent ground, or paved areas. The Contractor shall provide adequate protection to all structures during backfilling and shall use every precaution to avoid damaging or defacing them in any way. Contractor shall be responsible for the protection of all structures from damage or flotation prior to backfill being placed.

3. Unless otherwise approved by the Engineer, liquid-retaining structures shall not be backfilled until tested for leakage.

3.06 UNSTABLE SUBGRADE

Should unstable soil, organic soil, or soil types classified as fine-grained soils (silts and clays) by ASTM D-2487 be encountered in the bottom of pipe trenches or structure excavations, such soils shall be removed to a depth and width determined by the Engineer, properly disposed of and shall be backfilled with crushed stone conforming to the Department of Transportation Specifications, Size 57. Placement shall not exceed 12-inches loose and compacted to 90% of the dry density determined by the Standard Proctor test ASTM D698 (Concrete may be substituted in place of #57 stone at the Contractor's option. A 24-hour cure must be given before proceeding with the work).

3.07 COMPACTION

Compaction: Unless otherwise noted, each layer of fill and backfill and the top 12 inches of existing subgrade material in cuts shall be compacted by approved equipment as specified below. Maximum lift thickness shall be 8" of loose material prior to compaction efforts. The degree of compaction and the density shall be determined by the Standard Proctor Test (ASTM D698).

	Percent of Max. Dry Density at Optimum Moisture Content
Top 24 inches of fill under pavement or structures	98%
24" and deeper under roads and structures	95%
Fill and backfill in other areas	95%

Material too dry for proper compaction shall be moistened by suitable watering devices, turned and harrowed to distribute moisture, and then properly compacted. When material is too wet for proper compaction, operations shall cease until such material has sufficiently dried.

3.07 COMPACTION TESTING

The Owner, or its authorized representatives, reserve the right to perform compaction tests on any or all portion(s) of backfill placed at no cost to the Contractor. However, in the event the compaction of this backfill is not in compliance with the specification, then the Contractor shall take corrective measures at no cost to the Owner to bring the backfill within the limits of the specifications. The Contractor shall then be responsible for reimbursing the Owner all costs associated with the performance of compaction test(s) in those sections of the backfill that failed the initial compaction test(s). Minimum testing shall be:

1. Every 300 lf/lift in paved areas for linear utilities in paved areas.
2. Every 500 lf/lift in non-paved areas.
3. Other areas, such as adjacent to structures, 1 test/40 cubic yards of material.

In the event that the soil compaction is not in compliance with these specifications, then the Contractor shall take corrective action, at no cost to the Owner, to compact the soils within the limits of the specifications. The Engineer shall be notified within 24 hours of any failing compaction tests. Any retesting of failed areas shall be performed only after corrective measures have been made by the Contractor to bring the compacted soils into compliance. All retesting shall be performed with the Engineer present.

END OF SECTION

SECTION 31 25 00 EROSION AND SEDIMENT CONTROL

1. DESCRIPTION:

1.1 Erosion and sedimentation control shall be provided by the Contractor for all areas of the site denuded or otherwise disturbed during construction. The Contractor shall be responsible for all installation, materials, labor, and maintenance of erosion and sediment control devices, as well as removal of temporary erosion and sediment control devices shown on the plans or required to protect all downstream properties, natural waterways, streams, lakes, ponds, catch basins, drainage ditches, roads, gutters, natural buffer zones, and man-made structures.

1.2 Erosion and sediment control procedures and facilities shall conform to the "Erosion and Sediment Control Planning and Design Manual" as published by the North Carolina Sedimentation Control Commission, Sections 107 and 225 of the "Standard Specifications for Roads and Structures" dated January 1, 1990, as published by the North Carolina Department of Transportation and to all applicable local codes or ordinances, whichever is more stringent.

1.3 Related Work: See the following sections for related work.

1. 31 32 00 Site Stabilization

2. MATERIALS:

2.1 Washed stone to be used in temporary sediment basins shall be of strong, durable nature, resistant to weathering and shall be graded to conform to Standard Size Number 57 per Section l000 of the "Standard Specifications for Road and Structures" dated January 1, 1990, as published by the North Carolina Department of Transportation.

2.2 Refer to other sections within these specifications as listed in Item l.3 above for other material specification required in the installation of erosion and sediment control facilities.

3. INSTALLATION:

3.1 General Requirements:

3.1.1 The Contractor shall follow the erosion control construction sequence schedule as shown on the contract drawings, except that should circumstances dictate that extra precaution be taken to prohibit erosion and sedimentation on the project, the Contractor will, at his own expense, take preventative measures as needed.

3.1.2 The Contractor is required to maintain all erosion and sediment control facilities to insure proper performance throughout the construction phase and until such time all disturbed areas are permanently stabilized.

3.1.3 Upon completion of construction or successful permanent stabilization of all areas which were disturbed before or during construction operations or as indicated on the construction drawings, whichever occurs last, the Contractor shall remove all temporary erosion and sediment control devices and facilities from the project site. The Contractor shall retain these items for future use or properly dispose of these items offsite.

3.1.4 The Contractor shall provide temporary or permanent ground cover as called for on the construction plans.

END OF SECTION

SECTION 31 25 13 TEMPORARY SILT FENCE

1. **DESCRIPTION**:

1.1 The work covered by this Section consists of the furnishing, installing, maintaining, replacing as needed, and removing of temporary silt fence. The Contractor shall furnish all equipment, tools, labor and materials necessary to complete the work in accordance with the plans and specifications. All materials and procedures shall conform to Section 893 of the "Standard Specifications for Roads and Structures", dated January l, l990, published by the North Carolina Department of Transportation, Section 6.62 of the "Erosion and Sediment Control Planning and Design Manual", published by the North Carolina Sediment Control Commission and all local codes and ordinances, whichever is more stringent.

2. **MATERIALS**:

2.1 General Requirements:

2.1.1 Temporary silt fence shall be a water permeable filter type fence for the purposes of removing suspended particles from the water passing through it.

2.2 Posts:

2.2.1 Either wood posts or steel posts may be used. Wood posts shall be a minimum of 6 feet long, at least 3 inches in diameter, and straight enough to provide a fence without noticeable misalignment. Steel posts shall be at least 5 feet in length, approximately 1-3/8 inches wide measured parallel to the fence, and have a minimum weight of 1.25 lb/ft of length. The post shall be equipped with an anchor plate having a minimum area of l4.0 square inches, and shall have a means of retaining wire and fabric in the desired position without displacement.

2.3 Woven Wire Fence:

2.3.1 Wire fence fabric shall be at least 32 inches high, and shall have at least 6 horizontal wires. Vertical wires shall be spaced l2 inches apart. The top and bottom wires shall be at least l0 gage. All other wires shall be at least l2-l/2 gage.

2.4 Silt Fence Filter Fabric:

2.4.1 Filter fabric shall meet the requirements of Type 3 Engineering Fabric, Class A or B, per Section 1056 of the "Standard Specifications for Roads and Structures" dated January 1, 1990, published by the North Carolina Department of Transportation. Silt fence which incorporates filter fabric meeting the requirements of Section 1056 but which fails to

perform in an acceptable manner shall be replaced with silt fence which is capable of acceptable performance. Silt fence should also meet the requirements of the "NCDENR Erosion Control Planning and Design Manual", latest revision.

2.5 Wire Staples:

2.5.1 Wire staples shall be a No. 9 staple and shall be at least 1½ inches long.

3. **Installation**:

3.1 General Requirements:

3.1.1 The Contractor shall install temporary silt fence as shown on the plans. The silt fence shall be constructed at the locations shown on the plans and at all other locations necessary to prevent sediment transport, as directed by the Engineer.

3.1.2 Class A synthetic filter fabric may be used only in conjunction with woven wire fence fabric backing. Filter fabric shall be attached to the wire fence fabric by wire or other acceptable means.

3.1.3 Class B synthetic filter fabric may be used without the woven wire fence fabric backing, subject to the following conditions:

3.1.4 Post spacing is reduced to a maximum of 6 feet.

3.1.5 The proposed fabric has been approved by the Engineer as being suitable for use without the woven wire fence fabric backing.

3.1.6 Fence posts shall be inclined toward the runoff source at an angle of not more than 20^{o} from vertical.

3.1.7 Posts shall be installed so that no more than 3 feet of the post shall protrude above the ground. Where possible, the filter fabric from a continuous roll cut to the length of the barrier shall be used to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with overlap to the next post. At the time of installation, the fabric will be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

3.2 Maintenance and Removal:

3.2.1 The Contractor shall inspect temporary silt fences at least once a week and after each rainfall and shall make any required repairs and remove and dispose of silt accumulation

immediately. Should the fabric of the silt fence collapse, tear, decompose or become ineffective, the Contractor will replace it promptly at his own expense.

The Contractor shall remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence.

3.2.2 The Contractor shall remove all temporary silt fence and associated appurtenances once all disturbed areas upland of the fence are properly and satisfactorily stabilized as called for on the plans.

END OF SECTION

SECTION 31 32 00 SITE STABILIZATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment and materials necessary for the establishment of vegetation of all areas of the site disturbed by construction operations and all earth surfaces of embankments including rough and fine grading, topsoil if required, fertilizer, lime, seeding and mulching. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses and legumes.

PART 2: PRODUCTS

2.01 MATERIALS

A. FERTILIZER

1. The quality of fertilizer and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Fertilizer Law and regulations adopted by the North Carolina Board of Agriculture.

2. Fertilizer shall be 10-10-10 grade. Upon written approval of the Engineer a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

3. During handling and storing, the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original conditions before being used.

B. LIME

1. The quality of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and regulations adopted by the North Carolina Board of Agriculture.

2. During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original conditions before being used.

3. Lime shall be agriculture grade ground dolomitic limestone. It shall contain not less than 85% of the calcium and magnesium carbonates and shall be of such fineness that at least 90% will pass a No. 10 sieve and at least 50% will pass a No. 100 sieve.

C. SEED

1. The quality of seed and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Seed Law and regulations adopted by the North Carolina Board of Agriculture. Seed shall have been approved by the North Carolina Department of Agriculture or any agency approved by the Engineer before being sown, and no seed will be accepted with a date of test more than 9 months prior to the date of sowing. Such testing however, will not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the Engineer, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

2. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents or other causes.

3. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindweed, Quackgrass, Dodders, Dock, Horsenettle, Bracted Plantain, Buckhorn or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed 27 seeds of each per pound. No tolerance on weed seed will be allowed.

D. MULCH

Straw Mulch shall be threshed straw of oats, rye or wheat free from matured seed of obnoxious weeds or other species which would grow and be detrimental to the specified grass.

E. TACKIFIER

Emulsified asphalt or organic tackifier such as Reclamare R2400 shall be sprayed uniformly on mulch as it is ejected from blower or immediately thereafter. Tackifier shall be applied evenly over area creating uniform appearance. Rates of application will vary with conditions. Asphalt shall not be used in freezing weather.

PART 3: EXECUTION

3.01 PREPARATION

A. PROTECTION OF EXISTING TREES AND VEGETATION

1. Protect existing trees and other vegetation indicated to remain in place against 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 wood or metal stakes set on 8 to 10 foot centers and connected at a 4'-0" height by 2" minimum brightly colored flagging tape to protect trees and vegetation to remain. Set perimeter of protection at the drip line of trees to remain unless approved otherwise by the Engineer.

2. Provide protection for roots over 1-1/2" diameter cut during construction operations. Cleanly cut off end of damaged root and coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

3. The Contractor shall not remove or damage trees and shrubs which are outside the Clearing Limits established by the Owner or those within the Clearing Limits designated to remain.

4. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the Engineer. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

5. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the Engineer with trees of similar size and species. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at the Contractor's expense.

B. GRADING

1. Rough grading shall be done as soon as all excavation required in the area has been backfilled. The necessary earthwork shall be accomplished to bring the existing ground to the desired finish elevations as shown on the Contract Drawings or otherwise directed.

2. Fine grading shall consist of shaping the final contours for drainage and removing all large rock, clumps of earth, roots and waste construction material. It shall also include thorough loosening of the soil to a depth of 6" by plowing, discing, harrowing or other approved methods until the area is acceptable as suitable for subsequent landscaping operations. The work of establishing vegetation shall be performed on a section by section basis immediately upon completion of earthwork or pipeline installation.

3. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the Engineer may suspend the Contractor's grading operations until such time as the work is coordinated in a manner acceptable to the Engineer.

C. SEEDBED PREPARATION

1. The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas outside the graded section, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities which cannot be obliterated by normal seedbed preparation operations, shall be shaped and smoothed as directed by the Engineer to provide for more effective seeding and for ease of subsequent mowing operations.

2. The soil shall then be scarified or otherwise loosened to a depth of not less than 6" except as otherwise provided below or otherwise directed by the Engineer. Clods shall be broken and the top 2" to 3" of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the Engineer.

3. On 2:1 slopes a seedbed preparation will be required that is the same depth as that required on flatter areas, although the degree of smoothness may be

reduced from that required on the flatter areas if so permitted by the Engineer.

4. On cut slopes that are steeper than 2:1, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the Engineer, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge.

5. On cut slopes that are either 2:1 or steeper, the Engineer may permit the preparation of a partial or complete seedbed during the grading of the slope. If at the time of seeding and mulching operations such preparation is still in condition acceptable to the Engineer, additional seedbed preparation may be reduced or eliminated.

6. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the Engineer determines that it is in an otherwise unfavorable working condition.

3.02 APPLICATION

A. Seed shall be applied by means of a hydro-seeder or other approved methods. The rates of application of seed, fertilizer and limestone shall be as stated in Table I.

B. Equipment to be used for the application, covering or compaction of limestone, fertilizer, and seed shall have been approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.

C. Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer, but no limestone or fertilizer shall be distributed and no seed shall be sown when the Engineer determines that weather and soil conditions are unfavorable for such operations.

D. Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at the specified rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed. Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be as directed by the Engineer. If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.

E. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two kinds of seed are being used which require different depths of covering, the seed requiring the lighter covering may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.

F. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.

G. Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Engineer.

H. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the Engineer may direct or permit that modifications be made in the above requirements which pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compaction of the seedbed.

Such modifications may include but not be limited to the following:

1. The incorporation of limestone into the seedbed may be omitted on (a) cut slopes steeper than 2:1; (b) on 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or (c) on areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

2. The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.
3. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

I. MULCHING

1. All seeded areas shall be mulched unless otherwise indicated in the special provisions or directed by the Engineer.

2. It shall be spread uniformly at a rate of two tons per acre in a continuous blanket over the areas specified.

3. Before mulch is applied on cut or fill slopes which are 3:1 or flatter, and ditch slopes, the Contractor shall remove and dispose of all exposed stones

in excess of 3" in diameter and all roots or other debris which will prevent proper contact of the mulch with the soil. Mulch shall be applied within 24 hours after the completion of seeding unless otherwise permitted by the Engineer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operation.

4. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

5. Mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the Engineer. Where the binding material is not applied directly with the mulch it shall be applied immediately following the mulch application.

6. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities which may occur.

3.03 MAINTENANCE

A. The Contractor shall keep all seeded areas in good condition, reseeding if and when necessary, until an acceptable stand of grass is established over the entire area seeded and shall maintain these areas in an approved condition until final acceptance of the Contract. Any of these additional efforts will be at no additional cost to the Owner.

B. Grassed areas will be accepted when a 95% cover by permanent grasses is obtained and weeds are not dominant. On slopes, the Contractor shall provide against washouts by an approved method. Any washouts which occur shall be regraded and reseeded until a good sod is established.

C. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the Engineer. Areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the specifications, shall be repaired by the Contractor as directed by the Engineer at no cost to the Owner.

TABLE I - APPLICATION RATES

A. LIME AND FERTILIZER

In the absence of a soil test, the following rates of application of limestone and fertilizer shall be:

1. 4,000 pounds limestone per acre

2. 1000 pounds 10-10-10 (N-P_2O_5-K_2O) fertilizer per acre and the remaining quantity applied when vegetation is three inches in height or 45 days after seeding, whichever comes first.

B. MULCH

Mulch shall be applied at the following rates per acre:

1. 3,000-4,000 pounds straw mulch, or

2. 1,500-2,000 pounds wood cellulose fiber.

3. 35-40 cubic yards of shredded or hammermilled hardwood bark

4. 1,200-1,400 pounds of fiberglass roving

C. TEMPORARY SEED

The kinds of seed and the rates of application shall be as contained in this table. All rates are in pounds per acre.

1. Fall, Winter, and Early Spring

   40 pounds of Rye Grain

2. Summer

   15 pounds of German Millet

NOTE

1. These seeding rates are prescribed for all sites with less than 50% ground cover and for sites with more than 50% ground cover where complete seeding is necessary to establish effective erosion control vegetative cover. On sites having

50% to 80% ground cover where complete seeding is not necessary to establish vegetative cover, reduce the seeding rate at least one-half the normal rate.

END OF SECTION

SECTION 31 37 00 RIP RAP

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of the construction of plain rip rap in accordance with the requirements of the plans and these specifications and at the locations designated by the Engineer.

PART 2: PRODUCTS

2.01 DEFINITIONS

A. PLAIN RIP RAP

Plain rip rap shall consist of quarry run stone, or field stone or granite stone, etc., and shall be classified by size into Class 1, or Class 2. The class and thickness to be used will be called for on the plans.

B. CLASS 1 RIP RAP

Stone shall vary in weight from 5 to 200 pounds. At least 30% of the total weight of the rip rap shall be in individual pieces weighing a minimum of 60 pounds each. Not more than 10% of the total weight of the rip rap may be in individual pieces weighing less than 15 pounds each.

C. CLASS 2 RIP RAP

Stone shall vary in weight from 25 to 250 pounds. At least 60% of the total weight shall be in individual pieces weighing a minimum of 100 pounds each and not more than 100 pounds each and not more than 5% of the total weight may be individual pieces weighing less than 50 pounds each.

PART 3: EXECUTION

3.01 PLACEMENT OF RIP RAP

A. Unless otherwise indicated or directed by the Engineer, the stone shall be placed upon a slope which shall be no steeper than the angle of repose. The stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. The area and thickness shall be as shown on the plans or as designated by the Engineer.

B. The Contractor may place the stone by mechanical methods, augmented by hand placing where necessary; provided that when the rip rap is completed it forms a properly graded, dense, neat layer of stone.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 01 00 RESTORATION OF SURFACES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations which are not specifically scheduled or specified for topsoil and seeding, paving, landscaping or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to those of original construction.

PART 2: NOT USED

PART 3: EXECUTION

3.01 RESTORATION OF SURFACES

A. SEEDING ALONG PIPELINES

1. All ground surfaces along pipelines, which are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with the section entitled Site Stabilization. Large rocks, clumps of earth and excessive spoil material shall be removed from the area prior to seeding.

2. Shoulders of all roads shall be restored as specific for lawns and landscaped areas.

3. Wooded areas, not classified as lawns shall be restored to as near their original condition as possible.

B. CONCRETE SIDEWALKS

1. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of Class B concrete on a

thoroughly compacted subgrade, shall have a vertical thickness of not less than 4" or the thickness of the replaced walk where greater than 4".

2. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

C. DRIVEWAYS

1. Unpaved driveways shall be surfaced with not less than 3" of Crusher-run gravel, topped with 3" of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

2. Concrete drives shall be replaced with Class B concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete, a 6" aggregate base course shall be placed in the drive area.

3. Bituminous or Asphaltic concrete drives shall be restored with a 6" aggregate base course and a 2" surface course, as defined in the section entitled Asphalt Pavement Repairs.

D. ROADWAY REPLACEMENT

1. Bituminous or Asphaltic pavements shall include all areas paved with blacktop; built-up pavements or oil and stone, tar and stone and similar pavements constructed with a bituminous or asphalt and stone materials.

2. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled and the roadway shall be repaired. In the excavated area, the repair shall consist of an 8" aggregate base course, 4" HB Binder Course and a 2" surface course as defined in the section entitled Bituminous Pavement Repairs. If, in the opinion of the Engineer, the area adjacent to the excavation has not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

3. Portland cement concrete roadways shall be replaced with Class B Concrete and shall have equal thickness and reinforcing steel as the original roadway. An aggregate of 6" shall be placed prior to the placing of concrete.

4. Differential settlement of restored pavements shall be corrected immediately.

5. The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications.

6. All existing manhole and valve covers shall be raised as required by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

E. DITCHES

Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work.

F. LAWNS AND LANDSCAPED AREAS

1. Lawns and landscaped areas shall be regraded and replaced as follows:

   a. Grading shall be to the grade existing before construction of the work under this Contract.

   b. Lawn replacement shall be in accordance with the section entitled Landscaping. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

2. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

G. CURB AND GUTTER

Curb and gutter removed with, or damaged as a result of construction operations, injured or disturbed by the Contractor, his agents, or employees, shall be replaced with new construction to a condition similar and equal to that existing before damage was incurred. Class B Concrete shall be used in curb and gutter replacement.

H. DAMAGE TO STRUCTURES

Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or which cannot be repaired in a suitable

fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the Engineer. Replacement costs shall be responsibility of the Contractor.

END OF SECTION

SECTION 32 01 17 ASPHALT PAVEMENT REPAIRS

PART 1: GENERAL

1.01 SCOPE OF WORK

This section covers the repairs of pavement for all asphalt surfaces.

1.02 PERFORMANCE

Construction of the subgrade, base course and paving shall be undertaken immediately after completion of all underground piping and structures, all curbs and gutters, all yard piping, conduits and other facilities passing beneath paved areas, and all structural slabs and foundations required within or adjacent to the paved areas.

1.03 REFERENCES

All work and materials required under this section of the specifications shall conform to the applicable sections of the North Carolina Department of Transportation, Division of Highways, Standard Specifications for Roads and Structures - Latest Edition.

PART 2: NOT USED

PART 3: EXECUTION

3.01 INSTALLATION

A. PREPARATION OF SUBGRADE

The work covered under this section of this specification shall be performed in strict accordance with Section 500 or Section 505 whichever is applicable, of the Standard Specifications for Road and Structures - Latest Edition, of the North Carolina Department of Transportation, Division of Highways.

B. APPLICATION OF AGGREGATE BASE COURSE

The work covered under this section of this specification shall be performed in strict accordance with Section 520 of the Standard Specification for Road Structures - Latest Edition, of the North Carolina Department of Transportation, Division of Highways.

C. ASPHALT PLANT MIX - GENERAL

The work covered under this section of this specification shall be performed in strict accordance with Section 610 and Section 620 of the Standard Specifications for Roads and Structures - Latest Edition, of the North Carolina Department of Transportation, Division of Highways.

D. TACK COAT

1. Materials used as a tack coat shall meet the requirements for the grades indicated below unless otherwise indicated in the contract. Any of the grades of tack coat material noted in this specification may be used:

    - Asphalt Binder, Grade PG 64-22
    - Emulsified Asphalt, Grade RS-1H, CRS-1H, CRS-1, HFMS-1, CRS-2

2. Do not dilute or mix the tack coat with water, solvents, or other materials prior to application.

3. When tack coat is required beneath an open-graded asphalt friction course, the asphalt grade and rate of application to be used will be specified on the job mix formula.

4. Surface Preparation

    a. The surface to which the tack coat is to be applied shall be cleaned of dust, dirt, clay, and any other deleterious matter prior to placing the tack coat.

    b. The Contractor shall remove grass, dirt and other materials from the edge of the existing pavement prior to the placement of tack coat.

5. Weather Limitations

    a. Tack shall be applied only when the surface to be treated is sufficiently dry and the atmospheric temperature in the shade away from artificial heat is 35° F or above.

    b. Tack coat shall not be applied when the weather is foggy or rainy.

6. Application Rates and Temperatures

    a. Tack coat shall be uniformly applied at a rate from 0.04 to 0.08 gallons per square yard. The exact rate of application will be

established by the Engineer and will be based on the volume of material at the actual application temperature. When tack coat is required beneath an open-graded asphalt friction course, an asphalt binder Grade PG 64-22 material shall be used. The exact rate of application will be specified on the job mix formula and will be within the range of 0.06 to 0.08 gallons per square yard.

b. The temperature of the material at the time of application shall be within the ranges shown in the table below:

Application Temperatures for Tack Coat

Asphalt Material	Temperature Range
Asphalt Binder, Grade PG 64-22	375 - 425°F
Emulsified Asphalt, Grade RS-1H, CRS-1, CRS-1H	90 - 150°F
Emulsified Asphalt, Grade HFMS-1	90 - 160°F
Emulsified Asphalt, Grade CRS-2	125 - 185°F

7. Application

a. No more tack coat material shall be applied than can be covered with base, intermediate, or surface course during the following day's paving operations.

b. Tack coat material shall be uniformly applied to the entire surface utilizing an adjustable spray bar. Areas of tack coat application should be uniformly and completely covered.

c. Tack coat shall be applied only in the presence of and as directed by the Engineer. No base or surface mixture shall be deposited onto the tacked pavement until the tack coat has sufficiently cured.

d. Contact surfaces of headers, curbs, gutters, manholes, vertical faces of old pavements, and all exposed transverse and longitudinal edges of each course shall be painted or sprayed with tack coat before new asphalt mixture is placed adjacent to such surfaces.

e. Bridge floors, curbs and handrails of structures, and all other appurtenances shall be covered to prevent tack coat from being tracked or splattered on the structures or appurtenances.

8. Protection

a. Protect the tack coat after application until it has cured for a sufficient length of time to prevent if from being picked up by traffic.

b. Contractor shall take the necessary precautions to minimize tracking and/or accumulation of tack coat material on existing or newly constructed pavements. Corrective measures may be required in areas where an excessive accumulation of tack has occurred.

E. BASE COURSE (B 25.0X); INTERMEDIATE COURSE (I 19.0X); SURFACE COURSES (S 12.5X, S AND SF 9.5X)

1. Weather and Temperature Limitations

a. Asphalt mixtures shall not be produced or placed during rainy weather, when the subgrade or base course is frozen, or when the moisture on the surface to be paved would prevent proper bond. Asphalt material shall not be placed when the air temperature, measured in the shade away from artificial heat at the location of the paving operations, is less than the temperatures noted in the table on the following page.

b. Where the surface course is to be placed on the intermediate course, the surface course shall be placed as soon as possible after the intermediate course has been placed, and in all cases during the same paving season.

Minimum Paving Temperatures

Asphalt Mixture	Minimum Air Temperature (ºF)	Minimum Road Surface Temperature (ºF)
B 25.0B B 25.0C	35	35
I 19.0B I 19.0C	35	35
S 9.5C, S 9.5D, S 12.5C, S 12.5D	50	50
SF 9.5A S 9.5B	40	50

2. Spreading and Finishing

   a. Coat surface of manhole frames and inlet frames with oil to prevent bonding with asphalt pavement. Do not tack or prime coat these surfaces.

   b. Tack coat shall be applied to the existing pavement, when necessary, in accordance with the provisions of these specifications.

   c. The asphalt mixture shall be spread and struck off to the required grades, cross sections, and thicknesses.

   d. Should unevenness of texture, tearing, segregation, or shoving occur during the paving operation due to unsatisfactory methods or equipment, the Contractor shall immediately take such action as may be necessary to correct such unsatisfactory work. Excessively throwing back material will not be permitted.

3. Compaction

   a. Immediately after the asphalt mixture has been spread, struck off, shaped to the required width, depth, cross-section, and surface and edge irregularities adjusted, it shall be thoroughly and uniformly compacted. Compaction must be obtained in a manner that provides uniform density over the pavement and meets the required degree of compaction for the type of mixture being placed.

Compaction rolling shall be complete before material temperature drops below 185ºF.

b. Compaction rolling should be performed at the maximum temperature at which the mix will support the rollers without moving horizontally. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Adjustments to the compaction equipment may be required where uniform density is not being obtained throughout the depth of the layer being tested.

c. All final wearing surfaces, except open-graded asphalt friction course, shall be compacted using a minimum of 2 steel wheel tandem rollers. Pneumatic-tired rollers with smooth tread tires may be used after the breakdown roller and prior to finish rolling. Vibratory rollers must not be operated in vibratory mode during finish rolling on any mix type or pavement layer.

d. Rollers used to compact the mixture shall be in good condition and capable of reversing without backlash. The rollers shall be operated with the drive wheels nearest the paver and at uniform speeds slow enough to avoid displacement of the mixture. Steel wheel rollers shall be equipped with wetting devices to prevent the mixture from sticking to the roller wheels. Fuel oil shall not be used to moisten roller wheels.

e. All asphalt mixtures, except open-graded asphalt friction course and type SF 9.5A, shall be compacted to at least 92 percent of the mixtures maximum specific gravity. An SF 9.5A mixture shall be compacted to at least 90 percent of the mixtures maximum specific gravity.

f. Rolling for open-graded asphalt friction course shall consist of one coverage with a tandem steel wheel roller weighing a maximum of 10 tons, with additional rolling limited to one coverage with the roller where necessary to improve riding surface.

g. The use of rolling equipment that results in excessive crushing of the aggregate or excessive displacement of the mixture will not be permitted.

h. In areas inaccessible to standard rolling equipment, the mixture shall be thoroughly compacted by the use of hand tampers, hand operated mechanical tampers, or other approved equipment.

i. The tolerance of the final compacted pavement shall be within 1/4" of the typical cross-sections shown on the plans.

4. Joints

a. Placement of surface course material as the final layer of pavement should not be placed between November 15 and April 1 of the next year unless otherwise approved by the Engineer. In addition, open-graded asphalt friction course shall not be placed between October 31 and April 1, unless otherwise approved.

b. As an exception to the above, when in any day's operations the placement of a layer of asphalt base course material or intermediate course material 2 inches or greater in thickness has started, it may continue until the temperature drops to 32° F.

F. TRAFFIC MARKINGS

The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

G. EXISTING UTILITIES

All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.02 TESTING

All of the above work will be subject to thickness and compaction tests as deemed necessary by the Engineer. Such tests will be at the Expense of the Owner.

END OF SECTION

SECTION 320190 – TREE AND SHRUB PROTECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Protection of Existing Plant Material, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
   1. Protecting and maintaining existing trees and vegetation not specifically designated for removal, to remain.
   2. Protection shall be extended to trees and/or vegetation located within or directly adjacent to the Project Site, whether the tree trunk and/or vegetation is located within the designated Limits of Work.

C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 329219 – Seeding and Mulching
   2. Section 329300 – Exterior Plants
   3. Section 329301 – Landscape Planting Accessories

1.3 DEFINITIONS

A. *"Tree"* shall mean a woody perennial plant which usually has (but not limited to) a single dominant trunk and has a mature height of fifteen feet (15') or more and has a trunk diameter (caliper) of three (3") inches or more when measured at 24" above the finished grade.

B. *"Dripline"* shall be generally defined as the outermost extent of the tree's foliaged canopy, which encompasses the tree leaves or fronds, trunk, branches, roots, and soil. In no case shall a dripline encompass an area under a tree canopy, which is less than ten feet (10'), in diameter. Since each tree is unique in size, scale, and form, the delineated dripline of each tree shall be refined at the discretion of the Landscape Architect.

C. *"Injury"* shall be defined, without limitation, as any bruising, scarring, tearing, gouging, or breaking of roots, branches, or trunk(s), soil compaction or contamination around the dripline, which results in the decline to the health of the tree.

D. *"Tree Protection Fence" and "Tree Barricade"* shall be used interchangeably.

1.4 REFERENCE STANDARDS

A. *Standards for Tree Care Operations (Z133.1),* American National Standards Institute, Latest Edition.

B. *Safety Standards for Tree Care Operations (Z133),* American National Standards Institute, Latest Edition.

C. *Tree Pruning Guidelines*, International Society of Arboriculture, 1995 Edition.

D. *Pruning Standards for Shade Trees*, National Arborists Association. Latest Edition.

1.5 SUBMITTALS

A. Contractor shall provide site photographs or videotape, sufficiently detailed and described, of existing conditions of trees and vegetation, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing, tree pruning, or tree protection. Submit photographs or videotape to the Landscape Architect prior to commencement of Work.

B. Product Data: Submit complete and legible materials list of items to be provided for Work described herein this Section.

C. Submit complete detailed schedule and description of Work to be done within dripline, (if any), including list of equipment to be used.

D. Submit schedule and description of proposed pruning and/or other remedial work to existing plant materials. Submit qualifications describing years of experience and list of similar projects completed for the following:
   1. A State of North Carolina licensed Pest Control Advisor shall propose application of all herbicides or pesticides.
   2. A Certified Arborist shall propose pruning of trees or other vegetation. The Certified Arborist shall have a minimum of five (5) year's post-certification experience performing pruning and observation work for projects of comparable size with trees of similar size and nature.
   3. Tree Pruning Company, and List of Certified Tree Workers, who will perform Work relating to requirements herein this Section. Tree Pruning Company shall have a minimum of five (5) years experience specializing in the work of this Section for projects of comparable size with trees of similar size and nature.

1.6 QUALITY ASSURANCE

A. Pre-Installation Conference: Conduct conference at Project Site.

B. Pruning and remedial work shall be done under the direct supervision of an Arborist certified by the International Society of Arborists (ISA); or Arborist who is a member of the American Society of Consulting Arborists, in compliance with ISA and ANSI Standards. Arborist shall be on Site continuously while existing trees or roots are being pruned or remedial work is being performed.

1.7 PROJECT SITE CONDITIONS

A. Contractor shall become acquainted with existing site conditions, verifying quantities and locations of all protected trees and vegetation, and other information as may be necessary. Notify the Owner or Landscape Architect of unsatisfactory conditions, in writing, prior to commencement of Work.

B. Tree Flagging: Prior to commencement of Work, Contractor shall flag existing trees and vegetation to remain and protected throughout the duration of Work. Adequately flag tree trunks with bright-colored tape (neon colors preferred). Verify flagged trees and vegetation with the Owner and Landscape Architect.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during tree-pruning or tree-protection operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways, if required, by authorities having jurisdiction.

D. Locate all utilities prior to any Work, and perform Work in a manner which will avoid possible damage. Notify utility locator service for area where Project is located before site clearing where applicable. Notify the Owner and Landscape Architect if conflicts exist.

E. Improvements on Adjoining Property: Authority for performing indicated removal and alteration Work on property adjoining Owner's property shall be obtained by the adjoining property Owner(s) prior to commencement of Work.

F. Protect existing Work and Work of other trades: Damage to existing construction caused by Work of this Section shall be promptly repaired and/or replaced at the expense of the Contractor.

G. Environmental Requirements: Perform actual pruning operations (if needed) during those seasons suitable for the specific tree type, in accordance with locally acceptable horticultural practices.

H. Pre-Tree Pruning/Tree Protection Conference: Contractor shall conduct a Pre-Tree Pruning/Tree Protection Conference at the Project Site with Certified Arborist (who will be on-site supervising the Work of the Project) and the Landscape Architect:
   1. Contractor shall be responsible for notifying parties, in writing, at least seven (7) days in advance to schedule the Conference.
   2. Contractor shall provide to parties in attendance within seven (7) days a written legible inventory of Work to be accomplished, including species (botanical and common name), location, size, specific pruning needs or tree protection needs as identified during the Conference, recommended pruning or tree protection methods to meet the identified needs, and any additional conditions noted.

1.8 SCHEDULE

A. Install Tree Protection Barricades prior to commencement of Work.

B. Work shall be done according to approved Schedule.

1.9 GUARANTEE

A. Contractor shall Guarantee that plants covered under the Provisions of this Section shall be healthy and in a flourishing condition of active growth for one (1) year from the date of Final Completion.

B. Requirements of the guarantee shall apply if failure of the Contractor to take specified precautions and Work within restrictions of this Section contributes to the destruction, decline, or injury to a tree to remain, in the judgment of the Landscape Architect.

C. If a tree designated to be protected accordingly is destroyed or injured so that in the judgment of the Landscape Architect it should be replaced, it shall be removed at the expense of the Contractor. Contractor shall pay compensation to the Owner of the property where the tree was located at the rate as specified herein this Section (see Compensation).

1.10 COMPENSATION

A. Contractor shall replace existing plant material designated to remain that dies or sustained injury from the result of the Contractor’s negligence to provide adequate required protection, pruning, or maintenance during the course of construction operations. Compensation shall be awarded to the Owner as follows.

B. Trees: Contractor shall thoroughly remove damaged tree, including trunk, branches, and roots, at no cost to the Owner, and at the direction of the Landscape Architect.

1. Contractor shall furnish and install per requirements in Section 329300 ”Exterior Plants”, with an equal size tree (in height, spread, and caliper), and of the same form, species, and in the same quantity as those tree(s) that were damaged, at the direction of the Landscape Architect. Compensation shall include the actual cost of the item boxed out of the ground; transportation or delivery of boxed item to the site; unloading, planting and staking; maintenance, including watering, fertilizing, pruning, pest control, and other care to bring replacement to same general condition of the original item.

C. Other Plant Material (other than Trees): Contractor shall replace other vegetation (other than trees) that died or sustained injury from the result of the Contractor’s negligence to provide adequate required vegetation protection, pruning, or maintenance during the course of construction operations. Compensation shall be awarded to the Owner as follows:
   1. Contractor shall thoroughly remove damaged vegetation at no cost to the Owner, and at the direction of the Landscape Architect.
   2. Contractor shall furnish and install per requirements in Section 329300 “Exterior Plants”, with equal size plant material as those which damaged ((5) gallon container stock minimum (as applicable))of the same form, species, and in the same quantity as vegetation that was damaged, at the direction of the Landscape Architect.

PART 2 - PRODUCTS

2.1 TREE PROTECTION MATERIALS

A. Barricade for Protection of Existing Vegetation:
   1. Fabric: Utility (snow) type fencing, minimum four feet (4’-0”) high, consisting of a vinyl meshed fabric in a bright orange color. Fabric shall be approved by the Landscape Architect.
   2. Posts: Metal or wood, sufficient in gauge (as appropriate) and size to support the fabric material in a taut and plumb condition. Posts shall be subject to approval by the Landscape Architect.
   3. Signs: Posted plastic laminated signs, attached to fabric fencing, with words “WARNING-KEEP OUT-TREE PROTECTION ZONE”.

B. Mulch: Where available, Contractor shall stockpile and reuse shredded wood chips produced from on-site tree removals and remedial work, if chips are disease free and acceptable to the Landscape Architect. Where on-site chips are not available, Contractor shall provide mulch as specified in Section 329301 “Landscape Planting Accessories”.

PART 3 – EXECUTION

3.1. PREPARATION

A. Provide erosion-control measures as needed to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

3.2 TREE AND VEGETATION PROTECTION

A. Protect existing trees and other vegetation indicated to remain in place against the following:
   1. Storage or parking of automobiles or other vehicles.
   2. Stockpiling of building materials, refuse, or excavated materials.
   3. Use of trees as support posts, power posts, or sign posts, anchorage for ropes, guy wires, or power lines, or other similar functions.

4. Dumping of poisonous materials on or around plant roots, trunks, branches, or foliage. Such materials include, but are not limited to, paint, petroleum products, dirty water, or other deleterious materials.
5. Cutting, breaking, or shinning of roots caused by utility trenching, foundation digging, placement of curbs and trenches, and other miscellaneous excavation without prior written approval by the Landscape Architect.
6. Damage by skinning or bruising of bark on trunks or branches, caused by maneuvering vehicles or st6acking material or equipment too close to the plant.
7. Compaction of the soil within the dripline of the plants due to movement of grading machines, pedestrian or vehicular traffic, storage of equipment or materials.
8. Excessive water or heat from equipment, utility line construction, or burning of trash under or near vegetation to remain.
9. Damage to root system from flooding, erosion, and excessive wetting and drying resulting from watering and other operations.

B. Prior to commencement of construction activities, the Contractor shall erect and maintain a temporary fenced barricade around the dripline of individual trees, around perimeter dripline of groups of trees, or around other vegetation to remain.
1. Prevent damage to roots during installation of barricade posts. Space posts approximately 4'-0" on center and securely attach fabric.
2. Barricades shall be installed plumb, taut, and sturdy to prevent unauthorized access around dripline of trees and protected vegetation. Repair sagging or damaged barricades immediately.
3. Immediately after barricade fencing is installed, cover entire soil area inside of the fence area with a four-inch (4") layer of mulch. Keep mulch 18" away from root crown. Irrigate protected trees and vegetation to a moist soil depth of 18" deep.
4. During the course of construction, relocation of the barricade may be required to facilitate construction. Contractor shall relocate barricade as directed by the Landscape Architect at no additional expense to the Owner.
5. Remove barricade when construction operations are complete or when directed by the Landscape Architect

C. Irrigation: Contractor shall supply fresh potable water in adequate amounts and rates of application as required to maintain the health of protected plant material throughout the duration of the construction operations. Contractor shall maintain a watering schedule and document dates and duration of irrigation applications.
1. Construct a temporary watering basin, as required, on the surface of the existing undisturbed grade, with imported soil, to aid in the retention of water around existing protected trees and planting.

D. Do not excavate within drip line of trees, unless approved, in writing, by the Landscape Architect

E. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

F. Protect root systems of existing trees and vegetation from damage due to chemically injurious materials in solution caused by run-off or spillage during mixing or placement of construction materials, and drainage of stored materials.

G. Protect root systems from flooding, erosion, excessive wetting or drying resulting from de-watering or other operations.

H. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the Landscape Architect
   1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified Arborist.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.

B Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

3.4 PRUNING AND REMEDIAL WORK

A. Pruning and remedial work shall be done under continuous supervision of the approved Arborist, according to approved submittals, and per ANSI A-300 Pruning Standards.

B. Provide pruning, cabling and bracing, irrigation, pest and disease control and other remedial treatments as recommended by the approved Arborist, required to assure the long-term health of the trees and existing vegetation, and the safety of persons and property.

3.5 MAINTENANCE

A. Keep areas within tree protection barricades free from weeds, trash, and debris. Do not use herbicides.

B. Maintain mulch layer and protective devices throughout entire period of construction.

END OF SECTION 320190

SECTION 321216 - BITUMINOUS PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All work and materials required under this section of the specifications shall conform to the applicable sections of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and the North Carolina Department of Transportation Pavement Construction Section Superpave Hot Mix Asphalt / Quality Management System.

1.2 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.
7. Traffic-calming devices.

B. Related Sections:

1. Division 02 Sections "Demolition" and/or “Selective Demolition” for demolition, removal, and recycling of existing asphalt pavements.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each paving fabric, 12 by 12 inches minimum.
2. Each type and color of preformed traffic-calming device.
3. Each pattern and color of imprinted asphalt.

E. Material Certificates: For each paving material, from manufacturer.

F. Material Test Reports: For each paving material.

G. The Contractor shall furnish copies of certified weight tickets for all asphalt placed on the project. The original of all tickets, including any voided tickets or tickets for rejecting mixture, shall become the property of the Engineer.

1.5 QUALITY ASSURANCE

A. All aspects of the work, including, but limited to materials, equipment, application and installation procedures, quality control, and environmental conditions necessary for application/installation of materials shall be in accordance with the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Quality control and quality assurance are provided for through use of the Quality Management System, as discussed in Section 1 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. All hot mix asphalt must be provided by a Certified Asphalt Plant, as covered in Section 5.3 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Asphalt plant equipment and operations shall meet the Specifications set forth in Section 5 and 6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Delivery and Acceptance of Asphalt Materials must conform to Section 2.40.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. The Engineer reserves the right to sample and test any shipment and to reject any material not meeting the requirements of the specifications.

G. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the North Carolina Department of Transportation for all asphalt paving work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transportation of Bituminous Mixture: Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Deliver paint and pavement-marking materials to Project site in original containers and packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

C. Store paint and pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply asphalt materials only when the environmental conditions for the specific material to be applied are in accordance with Section 9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces in environmental conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. All aggregates utilized in bituminous pavement mixtures shall be in accordance with Section 2.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section with the exception of paragraph 2.5.2.D.

2.2 ASPHALT MATERIALS

A. All asphalt materials utilized on the project shall be in accordance with the requirements of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Water: Potable.

2.3 PAVEMENT MARKINGS

A. The following are minimum requirements and shall govern except all local, state and/or federal highway or transportation department standard specifications shall govern when their requirements are in excess thereof.

B. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type F, and colors complying with the latest revision of FS TT-P-1952.

1. Color: As indicated.

2.4 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2,500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.5 COMPOSITION OF MIXTURES

A. The asphalt mix formula shall be in accordance with Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. The job mix formula for each mixture will establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature at which the mixture is to be discharged from the plant and shall be within the design limits specified for the particular type of bituminous mixture.

C. The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

D. All mixtures furnished for the work shall conform to the job mix formula within the tolerance ranges specified for the particular mix involved as specified herein.

E. Should a change in sources of aggregate materials be made, a new job mix formula will be required before the new mixture is produced.

F. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

G. Bituminous Base Course, Type B 25.0B: The bituminous base course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

H. Bituminous Intermediate Course, Type I 19.0B: The bituminous intermediate course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

I. Bituminous Surface Course (SF 9.5A and S 9.5B): The bituminous surface course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

J. Tack Coat: Tack Coat shall conform to Section 9.31 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation asphalt.

3.2 COLD MILLING

A. The equipment utilized in milling of existing asphalt pavements shall be in accordance with Section 8.7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

B. Additional equipment necessary to satisfactorily remove the pavement in the area of manholes, water valves, curb and gutter, and other obstructions shall be provided.

C. The pavement removal operations shall be conducted to effectively minimize the amount of dust being emitted in accordance with local, State, and Federal air pollution control laws and regulations. The operation shall be planned and conducted so that it is safe for persons and property adjacent to the work including the traveling public.

D. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

E. The existing pavement shall be milled in a manner which will restore the pavement surface to a uniform longitudinal profile and cross section at the locations and in accordance with typical sections shown on the plans. Where indicated in the plans, removal shall be to a specified depth and shall produce a specified cross slope.

F. The Contractor may elect to make multiple cuts to achieve the required depth of cut or cross slope required by the plans.

G. The longitudinal profile of the milled surface shall be established by a mobile string line on the side of the cut nearest the centerline of the road. The cross slope of the milled surface shall be established by an automatic cross slope control mechanism or by a second skid sensing device located on the outside edge of the cut. The Engineer may waive the requirement for automatic grade and cross slope controls where conditions warrant.

H. The milling equipment shall be operated in such a manner as to prevent damage to the underlying pavement structure, utilities, drainage facilities, curb and gutter, paved surfaces outside the milled area, and any other appurtenances. The milled pavement surface shall be reasonably smooth and free of excessive scarification marks or other damage as determined by the Engineer. Any leveling or patching required as a result of negligence by the Contractor shall be repaired with hot bituminous plant mix at no cost to the Owner and in a manner acceptable to the Engineer. The Contractor shall coordinate the adjustment of manholes, meter boxes and valves boxes with the milling operation.

I. The Engineer may require remilling any area where surface laminations or defects resulting from the Contractor's operations cause a non-uniform surface to occur.

J. The milled pavement surface shall be thoroughly cleaned of all loose aggregate particles, dust and other objectionable material by the use of power brooms, power blowers, power vacuums or other means.

3.3 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. The surface preparation necessary for asphalt patching shall be done in accordance with Section 3.5 below.

C. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

D. Tack Coat: Tack coat shall be applied in accordance with Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

F. Traffic Markings: The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with the requirements described elsewhere in this section.

G. Existing Utilities: All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. Preparation of Subgrade: The work covered under this section of this specification shall be performed in strict accordance with Section 500 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

B. Application of Aggregate Base Course: The work covered under this section of this specification shall be performed in strict accordance with Section 520 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

C. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

D. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

E. Prime Coat: Prime coat shall be applied in accordance with Section 9.2 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Tack Coat: The work covered under this section of this specification shall be performed in strict accordance with Section 605 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.6 HOT-MIX ASPHALT PLACING

A. Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System.

B. Bituminous Plant Mix - General: The work covered under this section of this specification shall be performed in strict accordance with Section 610 and Section 620 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Sections 2 through 6 and Section 9 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. For pavement repairs, see Section 654 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

C. Base Course, Type B 25.0B); Intermediate Course (I 19.0B); Surface Courses (SF 9.5A and S 9.5B): All hot mix placement and compaction operations shall conform to Section 9.4 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Spreading and Finishing: Spreading and finishing of asphalt pavements shall be done in accordance with Section 9.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Compaction: Compaction of asphalt pavements shall be done in accordance with Section 9.7 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Joints:

1. Transverse Joints: Transverse joints are to be constructed in accordance with Section 9.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

2. Longitudinal Joints: Longitudinal are to be constructed in accordance with Section 9.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

G. Weather and Seasonal Limitations: Placement of asphalt is limited in accordance with Section 9.4.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.7 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 degrees F.

1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.8 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Paint shall only be applied when the atmospheric, surface, and material conditions are in accordance with the manufacturer’s requirements.

C. Contractor must insure that pavement surface to be painted shall be clean and dry before application. All surface contamination such as oil, grease, dirt, foreign matter, or other deleterious materials will be removed by the Contractor prior to application of paint.

D. Paint shall be applied with mechanical equipment to produce uniform straight edges in strict compliance with the manufacturer's instructions. Paint shall be applied in two (2) coats at the manufacturer's recommended rates.

3.9 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.10 PRE-FORMED TRAFFIC-CALMING DEVICES

A. Install pre-formed speed bumps, humps, and/or cushions in bed of adhesive as recommended by manufacturer for heavy traffic.

B. Securely attach preformed speed bumps, humps, and/or cushions to pavement with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.11 FIELD QUALITY CONTROL

A. The Owner will engage a qualified testing agency to perform tests and inspections and shall bear the responsibility for paying all costs associated with passing tests. The Contractor shall bear all costs in making all necessary repairs to make work satisfactory after a failed test and shall pay all costs associated with failed tests.

B. Sampling and testing shall be in accordance with Section 7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. Mat cross-slope and thickness shall be tested according to Section 10.1.8 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Surface texture shall conform to Section 10.1.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. Smoothness shall conform to Section 10.2. Areas found to reveal non-conformance corrected by the Contractor by removal of the defective work and replacement with new material unless other corrective measures are permitted by the Engineer. The work and materials required in the correction of defective work shall be provided by the Contractor at no cost.

E. The Contractor shall repaint and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

F. All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. The milled material shall become the property of the Contractor. All milled material shall be disposed of by the Contractor in an EPA-approved landfill, except where the

milled material is used in the work or recycled. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Walks.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

E. Material Test Reports: For each of the following:

1. Aggregates.
2. Portland Cement: The Contractor shall submit a copy of mill test reports on all cement delivered to the job 7 days prior to use of the cement.
3. Fly Ash: Complete chemical and physical analysis of each carload of fly ash shall be submitted to the Engineer ten (10) days prior to use of each carload delivered.

F. Submit records of all concrete pours showing exact location of pour, date of pour, quantity of pour, and class of concrete poured to the Engineer each month. Temperature at time of pour should also be recorded.

1.5 QUALITY ASSURANCE

A. All Portland cement concrete paving shall be in accordance with the appropriate sections of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Division 7 and associated referenced sections, standards and drawings.

B. If the average strength of the laboratory control cylinders shows the concrete to be below the specified design strength, the aggregate proportions and water content may be changed by the Engineer, who, in addition to such changes, may require core tests. Tests confirming concrete strengths on hardened concrete which was poured without testing shall be paid for by the Contractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for public and emergency uses, as well as other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Steel reinforcement utilized in all concrete paving shall be in accordance with the appropriate paragraphs of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1070.

2.3 CONCRETE MATERIALS

A. Cementitious Material: All cementitious materials utilized in the Work shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition). All cementitious materials, shall be of same type, brand, and source throughout Project:

1. Portland Cement: shall be fresh stock of an approved standard brand meeting the requirements of ASTM C 150, white portland cement Type II meeting the requirements of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-1.
2. Fly Ash: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-5.
3. Ground Granulated Blast-Furnace Slag: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-6.
4. Coarse Aggregate: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1014-2.
5. Fine Aggregate: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1014-1.

B. Water: shall be potable and in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-4.

C. Air-Entraining Admixture: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-3.

D. Chemical Admixtures: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-3.

2.4 CURING MATERIALS

A. All curing agents for concrete paving shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1026.

2.5 RELATED MATERIALS

A. Joint Materials: shall be appropriately selected in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1028.

B. Adhesive and Epoxy Bonding Agents: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1081.

2.6 PAVEMENT MARKINGS

A. Pavement-Markings: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1087.

2.7 CONCRETE MIXTURE

A. The concrete mix design utilized for all concrete paving shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1000-3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding. Proof-rolling shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 260-1 through 260-3.

C. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Before placing concrete, all equipment for mixing and transporting and placing concrete shall be cleaned, all debris and ice removed from spaces to be occupied by the concrete, forms thoroughly cleaned of soil, ice, or other coatings which will prevent proper bond, reinforcement shall be securely tied in place and expansion joint material, anchors, and other embedded items

shall be securely positioned. Hardened concrete and foreign materials shall be removed from the conveying equipment.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Form Installation, Use and Removal: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 425-1 through 425-5 for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Joint construction shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-11.

B. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
2. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
3. Provide tie bars at sides of paving strips where indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 INSPECTION

A. Before placing concrete, the formwork installation and reinforcing steel must be complete. Notify Engineer upon completion of installation of all forms and reinforcing in ample time to permit inspection of the work. Subbase is subject to testing as directed by the Engineer. Place concrete immediately after approval of subbase, formwork and reinforcement.

3.7 CONCRETE PLACEMENT

A. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

D. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practical by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality concrete is obtained. Conveying equipment shall be of size and design to insure a continuous flow of concrete at the delivery end.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Batch tickets for each load of concrete shall be submitted to the Engineer. The following information shall be provided on each batch ticket:

1. Design mix designation.
2. Exact time cement, water and aggregate were discharged into the mix.
3. Compressive strength of mix.
4. Amount of water added to the mix.

G. Concrete shall be deposited and spread in a continuous operation such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located at points as provided for in the drawings or as approved. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as possible to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Maintain equipment in proper operating condition, with drums cleaned before charging of each batch. Schedule delivery of trucks in order to prevent delay of placing after mixing.

I. Concrete shall not be allowed to "freefall" a distance greater than 3 feet.

J. Do not use concrete which has become non-plastic and unworkable or does not meet the required quality control limits, or which has become contaminated by foreign material. Remove rejected concrete from the project site and dispose of in an acceptable location.

K. Consolidate concrete in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-6.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 degrees F within five (5) days after the concrete is placed, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 55 degrees F and not more than 80 degrees F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
4. Cover top with insulating blankets. Blankets shall remain in place for a minimum period of five days.
5. In addition to laboratory-cured test specimens, additional concrete test specimens shall be cured under the same field conditions that the concrete in the field represented by these cylinders is cured and high thermometers shall be placed on the surface of slab to record daily temperatures during curing period.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. An approved admixture designed to retard the rate of set shall be used for all concrete placed when temperatures exceed 75 degrees F. Set retarding admixtures shall conform to ASTM C-494, Type D, water reducing and retarding.
2. Provide wind breaks around the perimeter of the area where concrete is being placed.
3. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Fresh concrete with temperatures 90 degrees F. or above shall be discarded off site. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water.
4. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
5. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 CONCRETE FINISHING

A. Finish concrete surfaces in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 710-6.

3.9 JOINT SEALING

A. General: Joint sealing shall be performed in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-12.

3.10 CONCRETE PROTECTION AND CURING

A. Concrete Protection: shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-8.

B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

C. Concrete Curing: shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9.

D. Curing for concrete paving surfaces during periods when the outside air temperature does not exceed 60 degrees F. shall be provided by applying a membrane-forming curing compound to concrete surfaces as soon as the final troweling or floating operation has been completed. Application shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to the concrete or with any other cover or finish material which shall be bonded to the concrete.

E. Curing for all pavement surfaces during periods when the outside air temperature will exceed 60 degrees F. shall be provided by covering the entire surface with burlap. Application shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9. Immediately following the placement of the burlap, the entire surface shall be maintained continuously wet for a period of 7 days. Do not permit surfaces to dry at any period during the required curing period.

F. During the curing period, protect concrete from damaging mechanical disturbances, including load stresses, shocks, excessive vibration and from change caused by subsequent construction operations.

3.11 PAVING TOLERANCES

A. Tolerances for pavement thickness shall comply with the appropriate portions of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 700-15 and 710-9.

B. Tolerances for surface smoothness shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 710-7.

3.12 PAVEMENT MARKINGS

A. The application of pavement markings shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1205.

B. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

C. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required.

3.14 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer. Make edges of cuts perpendicular to the concrete surfaces.

B. Repair and patch defective areas immediately after removal of forms as directed by the Engineer. Dampen all concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

C. Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with approved non-shrink grout compatible with the pavement concrete.

D. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

E. Protect concrete paving from environmental factors in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-8.

F. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.15 TESTING AND QUALITY CONTROL

A. The Owner shall employ a concrete testing laboratory to provide all laboratory testing services on the project and a concrete technician to perform all quality control tests on concrete and materials used to batch concrete. The testing agency employed shall meet the requirement of "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", (ASTM E-329).

B. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests.

C. The Contractor shall provide and maintain adequate facilities on the project for the testing laboratory to locate the required testing equipment and for safe storage area for test cylinders. The general contractor shall provide at his own expense all casual labor needed to assist the concrete technician in obtaining samples of concrete and concrete materials and moving and transporting cylinders and materials which are being tested.

D. Acceptance testing for concrete pavement shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 700-15.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Expansion joints within cement concrete pavement, as shown in the Contract Drawings, and as specified herein this Section.

B. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 321313 – Concrete Paving

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of join sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with join substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner and Landscape Architect from manufacturer's full range for this characteristic.

2.2 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

2.3 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 328401 - SOIL PREPARATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete and thorough preparation of the planting soil, including soil amendment products, imported topsoil, as required, to make up deficiencies in quantity of soil available on site, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
   1. Topsoil.
   2. Pre-Plant Weed Control.
   3. Soil Conditioners, Amendments, and Fertilizers.

C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 312001 – Finish Grading
   2. Section 329219 – Seeding and Mulching
   3. Section 329300 – Exterior Plants
   4. Section 329302 – Landscape Establishment Period

1.3 BID ALLOWANCE / UNIT PRICING

A. Contractor shall not be entitled to any fee, payment, stipend, grant, mark-up, or any other financial gain or incentive for any Work performed.

1.4 DEFINITIONS

A. Topsoil:
   1. *Topsoil* - Shall be friable and have sufficient structure in order to give good till and aeration to the soil.

   2. *Gradation Limits* - Soil shall be a sandy loam, loam, clay loam or clay. The definition of soil texture shall be per the USDA classification scheme. Gravel over ¼-inch in diameter shall be less than 10% by weight.

   3. *Permeability Rate* - Hydraulic conductivity rate shall be not less than one-inch (1”) per hour, nor more than twenty-inches (20”) per hour, hen tested in accordance with the USDA Handbook Number 60, Method 34b, or other approved Methods.

4. *Fertility* - The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/ DTPA Extraction (parts per million	
Element	(mg/kilogram) dry weight basis
Phosphorous	4 - 40
Potassium	60 - 220
Iron	4 - 35
Manganese	0.6 - 6
Zinc	0.6 - 8
Copper	0.1 - 5
Boron	0.2 - 1
Magnesium	50 - 500
Sodium	0 - 100
Sulfur	25 - 500
Molybdenum	.1 – 2

5. *Acidity* - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook number 60) shall be 6.0 – 7.9.
6. *Salinity* - The salinity range measured in the saturation extract (Method 3a, USDA Hand Number 60) shall be 0.5 – 2.0 dS/m. If calcium and if sulfate ions both exceed 20 milli-equivalents per liter in the saturation extract, the maximum salinity shall be 4/0 dS/m.
7. *Chloride* - The maximum concentration of soluble chloride in the saturation extract (Medoth3a, USDA Handbook Number 60) shall be 150 mg/1 (parts per million).
8. *Boron* - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/1 (parts per million).
9. *Sodium Adsorption Ratio (SAR)* - The maximum SAR shall be 4 measured per Method 20b, USDA Handbook Number 60.
10. *Soil Organic Matter Content* - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter. The normal range is 3% to 7% on a dry weight basis.
11. *Calcium Carbonate Content* - Free calcium carbonate (limestone) may be present. However, it shall not be present for acid-loving plants.
12. *Heavy Metals* - The maximum permissible elemental concentration in the soil shall not exceed the following:

Ammonium Bicarbonate/DTPA Extraction (parts per million):	
Element	(mg/kilogram) dry weight basis
Arsenic	1
Cadmium	2
Chromium	10
Cobalt	2

Lead	30
Mercury	1
Nickel	5
Selenium	3
Silver	.5
Vanadium	3

13. *Elemental Concentration* - If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be present at 50% or more of the above values.
14. *Phytotoxic constituent, herbicides, hydrocarbons, etc.* – Germination and growth of plants shall not be restricted more than 10% compared to standard controls. Standard controls shall be both monocots and dicots. Petroleum hydrocarbons shall not be present.

B. *Sub Grade* - Soil level resulting from the rough grading work under another Section. Cultivation of sub grade areas prior to placement of Topsoil is included in this Section.

C. *Stockpiled Topsoil* - Soil stockpiled for spreading over prepared sub grade.
1. *Stockpiled Native Topsoil:* Topsoil stripped from the site prior to rough grading work under another Section, to be spread and amended as Work under this Section.
2. *Imported Topsoil*: Off-site topsoil imported and stockpiled under this Section, to be spread and amended as Work under this Section.

D. *On-Structure:* Planted areas to be installed on top of concrete structure built under another Section.

1.5 SUBMITTALS

A. Product Data and physical Product Samples: Submit Manufacturer's current catalog cuts, specifications, and physical Product Samples (provided in re-sealable labeled plastic bags for the following (as applicable):
1. Planting Soil (Imported/Amended Topsoil).
2. Soil Amendments (for each type used, for Sand, Perlite, Peat Humus, Gypsum, Soil Sulfur, Iron, etc).
3. Bulk Composted Organic Soil Amendment Material.
4. Granular Soil Conditioning Material.
5. Mycorrhizal Inoculum.
6. Fertilizers (for each type used).

B. Submit copies of the laboratory's Agronomic Soil Fertility Analysis and Recommendations to Owner and Landscape Architect prior to amending of the soil and ordering soil amendments. The locations of where each of the soil test samples were derived from the Project Site shall be keyed to the site plan and shall be included with the results.

C. Planting operations shall not commence until the results of the Agronomic Soil Fertility Analysis and Recommendations are reviewed accordingly by the Owner and Landscape Architect.
1. The quantity or type of amendments may be modified by the Landscape Architect. The Agronomic Soil Fertility Analysis and Recommendations shall take precedence over the

amendment and fertilizer application rates specified herein or on the Contract Documents.

D. The Agronomic Soil Fertility Report/Recommendation shall take precedence over the amendment and fertilizer application rates specified herein or on the Contract Documents.

E. Submittals under this Article (including Samples) will be rejected without the benefit of review by the Owner or Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.

F. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Owner and Landscape Architect.

1.6 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications for requirements indicated herein this Section:
   1. Licensed Landscape Contractor, in the State of North Carolina.
      a. Engage an experienced, licensed Contractor who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
      b. Installer's Field Supervision: Contractor shall maintain an experienced, full-time landscape supervisor/superintendent at the Project Site during times that landscaping operations identified herein the Contract are in progress.

B. Manufacturer’s Directions: Follow Manufacturer’s directions and drawings in cases where the Manufacturers of articles used in this Section furnish directions covering points not shown in the Contract Drawings or Contract Specifications.

C. Permits, Fees, Bonds, Testing, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, testing, and inspections necessary to perform and complete his portion of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.8 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to adequate Soil Preparation operations are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease operations and notify Owner and Landscape Architect for further direction.

C. Installation: Perform Soil Preparation operations only when weather and soil conditions are suitable in accordance with locally accepted practices.

D. Construction Site Observations: Periodic site observations shall be made by the Landscape Architect during the installation of Work under this Section. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Landscape Architect are required.

1.9 SITE CONDITIONS

A. Project Site shall be free of weeds and invasive prior to Topsoil distribution or soil amendment placement.

B. Excessive rock, dead or declining vegetation, trash, debris, or other items that has accumulated throughout the duration of the Project shall be removed from the Project Site by the Contractor, and as directed by the Owner or Landscape Architect.

C. Grading and soil preparation Work shall be performed only during the period when beneficial and optimum horticultural results may be obtained. If the moisture content of the soil should reach such a level that working it would destroy soil structure or cause compaction, spreading and grading operations shall be suspended until the moisture content is increased or reduced to acceptable levels and the desired results are likely to be obtained.
   1. Soil moisture level prior to planting shall be no less than 75% of field capacity.
   2. If the soil moisture level is found to be insufficient for planting, planting pits shall be filled with water and allowed to drain before commencing planting operations.

D. Planting areas which become compacted in excess of 85% relative compaction due to construction activities shall be tilled and thoroughly cross-ripped to a minimum depth of twelve-inches (12”) to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.

E. Fill areas deeper than one foot, shall be crossed-ripped to a minimum depth of 24 inches on 12”inch centers.

1.10 SUBSTITUTIONS

A. Substitutions shall be in accordance with Division I.
   1. Specific reference to Manufacturer’s names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Owner and Landscape Architect for Work under this Section.

B. Materials substituted and installed by the Contractor, without prior written approval by the Owner and/or Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
   1. Contract Price: Substituted Materials shall not increase the Contract price.

PART 2 – PRODUCTS

2.1 PLANTING SOIL (TOPSOIL)

A. Topsoil: Meet ASTM D5268, pH range of 5.5 to 7, 4 percent organic material minimum.
   1. Topsoil Source: Provide Imported Topsoil obtained from off-site sources, from naturally well-drained sites; do not obtain from bogs or marshes.
      a. Quantity: Provide Imported Topsoil as soon as an insufficient quantity of native stockpiled surface soil is verified. Quantity of Imported Topsoil to complete the Work shall be calculated by Contractor.
      b. Stockpiling: Stockpile on site as directed by Owner.
      c. Composition: To match in quality, accepted native stockpiled Topsoil.
      d. Analysis: Obtain an Agronomic Soil Fertility Report/Recommendation of the Imported Topsoil from the approved Testing Laboratory indicated herein this Section.
      e. Review: Owner and Landscape Architect reserves the right to take samples of the Imported Topsoil delivered to the site for conformance to the Contract Specifications.
      f. Rejected Imported Topsoil: Immediately remove rejected Imported Topsoil off site, at Contractor's expense.

2.2 SOIL MIXES/BLENDS

See Section 1.3

A. Soil Conditioner Blend, for amending on-site native soils or imported topsoil: Provide a thoroughly blended composition of Bulk Composted Organic Soil Amendment Material and Granular Soil Conditioning Material & Fertilizer. Any substitution for the "Soil Conditioner Blend" listed herein must be requested, in writing, by the Contractor and approved by the Owner and Landscape Architect at least 30 days prior to installation.
   1. Bulk Composted Organic Soil Amendment Material:
      a. Material Composition: Bulk Composted Organic Soil Amendment Material shall be produced from a composted, nitrolized blend of wood shavings, forest products, and/or rice hulls. Upon completion of the composting process, the Material shall be thoroughly cured for a minimum of 100 days, and shall be free from any trash (glass, metal, plastic, etc.) deleterious materials, bio-solids, and/or toxic chemicals. The Material shall be non-hazardous, and conform to US Environmental Protection Agency 40 CFR503 criteria for "Class A" products. (Note: this standard is for biosolids. The application rate is limited to the agronomic supply of nitrogen.). It shall also exceed standards and specifications for unrestricted application as a landscaping and agricultural soil amendment.
         1). Gradation/Screen Analysis: A minimum of 90% of the material by weight shall pass a ½" screen. Material passing the screen shall meet the following criteria:

Percent Passing	Sieve Designation
85-100	9.51 mm (3/8")
0-80	2.38 mm (No. 8)

         2). Maturity: Physical characteristics suggestive of maturity include shall include:
            i. Color: Dark brown to black
            ii. Odor: No odor, soil-like. Grounds for unacceptable Material include sour, putrid, or ammonia-like odors.

iii. Particle characterization: Identifiable wood pieces are acceptable but the balance of Material should be soil-like without recognizable grass or leaves.

b. Analytical Properties: Contractor shall submit proof of the Bulk Composted Organic Soil Amendment Material by providing a sample as identified herein this Section, and a lab analysis that has been performed within 30 days of the installation of the planting. Soil mix shall have (at a minimum) the following properties:

Material	*Minimum Targeted Property/Range*
Total Nitrogen (N%)	.50-1.0%
Phosphorus (as P2O5)	2.0%
Potassium (as K2O)	0.2%
pH (units)	7.0-8.0, as determined in saturated paste.
Organic Content	Minimum 50% based on dry weight and determined by ash method. Minimum 205 lbs. organic matter per cubic yard of compost.
ECe (millimho/cm)	<5.0; based on pre-leaching with equal volume of water.
Carbon-to-Nitrogen Ratio	<25-to-1, nitrogen stabilized.
Bulk Density	500 to 2,000 pounds/cubic yard.
Sodium Absorption Ratio (SAR)	Under 6.0
Total Iron	1.5%-3
Moisture Content	35%-60%

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic	20	copper	150	selenium
cadmium	15	lead	200	silver
chromium	300	mercury	10	vanadium
cobalt	50	molybdenum	20	zinc
		nickel	100	

c. Application Rate: As indicated herein this Section under "Planting Soil Amendments Schedule".
d. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
1). Triangle Landscape Supply, Raleigh, NC. 919-274-1555
2). Carolina Mulch Plus, Raleigh, NC. 1-866-626-8524
3). Or equal, as approved by the Owner and Landscape Architect.

2. Granular Soil Conditioning Material & Fertilizer
a. Material Composition and Analytical Properties: Granular Soil Conditioning Material & Fertilizer shall be a singular manufacturer-blended combination of soil conditioning material and fertilizer. It shall be granular in form, long-lasting, free flowing, and suitable for application with approved equipment. It shall not contain any sewage sludge or manure-based products, and shall contain the following guaranteed minimum available analysis range:

Element/Material	*Targeted Property Range*
Nitrogen (N)	5.0% to 6.0%
Phosphoric Acid (as P2O5)	2.0% to 3.0%
Potash (as K2O)	1.0% to 4.0%
Humic Acids	15.0 % to 20.0%
Calcium	7.0%
Sulfur	0.0% to 5.0%

b. Commercial-Grade Products, Manufacturers and Associated Rates of Application: Subject to compliance with requirements, provide products by one (1) of the following:
i. LESCO Products, Cleveland, OH (800).321.5325
a). Verify Specific Product and Application Rate (lbs. per square feet of planting area) with Landscape Architect and Agronomic Soil Fertility Analyses Report.
ii. John Deere Landscapes (828) 651 9967
a). Verify Specific Product and Application Rate (lbs. per square feet of planting area) with Landscape Architect and Agronomic Soil Fertility Analyses Report.
iii. Or equal, as approved by the Owner and Landscape Architect.

B. Amended Imported Soil Mix for On Structure Plant Areas:
1. Submit Mix to Owner Landscape Architect for evaluation.
2. Recipe: Per Contract Documents
3. Provide Mix in sufficient quantities which allow for natural settling and compaction of the Mix in the plant area prior to installing Plant Materials, Planting vessels shall be compacted to 90% density to minimize settling. Set Mix and compact accordingly in 6" lifts, to depth called out on contract documents.

2.3 ORGANIC SOIL AMENDMENT COMPONENTS

A. Washed Plaster Sand: Clean, washed, natural or manufactured sand, sharp, free of toxic materials. Sieve tested in accordance with ASTM C136, with 100% passing through a #8 screen, 0 % passing through a #200 screen.

1. Chemical Properties: (by Saturation Extract Method):
   a. Soluble Salts/Salinity: Maximum conductivity of 3.0 milliohms/cm at 25 degrees C. Determined in saturation extract.
   b. Boron: Maximum concentration of 1.0 ppm.
   c. Sodium Absorption Ratio (SAR): Maximum 6.0.

B. Perlite: Horticultural Perlite, soil amendment grade, 6.5 to 7.5 pH.
   1. Unacceptable Materials: Polystyrene beads shall not be used as a substitution for horticultural Perlite.

C. Vermiculite: Horticultural Vermiculite, gold-brown in color,
   1. Size: 2-4mm, 5 mesh to 10 mesh sieve size
   2. Density: 4.5 to 5.5 lb./cuft.
   3. Grade: #2, Medium Grade.

D. Peat Humus:
   1. Type: Canadian Sphagnum Peat, as derived from the genus Sphagnum, medium-divided, coarse fibrous texture, brown in color.
   2. Measurement: Measure peat in air dry condition, containing not more than 35% moisture by weight on an "as-received" basis.
   3. Physical Properties:

Percent Passing	Sieve Size
95 - 100	9.51 mm (3/8 in.)
0 - 40	500 micron (#35, 32 mesh)

   4. Organic Content (dry weight basis): minimum 95%.
   5. Fiber Content: Greater than 66%
   6. Water Holding Capacity: 20x to 30x its dry weight in water.
   7. Range in Ash Content (%): 1.0 to 5.0.
   8. Chemical Properties:
      a. Nitrogen (dry weight basis): 0.6-3.0%.
      b. Salinity/Soluble Salts: Saturation extract conductivity 0.0-3.0 milliohms/cm @ 25 degrees C.
      c. pH range: 3.0 to 4.0.
   9. Unacceptable Materials:
      a. Coir Dust.
      b. Sedge Peat.
      c. Reed Peat.
      d. Hypnum Peat.

E. Mycorrhizal Inoculum:
   1. Mycorrhizal Inoculum for Plant Materials: Dual soil-conditioning biological inoculum system of endo-and ecto- Mycorrhizal, used to further aid the plants ability to efficiently uptake available soil nutrients and increase resistance to drought.
      a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
         i. *7-gram Myco-Pak*, Tri-C Enterprises LLC, Chino, CA, 800-927-3311
         ii. *4 oz. Packet - Roots 1 Step*, Roots, Inc., Independence, MO, 800-342-6173.
         iii. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051

iv. Or equal, as approved by Owner and Landscape Architect.

b. Provide at the prescribed application rate, per the Manufacturer's written recommendations.

2. Mycorrhizal Inoculum for Plant Materials from Hydromulch-type Applications: To be added as part of the Hydromulching operations, providing a dual soil-conditioning biological inoculum system of endo-and ecto- Mycorrhizal to further aid the immature plant's ability to efficiently uptake available soil nutrients and also increase resistance to drought.

a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

i. *Gro-Life*, Gro-Power, Gro-Power, Chino, CA. 909-393-3744.

ii. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051

iii. Or equal, as approved by Owner and Landscape Architect.

b. Provide at the prescribed application rate per the Manufacturer's written recommendations, or as indicated herein this Section.

2.4 CHEMICAL SOIL AMENDMENT COMPONENTS

A. General: Chemical Soil Amendment Components listed herein may or may not be used, depending on the results of the Agronomic Soil Fertility Report. Provide as required:

B. Gypsum: Commercially-processed and packaged agricultural-grade hydrated calcium sulfate product (CaSO4), 92.0% minimum, pH at 7.1.

1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a. *Ben Franklin™ No. 1 Agricultural Gypsum*, U.S. Gypsum Company.
   b. *100% Good Stuff Gypsum™*, Art Wilson Company.
   c. Or equal as approved by Owner and Landscape Architect.

C. Iron: Becker Underwood Sprint 138 Fe or other FeEDDHA chelated iron or . Becker Underwood Sprint 330 Fe or other FeDTPA chelated iron

D. Ground Limestone: Agricultural-grade limestone containing not less than 85% of total carbonates, ground to such fineness that 50% will pass a #100 sieve, and 90% will pass #60 sieve.

E. Dolomite Lime: Agricultural-grade mineral soil conditioner containing 35% minimum magnesium carbonate, and 49% minimum calcium carbonate, 100% passing #65 sieve.

F. Sulphate of Potash: Agricultural-grade, containing 50% to 53% of water-soluble potash.

G. Single Superphosphate: Commercial product containing 20% to 25% available phosphoric acid.

H. Triple Superphosphate: Commercial product containing 45% available phosphoric acid

I. Ammonium Sulfate: Commercial product containing approximately 21% nitrogen in the ammonia form.

J. Ammonium Nitrate: Commercial product containing approximately 17% nitrogen in the ammonia form and 17% nitrogen in the nitrate form.

K. Calcium Nitrate: Agricultural grade containing 15-1/2% nitrogen and 21% calcium.

L. Urea Formaldehyde: Granular commercial product containing 38% nitrogen.

2.5 FERTILIZERS

A. Composition: Nitrogen (N), phosphorous (P), and potassium (K) content, plus other elements, as indicated.

B. Turf Grass Starter Fertilizer (pre-plant 3-12-12), as required:
1. General: Shall be applied for turf grasses planted from sod or seed (not hydroseed or hydrostolons).
2. Fertilizer shall be an organic-based, long-lasting, controlled-release, uniform in composition, free flowing, granular-type fertilizer with micronutrients, suitable for application with approved equipment. Fertilizer shall be high in potassium and phosphorous elements to aid in strong root development.
   a. Turf/Lawn fertilizer shall contain the following minimum available percentages by weight of plant food (pending results of soil analysis):

Element/Material	*Targeted Property Range*
Nitrogen (N)- Slow Release	3.0% minimum
Phosphoric acid (as P2O5)	12.0% minimum
Potash (as K2O)	12.0% minimum
Humus	35.0% minimum
Humic Acids w/ micronutrients and soil enhancers	7.0% minimum

3. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a. *Gro-Power 3-12-12 Flower & Bloom,* Gro-Power, Chino, CA. 909-393-3744.
   b. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051
   c. Or equal, as approved by Owner and Landscape Architect.
4. Application Rate: Twenty (20) pounds per 1,000 SF.

C. Commercial Fertilizer (Controlled Release Nitrogen, 6-8 Month Formulation):
1. Pelleted- or granular-form fertilizer, organic-based, long-lasting, controlled-release, uniform in composition, free flowing, singular manufacturer-blended combination of soil conditioning material and fertilizer with micronutrients, suitable for application with approved equipment. It shall not contain any sewage sludge or manure-based products, and shall contain the guaranteed minimum available analysis range.

Element/Material	*Targeted Property Range*
Total Nitrogen (N)	12%

Available Phosphoric Acid (as P2O5)	8%
Soluble Potash (as K2O)	8%
Sulphur (S)	7%
Iron (Fe)	2%
Manganese (Mn)`	.05%
Zinc (Zn)	.05%
Humic Acids	5.0%

2. Commercial-Grade Products, Manufacturers and Associated Rates of Application: Subject to compliance with requirements, provide products by one (1) of the following:
   a. *Gro-Power Controlled Release Nitrogen 12-8-8*, Gro-Power, Chino, CA. 909-393-3744.
   b. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051
   c. Or equal, as approved by Owner and Landscape Architect.
      1). Application Rate per Manufacturer's recommendation and Soil Fertility Report.

E. Fertilizer Tablet:
1. General: Fertilizer Tablet shall be a 7-gram tablet, organic-based, tightly compressed chip-type commercial grade, 12-month slow-release planting tablets, and shall be composed of the following available percentages by weight of plant food:

Element/Material	*Targeted Property Range*
Nitrogen (N)	12.0% minimum
Phosphoric acid (as P2O5)	8.0% minimum
Potash (as K2O)	8.0% minimum
Humus	20.0% minimum
Humic Acids w/ micronutrients and soil enhancers	4.0% minimum

2. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a. *Gro-Power 12-8-8 Planting Tablets*, Gro-Power, Chino, CA 909-393-3744.
   b. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051
   c. Or equal, as approved by Owner and Landscape Architect.
      i. Application Rate: As indicated herein Part III this Section.

2.6 ACCESSORIES

A. Drain Rock/Aggregate: Crushed Stone, conforming to ASTM C-33, graded to ¾"-size, clean, hard, durable, free of materials toxic to plant growth, set in bottom of Planters, at depth indicated in Contract Drawings. Provide Geotextile Filter Fabric between Drain Rock/ Aggregate and amended planting backfill soil.

B. Wetting Agent/Water Storing Polymer: Non-biodegradable, granular, polyacrylamide polymer soil amendment.

1. Commercial-Grade Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
    a. *Broadleaf P4*, Broadleaf Industries, Inc. Chula Vista, CA 619-424-7880.
    b. Or equal by Plant Health Care, Inc, Pittsburgh, PA 1-800-421-9051
    c. Or equal, as approved by Owner and Landscape Architect.
        i. Application Rate per Manufacturer's recommendation and Soil Fertility Report.

C. Drainage Mat:
1. Description: Two (2) -layer composite polyester non-woven filter fabric, bonded to a compression resistant nylon matting of open, three-dimensional construction.
2. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
    a. *#9010,* American Enka, as distributed by American Excelsior Co., 916-383-3835.
    b. Or equal (no known equal).

D. Perforated Drain Pipe & Drain Sock. (See Section 329301 "Landscape Planting Accessories").

E. Landscape Mulch Material. (See Section 329301 "Landscape Planting Accessories").

PART 3 – EXECUTION

3.1 SOIL PERCOLATION TESTS

A. Type/Quantity: During operations of Agronomic Soil Fertility Testing and prior to installing Plant Material, Contractor shall perform Soil Percolation Tests, through the direction of the Landscape Architect, in selected representative areas of the Project Site, to verify acceptable natural drainage, soil structure, and soil composition. Contractor shall verify the locations of the Soil Percolation Tests with the Landscape Architect.
1. Required Number of Soil Percolation Tests: Six (6)

B. Procedure: Each Soil Percolation Test shall be performed as follows:
1. Dig a hole: 2'-0" wide x 2'-0" long x 2'-0" deep.
2. Fill the hole with water to top and cover with plywood and barricade. Allow hole to drain and fill again to top.
3. Make daily observations, noting the depth of water each day.
4. Report findings, in writing, to the Landscape Architect. Include the length of time the water takes to drain completely from each hole, date of test, location, and other information, which may be useful in providing further recommendations.

C. Results: Based on the combined results of the Agronomic Soil Fertility Testing and the Soil Percolation Tests, Contractor may be required to install additional tree drainage sumps or other drainage methods at each planting pit for trees larger than 15-gallon container stock. This does not relieve the Contractor's obligation within the Base Bid to provide the required Tree Root Aeration Units indicated in Section 329301 "Landscape Planting Accessories". Contractor shall include, as a line-item price within the Base Bid, the price per each additional tree drainage sump, should they be required (based on the testing). Should additional tree drainage sumps or other methods is required, compensation shall be awarded to the Contractor at the line-item price (each) as provided by the Contractor.

3.2 SOIL MOISTURE CONTENT

A. General: Do not work soil when moisture content is so great that excessive compaction occurs, or when it is so dry that dust will form in air, or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting. Soil moisture level prior to planting shall be no less than 75% of field capacity. The determination of adequate soil moisture for planting shall be the judgment of the Landscape Architect. Range: Maintain within two-percent (2%) above or below optimum moisture content at times during Work.

3.3 PROTECTION OF SITE

A. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and maintenance period.

B. Protect concrete paving, headers, and drainage from staining due to contact with wet nitrogen stabilized mulch/sawdust, or contact with chelated iron. Correct any stained concrete.

3.4 CLEARING & CULTIVATION

A. Clearing: Clear planting areas free of stones two-inches (2") in diameter and larger, weeds, debris, and other extraneous materials prior to soil preparation Work.

B. Pre-Plant Weed Control:
   1. Clear and remove existing weeds by mowing or grubbing to at least one-inch (1") below the soil surface.
   2. Fertilize areas to receive planting with a 46-0-0 NPK commercial fertilizer at the rate of ½ lb. per 1,000 square feet.
   3. After fertilization, irrigate the soil thoroughly and continuously at the equivalent of four inches (4") of water distributed over a fourteen (14)-day period. The application of water shall be applied to the soil as needed to gradually soak through the soil profile and not allowed to run-off the surface. Employ a specific watering duration and frequency program designed to germinate residual weeds.
      a. Providing full irrigation coverage for the limits of the subject areas under this requirement shall be the responsibility of the Contractor. Contractor shall utilize permanent irrigation system installed under other Sections of the Contract, where available. Should limited coverage or no permanent irrigation system is available, Contractor shall provide temporary irrigation, as required, to fully meet the requirements herein.
   4. After sufficient weed germination is present, apply non-selective, post-emergent contact herbicide, in strict accordance to the Manufacturer's directions. Refer to Section 329302. Protect and buffer surrounding properties, buildings, and vegetation from overspray, as required.
   5. Allow for a sufficient time period to ensure that the weeds are dead and the herbicide has dissipated, per the Manufacturer's recommendation.
   6. Water planting areas thoroughly and continuously for a period of one (1) week after the application of the herbicide. Discontinue the watering process for one (1) day prior to the second application of the herbicide. Apply a second application of the herbicide. Avoid

any irrigation for a minimum of four (4) days after the second application for effective weed kill.

7. After the second application and waiting period, water planting areas thoroughly and continuously for three (3) consecutive days to saturate upper layers of the soil prior to commencing planting operations.
8. Dead weeds shall be cleared and removed prior to planting.
9. Maintain a weed-free Project Site until final acceptance by the Owner, utilizing mechanical, chemical, or manual treatment.

C. Cultivation of Existing Topsoil:
   1. Cultivation: Following Pre-Plant Weed Control operations, in planting areas where Topsoil will NOT be applied, rip or cultivate areas of existing soil to receive planting to the following depth, prior to applying soil amendments:
      a. Less Than 2:1 Slopes: Ten-inches (10”).
      b. 2:1 Slopes and Greater: Six-inches (6”).
   2. Trees to Remain: Hand cultivate within the drip-line of existing trees to remain. Depth of cultivation shall not exceed two-inches (2”). Cultivate immediately prior to amending existing soil.
   3. Following initial cultivation of Topsoil, uniformly broadcast and cultivate/blend the materials indicated in the following Planting Soil Amendments Schedule, with the Topsoil, to a minimum six-inch (6”) depth:

Planting Soil Amendment Schedule:

Soil Amendment/Fertilizer	Ratio
First Component of Soil Conditioner Blend: Bulk Composted Organic Soil Amendment	4 cu. yds. / 1,000 square feet of planting area.
Second Component of Soil Conditioner Blend: Granular Soil Conditioning Material & Fertilizer	At indicated ratio, per selected Manufacturer.
Gypsum	20 pounds / 1,000 square feet.
Commercial Fertilizer (Slow Release)	At indicated ratio, per selected Manufacturer.
Soil Sulfur	8 pounds / 1,000 square feet of planting area.
Iron (non-staining)	10 pounds / 1,000 square feet of planting area.

   a. Modifications: The Planting Soil Amendment Schedule may be modified, based on the combined results of the Agronomic Soil Fertility Tests and Percolation Tests.

i. Contractor shall be provided with fair and adequate compensation by the Owner should additions or increases to the specified ratios are required to the Planting Soil Amendment Schedule due to the Agronomic Soil Fertility Test results and/or recommendations by the Landscape Architect.
ii. Contractor shall provide the Owner fair and adequate credit should subtractions or decreases to the specified ratios are required to the Planting Soil Amendment Schedule due to the Agronomic Soil Fertility Test results and/or recommendations by the Landscape Architect.

4. Complete finish grading operations per Section 312001 "Finish Grading".

D. Cultivation of Sub-Grade and Spreading of Imported Topsoil:
1. Verification: In planting areas where Imported Topsoil will be applied, verify that sub-grades prior to installation of Imported Topsoil have been established under rough grading. Do not spread Imported Topsoil prior to acceptance of sub-grade Work.
   a. Depth: Verify that sub-grades are twelve inches (12") minimum below finished grades, +/- one-inch (1"). Report variations to Owner.
2. Cultivation: Following Pre-Plant Weed Control operations, rip or cultivate sub-grade in planting areas to a depth of six-inches (6") prior to spreading Imported Topsoil.
3. Spread Imported Topsoil in planting areas, as required to meet required finished grades. Once Imported Topsoil has been spread, uniformly broadcast and blend materials indicated in the Planting Soil Amendments Schedule (indicated above) with the Imported Topsoil to a six-inch (6") depth.
4. Complete finish grading operations per Section 312001 "Finish Grading".

E. Fertilizer Tablet(s) Application Rate:
1. Fertilizer Tablets shall be spread equidistantly around the perimeter within the Amended Planting Backfill Mixture, up to within three (3") inches of the finished grade of the Mixture, and at the following rates:

Size of Plant Material	*Total Quantity of 7-gram Fertilizer Tablets*
Liner, Plug, Flat-Size Plant, or 4" Pot.	One (1) Tablet
One (1)-gallon Container stock.	Three (3) Tablets
Five (5)-gallon Container stock.	Nine (9) Tablets
Fifteen (15)-gallon container stock, or 16" Ball & Burlap	Fifteen (15) Tablets
20" Box Container Stock, 1 ¼" – 2" Caliper or 20" – 28" Ball & Burlap	Sixteen (16) Tablets
24" Box Container Stock, 1 ½" – 2 ½" Caliper or 28" Ball & Burlap	Sixteen (16) Tablets

30” Box Container Stock, 2 ½ ” – 3” Caliper or 28” - 32” Ball & Burlap	Eighteen (18) Tablets
36” Box Container Stock 3” – 3 ½” Caliper or 32” - 38” Ball & Burlap	Twenty (20) Tablets
42” Box Container Stock 3 ½” – 4” Caliper or 38” – 42” Ball & Burlap	Twenty-two (22) Tablets
48” Box Container Stock 4” – 5” Caliper or 42” – 54” Ball & Burlap	Twenty-four (24) Tablets
60” Box Container Stock 4 ½” – 6” Caliper or 48” – 60” Ball & Burlap	Thirty-six (36) Tablets
For Container Stock larger than 60” Box.	Six (6) Tablets for each ½” of tree caliper size.

2. Contractor shall not provide Fertilizer Tablets for designated native plant species, as indicated in the Contract Drawings or as directed by the Owner or Landscape Architect. Contractor shall verify with the Landscape Architect, in writing, as to which plants are subject to not receive the Fertilizer Tablets.

F. Mycorrhizal Inoculum Application Rate:
   1. During application of Fertilizer/Planting Tablets, Mycorrhizal Inoculum packets shall also be spread equidistantly around the perimeter within the Amended Planting Backfill Mixture, up to within three (3”) inches of the finished grade of the Mixture, at the prescribed application rate per the Manufacturer’s written recommendations.

3.6 DRAINAGE OF PLANTING AREAS

A. Surface Drainage:
   1. Discrepancies: Provide proper surface drainage of planted areas. Submit in writing all discrepancies in the Contract Drawings or Specifications, or prior work done by others, which Contractor feels precludes establishing proper drainage.
   2. Correction: Include description of work required for correction or relief of said condition.

B. Detrimental Drainage, Soils and Obstructions:
   1. Notification: Submit in writing all soils or drainage conditions considered detrimental to growth of plant materials. State condition and submit proposal and cost estimate for correcting condition.
   2. Correction: Submit for acceptance a written proposal and cost estimate for the correction before proceeding with Work.

3. Obstructions: If rock, underground construction Work, tree roots, or other obstructions are encountered in the performance of Work under this Section, submit cost required to remove the obstructions to a depth of not less than six inches (6”) below the required soil depth.

3.7 CLEAN UP AND PROTECTION

A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.

B. Protect site from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged Soil Preparation areas as directed.

C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section, as directed by the Owner or Landscape Architect.

END OF SECTION 328401

SECTION 32 92 19 SEEDING AND MULCHING

1. **DESCRIPTION**:

1.1 The work covered by this section consists of furnishing all labor, materials, and equipment to perform all necessary operations to topsoil, fine grade, fertilize, mulch and maintain temporary and permanent seeding of all graded, cleared, or disturbed areas during construction. The work covered by this section shall be in conformance with Section 880 of the "Standard Specifications for Roads and Structures" dated February 10, 2006, published by the North Carolina Department of Transportation and with Section 6.ll of the "Erosion and Sediment Control Planning and Design Manual" published by the Land Quality Section of the North Carolina Department of Environment and Natural Resources unless otherwise stated herein.

1.2 Related Work: See following sections for related work:

1. 31 11 00 - Clearing and Grubbing.
2. 31 22 00 - Grading
3. 31 25 00 - Erosion and Sediment Control.

2. **MATERIALS**:

2.1 Topsoil: Topsoil shall be from stockpiles created from stripping and required excavation. Should additional topsoil be required in excess of that obtained from stripping and excavation, the contractor shall obtain material from other sources on the site where authorized by the Owner, or from approved sources off the site. The topsoil shall be natural, friable soil, possessing characteristics of representative soils in the vicinity which produce heavy growths of crops of grass. It shall be obtained from naturally well-drained areas, shall be reasonably free from subsoil, brush, objectionable weeds, and other litter and shall be free from toxic substances, clay lumps, stones, roots and other objects larger than l inch in diameter, or any other material which might be harmful to plant growth or be a hindrance to grading, planting, and maintenance operations.

2.2 Fertilizer: Fertilizer shall be the product of an approved commercial fertilizer manufacturer and shall be 5-10-5 grade, uniform in composition, free-flowing material suitable for application with approved standard equipment. The fertilizer shall conform to the applicable State fertilizer laws and shall be delivered to the site in bags or other convenient containers each fully labeled and bearing the name, trademark, and warranty of the producer.

2.3 Lime: Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that at least 50% will pass through a 100-mesh sieve and at least 90% will pass through a 20-mesh sieve. Coarser materials will be acceptable provided the specified rates of application are increased proportionately on the basis of

quantities passing the l00-mesh sieve, but no additional payment will be made for the increased quantity.

2.4 Mulch: Mulch shall be straw from wheat or oats. Materials for securing mulch may be one of the following:

2.5 Mulch Netting: Only netting made from natural occurring fibers shall be used, such as cotton, jute, or paper.

2.6 Peg and Twine: Bailing twine and soft wood pegs l/2" x l" x l2".

2.7 Liquid Mulch Binder: RC-2 cut back asphalt conforming to the requirements of Federal Specifications SS-A67lA, and asphalt emulsion shall conform to the requirements of Federal Specification SS-A-674, Type V.

2.8 Seed: Seed used shall bear the official "certified seed" label inspected by North Carolina Crop Improvement Association. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable. The seed used shall be that shown in seeding schedule specified herein or on the plans.

2.5 Wire Staples:

2.5.1 Wire staples shall be a No. 9 staple and shall be at least 1½ inches long.

3. **Installation**:

3.1 Seedbed Preparation:

3.1.1 Clearing: Prior to or during grading and tillage operations, the ground surface shall be well drained, cleared of all brush, roots, stones larger than 2 inches in diameter, or any other material which may hinder proper grading, tillage, or subsequent maintenance operations.

3.1.2 Fine Grading: Areas to be seeded shall be graded as shown on the drawings or as directed and all surfaces shall be left in an even and properly compacted condition so as to prevent the formation of depressions where water will stand. Areas to be topsoiled shall be graded to a smooth surface and to a grade that will allow topsoiling to finished grade.

3.1.3 Topsoiling: Immediately prior to placing topsoil, the subgrade, where excessively compacted by traffic or other causes, shall be loosened by scarifying to a depth of at least 2 inches to permit bonding of the seeding and mulching to the subgrade.

3.1.4 Tillage: After grassed areas required to be seeded have been brought to the grades shown on the plans and as specified, they shall be thoroughly tilled to a depth of 3 inches

by approved methods, until the condition of the soil is acceptable to the Engineer. Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. The work shall be performed only during periods when satisfactory results are likely to be obtained. When conditions are such, by reason of drought, excessive moisture or other factors, that results are not likely to be satisfactory, the Engineer will stop the work and it shall be resumed only when, in his opinion, the desired results are likely to be obtained.

3.2 Limestone, Fertilizer and Seed:

3.2.1 General: Seasonal limitations for seeding operations; the kinds and grades of fertilizers; the kinds of seed; the rates of application of limestone, fertilizer, and seed shall be as shown in the seeding schedule.

3.2.2 Equipment to be used for the application, covering, or compaction of limestone, fertilizer, and seed shall have been approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.

3.2.3 Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer, but no limestone or fertilizer shall be distributed and no seed shall be sown when the Engineer determines that weather and soil conditions are unfavorable for such operations.

3.2.4 During the application of fertilizer, adequate precautions shall be taken to prevent damage to structures or any other appurtenances. The Contractor shall either provide adequate covering or change methods of application as required to avoid such damage. When such damage occurs, the Contractor shall repair it, including any cleaning that may be necessary.

3.3 Limestone and Fertilizer: Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at a specified rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

3.3.1 If liquid fertilizer is used, storage containers for the liquid fertilizer shall be located on the project and shall be equipped for agitation of the liquid prior to its use. The storage containers shall be equipped with approved measuring or metering devices which will enable the Engineer to record at any time the amount of liquid that has been removed from the container. Application equipment for liquid fertilizer, other than a hydraulic seeder, shall be calibrated to insure that the required rate of fertilizer is applied uniformly.

3.4 Seeding: Seed shall be distributed uniformly over the seedbed at the rate indicated in the seeding schedule, and immediately harrowed, dragged, raked, or otherwise worked so as

to cover the seed with a layer of soil. The depth of covering shall be as directed by the Engineer. If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.

3.4.1 When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two kinds of seed are being used which require different depths of covering, the seed requiring the lighter covering may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.

3.4.2 When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.

3.4.3 Immediately after seed has been properly covered, the seedbed shall be compacted in the manner and degree approved by the Engineer.

3.5 Modifications: When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the Engineer may direct or permit that modifications be made in the above requirements which pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compaction of the seedbed.

3.5.1 Such modifications may include but not be limited to the following:

1. The incorporation of limestone into the seedbed may be omitted on (a) cut slopes steeper than 2:1 (b) on 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or (c) on areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

2. The rates of application of limestone, fertilizer, and seed on slopes 2:l or steeper or on rocky surfaces may be reduced or eliminated.

3. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

3.6 Mulch:

3.6.1 General: All seeded areas shall be mulched unless otherwise indicated on the plans or directed by the Engineer. Application rate of mulch shall be indicated in seeding schedule.

3.6.2 Mulching: Mulch shall be applied within 36 hours after the completion of seeding unless otherwise permitted by the Engineer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

3.6.3 Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

3.6.4 Mulch Binding: Mulch shall be held in place using devices approved by the Engineer as per manufacturers recommendations. During application, the Contractor shall take adequate precautions to prevent damage to structures or appurtenances.

3.7 Maintenance:

3.7.1 General: The Contractor shall be responsible for the proper care and maintenance of the seeded areas until the work under the entire contract has been completed and accepted by the Engineer. Maintenance shall consist of repair and replacement of eroded areas, watering, refertilizing, reliming, reseeding, and remulching as necessary to provide an even, fixed growth of grass. In addition, the Contractor shall provide protection against traffic and shall erect the necessary barricades and warning signs immediately after planting is completed.

3.7.2 Mowing: The seeded areas shall be mowed with approved mowing equipment as per seeding schedule. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be removed at no cost to the Owner.

3.8 Inspection and Testing:

3.8.1 Fertilizer and Lime: The Engineer shall be furnished with duplicate copies of invoices for all fertilizer and lime used on the project. Invoices for fertilizer shall show the grade furnished. Invoices for lime shall show total minimum carbonates and minimum percentages of the material furnished that pass l00-mesh and 20-mesh sieve. Upon completion of the project, a final check of the total quantities of fertilizer and lime used will be made against the total area topsoiled and seeded, and if the minimum rates of application have not been met, the Engineer may require the distribution of additional quantities of these materials to make up the minimum application specified at no additional cost to the Owner.

3.8.2 Seed: The Engineer shall be furnished duplicate signed copies of a statement from the Vendor, certifying that each container of seed delivered is fully labeled and in full accordance with the specifications in this section and the seeding schedule.

END OF SECTION

SECTION 329300 - EXTERIOR PLANTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete exterior landscape planting installation, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this section consists of, but is not necessarily limited to, furnishing and installing the following:
   1. Trees.
   2. Shrubs.

C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 320190 – Tree and Shrub Preservation
   2. Section 312001 – Finish Grading
   3. Section 328401 – Soil Preparation
   4. Section 329301 – Landscape Planting Accessories
   5. Section 329302 – Landscape Establishment Period

1.3 DEFINITIONS

A. “Plant Material” refers to living plant species, inclusive of trees, shrubs, groundcovers, vines, ornamental grasses, cacti/succulents, espaliers, annuals, perennials, etc. as indicated in the Contract Drawings.

B. “Planting Area” (PA) as denoted on the Contract Drawings shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.

C. Acceptance: Wherever the terms “accepted”, “approved”, “acceptable”, or “directed” are used herein, they shall mean “reviewed accordingly” by the Owner and Landscape Architect.

D. References:
   1. ASTM - American Society for Testing Materials.
   2. USDA – United States Department of Agriculture.
   3. ANSI – American National Standards Institute.

E. Plant Height: Measurement of main body height, not measurement to branch tip.

F. Plant Spread: Measurement of main body diameter, not measurement from branch tip to branch tip.

1.4 REFERENCE STANDARDS

A. Plant Material shall be true to botanical and common name as indicated in the following:
   1. *American Standard for Nursery Stock*, ANSI Z60.1-1966, edition approved November 6, 1996, American Association of Nurserymen, and American National Standards Institute.
   3. *American Joint Committee on Horticultural Nomenclature*, 1942 Edition of Standardized Plant Names.
   4. *Hortus III*, 1976 Edition, Liberty Hyde Bailey Hortorium, Cornell University.
   5. *The Hillier Gardener's Guide to Trees and Shrubs*, 4th Edition, 1978.
   6. *Manual of Cultivated Conifers*, Den Ouden & Boon, 1978.
   7. *Datascape Guide to Commercial Nomenclature*, American Nurserymen Publishing Co., Chicago, IL, 1994.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.

C. Planting installation schedule, indicating anticipated locations and dates for each type of planting.

D. Submittals under this Article will be rejected without the benefit of review by the Owner and Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.

E. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Landscape Architect.

1.6 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications:
   1. Engage an experienced Installer who has demonstrated completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
      a) Requirement: Licensed Landscape Contractor in the State of North Carolina.
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping installations under this Section are in progress.

B. Provide quality, size, genus, species, and variety of Plant Material indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."
   1. Selection of Plant Material purchased under allowances will be made by the Owner, who has the option to tag Plant Material stock at their place of growth before they are prepared for transplanting.

2. At least one (1) plant of each Plant Material species delivered to the Project Site shall have an identification tag from supplying nursery showing botanical and common name of the plant as identified in the Contract Drawings. Landscape Architect shall be provided the opportunity for an on-site debriefing by the Contractor that identifies the size and specific type of Plant Material upon delivery.
3. Incorrect Planting Materials:
   a). Replace, at no cost to Owner, Plant Material that is revealed during the course of the Contract as to being untrue to the species indicated in the Contract Drawings and reviewed accordingly under this Section.
   b). Provide replacements equal to the size and quality to match the planted materials at the time the untrue species is discovered.
4. Replacement of Plant Material: Refer to Guarantee Article indicated herein this Section.

C. Observation: Owner and Landscape Architect may observe Plant Materials at either their place of growth or at the site before or after planting, for compliance with requirements for genus, species, variety, size and quality. Owner and Landscape Architect also retain right to observe Plant Material further for size and condition of root balls, trunks, branches, and crowns; insects; pests; disease; weeds; injuries, and latent defects. Owner and Landscape Architect reserve the right to reject unsatisfactory and/or defective Plant Material at any time during progress of Work. Contractor shall remove rejected Plant Material immediately from Project site.

D. Regulatory Requirements:
1. Contractor shall meet the requirements of applicable laws, codes, and regulations as required by the authorities having jurisdiction over the Work.
2. Provide for inspections and permits by Federal, State, and Local authorities in furnishing, transporting, and installing materials.

E. Permits, Fees, Bonds, and Inspections: Contractor shall arrange and pay for permits, fees, bonds, and inspections necessary to perform and complete Work under this Section.

F. Plant Material Review and Selection (Tagging):
1. At the discretion of the Landscape Architect, Plant Material will be subject to review, photographed, and selected/tagged by the Landscape Architect at the nursery, or other place of growth, prior to delivery to the Project Site. Contractor shall verify with the Landscape Architect if tagging operations are required.
2. Selecting/Tagging of Plant Materials at the nursery or place of growth does not cancel the right of the Owner and/or Landscape Architect to reject Plant Materials at the Project Site, if damaged or unacceptable conditions are found that were not detected at the nursery, place of growth, or in the submitted photographs.
3. Plant Material Delivery: Plant Material shall be delivered with original Plant Material tagging materials set in place, as selected and marked by the Landscape Architect at the nursery or place of growth. Contractor shall notify Landscape Architect upon deliver of Plant Material for review of stock and tagging materials. Plant Materials delivered without original tagging materials, or with broken, damaged, or altered tagging materials, shall be subject to rejection by the Owner or Landscape Architect. Rejected Plant Material shall be removed immediately.

G. Contract Drawings and Contract Specifications:

1. Comply with the intent and meaning of Contract Drawings and Contract Specifications taken as a whole, not taking advantage of any readily perceived error or omission, shall any exist.
2. Figures and dimensions on the Contract Drawings shall take precedence over measurements by scale, and detailed drawings shall take precedence over general drawings.
3. Refer any errors and/or discrepancies in or between Contract Drawings and Contract Specifications to the Landscape Architect for adjustments before proceeding with the Work. The Contractor shall assume responsibility for proceeding with Work without referring.
4. Landscape Architect shall interpret the meaning of the Contract Drawings and Contract Specifications in the event of conflict, and their decision shall be final.

H. Pre-installation Conference: Conduct conference at Project Site to comply with requirements of Division 01 Section "Project Meetings."

I. Protection of Plant Material:

1. Refer to Requirements specified in Section 320190 “Tree and Shrub Preservation”.
2. It is the intent of the Contract Documents that certain existing Plant Materials shall be retained. Prior to the removal of any Plant Materials, the Contractor shall confer with the Landscape Architect to determine which Plant Materials are to remain.
3. All existing Plant Materials which are to remain in the project shall be tagged and identified by the Contractor prior to start of Work.
4. Contractor shall be responsible for Plant Materials that are designated to remain. Damage to any Plant Materials which results in death or permanent disfiguration of said Materials shall result in compensation outlined in Section 320190 “Tree and Shrub Preservation”.
5. Existing Plant Materials designated to remain shall be protected at all times from damage by construction activity (tools, materials, equipment, personnel, etc.). Damage by the Contractor to existing Plant Materials shall be repaired at the Contractor’s expense to the satisfaction of the Owner, as directed by the Landscape Architect.
6. Contractor shall insure that no foreign material and/or liquid, such as paint, concrete, cement, oil, turpentine, acid or the like, be deposited or allowed to be deposited on soil within the drip line (the outside edge of the foliage overhang) of any Plant Material. Do not store construction materials, debris, or excavated material within drip line of existing Plant Material. Should any such poisoning of the soil occur, the Contractor shall thoroughly remove said soil as directed by the Landscape Architect and replace with acceptable soil at no additional cost to Owner.
7. Excavation adjacent to existing Plant Materials: Where it is necessary to excavate in close proximity to the drip lines of existing Plant Materials, all possible caution shall be exercised to avoid injury to roots and trunk. Excavation close to Plant Materials shall be done by hand, with narrow-tine spading forks or other approved tools to comb soil to expose roots. Tunnel under roots 2” and larger in diameter. Cutting of roots 2” and larger shall be only on the approval of the Landscape Architect.
8. Replacement of Damaged Plant Material: Replace existing Plant Material to remain as required, that are damaged by Contractor during construction with accepted Plant Material of the same species, size, and quantity as those damaged, at no additional cost to Owner. Owner shall be the sole judge as to the extent of the damage and the value of said damaged Plant Material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Plant Material: Do not prune before delivery, except as approved by the Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie Plant Material in such a manner as to destroy natural shape. Provide protective covering during delivery.
   1. Immediately after digging field-grown Plant Materials, pack root systems in wet straw, hay, burlap, or other suitable material to keep root system moist until final planting installation
   2. Deliver freshly dug field-grown Plant Materials with firm, natural balls of earth of sufficient depth to include fibrous and feeding roots, meeting or exceeding requirements of ANSI Z60.1 for root ball diameter.

B. Handling Plant Materials:
   1. Handle balled and burlap Plant Material stock by the root ball.
   2. Handle container-grown Plant Materials only by their containers.
   3. DO NOT handle Plant Materials by their trunks or stems.
   4. DO NOT drop any Plant Materials.
   5. DO NOT bind or handle Plant Materials with wire or rope.
   6. Pad trunk and branches of Plant Materials whenever using hoisting cables, chains, or straps.
   7. Should the Contractor engage in handling any Plant Material(s) by any unacceptable method(s), the Owner and Landscape Architect shall reserve the right to reject any of the mishandled Plant Material(s). The Contractor shall replace rejected Plant Material(s) with approved Plant Material(s), at no additional cost to the Owner.

C. Deliver Plant Material only after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, set Plant Materials in shade, protect from weather and mechanical damage, and keep roots moist. Anchor plants to prevent damage from winds.
   1. Heel-in bare-root Plant Material stock. Soak roots in water for two (2) hours prior to planting.
   2. Set balled Plant Material stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   3. DO NOT remove container-grown Plant Material stock from containers before time of planting.
   4. Water root systems of Plant Material stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.8 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Acceptance: Do not install Plant Materials prior to acceptance of finish grades.

B. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease planting operations and notify Owner and Landscape Architect for further direction.

D. Construction Site Observations: Periodic site observations shall be made by the Owner and Landscape Architect during the installation of work under this Section. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Owner and Landscape Architect are required.

1.9 SUBSTITUTIONS

A. Substitutions shall be in accordance with Division I.
   1. Specific reference to Plant Materials herein this Section are used as standards of quality. This implies no right to the Contractor to substitute other Materials without prior written approval by the Owner and Landscape Architect for work under this Section.

B. Plant Materials substituted and installed by the Contractor, without prior written approval by the Owner and Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.
   1. Substituted Plant Materials shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted. If larger Plant Materials are accepted, increase the ball of earth in proportion to the size of the plant, as required. Plant Materials overgrown for their container size will be rejected.

C. Contract Price: Substituted Plant Materials shall not increase the Contract price.

1.10 GUARANTEE

A. General: The Guarantee indicated herein in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract, and shall be in addition to, and run concurrent with, other guarantees or warranties made by the Contractor under requirements of the Contract Documents.

B. Guarantee: Contractor shall guarantee living Plant Materials under this Section for a period of one (1) year after date of Substantial Completion. Guarantee against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Owner; abnormal weather conditions unusual for the Guarantee Period; or incidents which are beyond the Contractor's control.

C. Replacement of Plant Material:
   1. Replace Plant Materials exhibiting conditions which are determined to be unacceptable due to workmanship by the Contractor, at no cost to the Owner, per the direction of the Landscape Architect.
   2. Remove and replace dead or dying Plant Material immediately unless required to plant in the succeeding planting season.
   3. Contractor shall be held responsible for a maximum of two (2) replacement of each failed Plant Material after Final Acceptance during the Guarantee Period.
      a). Closely match replacements to adjacent specimens of the same species. Apply requirements of this Specification to replacements.

1.11 FINAL ACCEPTANCE AND LANDSCAPE ESTABLISHMENT PERIOD

A. Refer to Section 329302 “Landscape Establishment Period.”

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PLANT MATERIAL

A. Immediately upon award of Contract for Work in this Section, the Contractor shall locate and purchase or hold for purchase plant material as required.

B. Contractor shall verify with Landscape Architect of Plant Material that has been nursery contract grown by the Owner for use of Work under this Contract.
   1. Contractor shall review the condition of the Plant Material with Landscape Architect at the nursery maintaining the Plant Material, and at the time of delivery at the Project Site.

C. Plant Materials shall have a growth habit typical for each variety and species indicated in the Plant List; Plant Materials shall be symmetrical, with tightly knit branching, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry, healthy, and vigorous in growth. Plant Materials shall be free from insect pests, eggs and larvae, plant diseases, sun scalds, fresh bark abrasions, excessive abrasions, windburn, salt burn, weeds, or other disfigurements or conditions, as determined by the Landscape Architect.
   1. Container stock (excluding annuals) shall be grown in containers in which delivered for at least one (1) growing season, but not over two (2) years. Plant Material grown in boxes or containers shall be cultivated during this time to permit full rooting within the specified container to bind the planting soil, but not so long as to create a “root-bound” condition. Plant Material shall be completely free of circling, kinked or girdling trunk surface and center roots, and show no evidence of a pot-bound condition. No boxed or container Plant Material shall be planted which have cracked or broken balls of earth when separated from their boxes or containers. No Plant Material shall be planted with damaged roots, broken root balls, or which are found to be “root-bound” when separated from their containers.
   2. Growing Conditions: Plant Materials shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project unless otherwise specifically authorized.
   3. Pruning: Pruning of Plant Material as grown at the nursery shall conform to ANSI A300-Part 1 Pruning standards.
      a). Do not prune Plant Materials before delivery. Consult Landscape Architect for pruning after installation.
   4. Plant Material shall be subject per the North Carolina State Department of Agriculture’s Regulations for Nursery Inspections of Rules and Grading. Quantity and size of Plant Material shall be No. 1 Grade of Pinto Tag stock.

D. Measurements: Measurements: Measure Plant Material according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes.
   1. Take caliper measurement at a point on the trunk six-inches (6”) above natural ground line for trees up to four-inches (4”) in caliper (at a point twelve-inches (12”) above the natural ground line for trees over four-inches (4”) in caliper.)

a). Measure foliage across mean foliage dimension when branches are in their normal upright position.
b). For trees to be supplied in "raised up" condition, foliage origin along main trunk shall be measured from soil line after installation.
c). Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.

2. Size Range: If a range of size is given, do not use Plant Materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plant Materials that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

E. Field Dug Stock: Prior to digging of field-grown Plant Materials, insure that excess loose fill resulting from cultivation around trunks/stems and over roots be removed down to natural finish grade at crown of Plant Materials. During digging, verify that size of tree spade or other equipment is adequate to encompass the actively growing root zone of all Plant Materials. Plant Materials which, after digging, show mostly large fleshy roots and few fibrous roots will be rejected.

F. Condition of Root Systems: Plant Materials must prove to be completely free of circling, kinked or girdling trunk surface and center roots and show no evidence of a root-bound condition. Upon inspection by Landscape Architect at the job site, if five (5) percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species shall be rejected.

G. Unacceptable Trees: Trees that have damaged or crooked leaders will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused will be rejected.

2.2 SHADE AND FLOWERING TREES

A. Shade and Flowering Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required, subject to review and acceptance by the Landscape Architect. Container-grown trees will be acceptable and shall be subject to meeting ANSI Z60.1 limitations for container stock.
1. Branching Height: 1/3 to 1/2 of tree height.

B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, subject to review and acceptance by the Landscape Architect. Container-grown trees will be acceptable and shall be subject to meeting ANSI Z60.1 limitations for container stock. Stem form shall be as specified on the Contract Documents:
1. Form: Single stem, or,
2. Form: Multi-stem, clump, with two (2) or more main stems.

C. Field Dug and/or Specimen Trees:

Form: As specified on the Contract Documents for height, spread, and/or caliper, subject to review and acceptance by the Landscape Architect at the supplying nursery prior to delivery and installation. Provide superior quality, full, symmetrical, well-rooted, upright, spreading, with well-balanced crown.

1. Form to be selected by the Landscape Architect

2.3 SHRUBS

A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of Shrub. Container-grown Shrubs will be acceptable in lieu of balled and burlapped. Shrubs subject to meeting ANSI Z60.1 limitations for container stock, subject to review and acceptance by the Landscape Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED ACCORDINGLY BY THE OWNER AND LANDSCAPE ARCHITECT.

B. Prior to commencing Work under this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and to the point where Work herein may commence properly. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. Installation practices of the Plant Materials shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practices, as judged by the Owner and Landscape Architect.
   1. Soil moisture levels prior to planting shall be no less than 75% of field capacity.
      a). If the soil moisture level is found to be insufficient for planting installation, planting pits shall be filled with water and allowed to drain before commencing planting operations.
      b). Any planting area that may become compacted in excess of 85% relative compaction (due to construction operations or other activities during the Contract) shall be tilled and thoroughly cross-ripped to a minimum depth of nine-inches (9”) to alleviate the condition, taking care to avoid all existing subsurface utilities, drainage, etc.
      c). Do not commence planting installation prior to acceptance of Soil Preparation (See Section 328401 “Soil Preparation”).

D. Contractor shall notify the Owner and Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.

E. Preparation of Planting Installation: Lay out individual Plant Material locations and areas for multiple plantings. Stake locations, outline areas, and gain the Owner and Landscape Architect’s acceptance prior to commencing physical planting installation. Contractor shall make minor adjustments to the planting layout as required, per the direction of the Owner and Landscape Architect.

F. No more Plant Materials shall be distributed in the planting area on any day than can be installed and watered on that day. Plant Materials shall be planted and watered immediately after the removal of their containers, as applicable.

G. Contractor shall protect existing and new improvements and systems installed prior to planting installation. Maintain protection in place until completion of Work and Landscape Establishment Period.

H. Finish Grades for planting areas shall have been established (per Section 312001 "Finish Grading") prior to Work under this Section, Verify that grades are within one-inch plus or minus (1"+/-) of the required finish grade, and that all proper soil amendments and fertilizers have been furnished and installed accordingly as specified (per Section 328401 "Soil Preparation").
   1. Maintain positive surface drainage of all planted areas throughout the duration of the Contract.

I. Pre-Planting: Where Plant Materials are to be pre-planted to permit site improvements to be installed around them, Contractor shall be responsible for the accurate layout and placement of those Plant Materials, as measured to their centerlines. Confirm designated pre-planting operations with Owner and Landscape Architect prior to commencing Work. Contractor shall also be responsible for the protection of pre-planted Plant Materials while other Work is taking place around them. Provide regular irrigation, as necessary, for plant establishment

3.2 EXCAVATION FOR PLANT MATERIAL

A. General: Upon completion of applicable pre-planting soil preparation requirements indicated in Section 328401 "Soil Preparation", excavate planting hole(s) for Plant Material with scarified vertical sides, with the bottom of the excavated hole slightly raised and compacted at the center to assist drainage and to minimize settlement of the Plant Material. Excavate holes according to the spacing alignment (i.e. hedge spacing, grid spacing, triangular spacing, etc.) and the on-center (O.C.) spacing intervals (i.e. 24" O.C. etc.) indicated on the Contract Drawings. Loosen any hard subsoil in the bottom of the excavation where evident, and remove all rocks greater than one-half-inch (1/2") in diameter, trash, debris, etc. Retain the excavated soil for use as part of the Amended Planting Backfill Mixture (as indicated in Section 328401 "Soil Preparation").
   1. Bare-Root Plant Material:
      a). Excavate at least twenty-four-inches (24") wider than the perimeter of the bare root spread, and deep enough to allow setting of the roots on a compacted layer of native planting soil, where the top of the plant's root collar is one-inch (1") higher than finished grade or as further directed by the Landscape Architect:
      b). Compacted Setting Layer: Provide a crown of a minimum six-inch (6") depth of native planting soil.

   2. Balled and Burlap Plant Material:
      a). Excavate the planting hole to the width and depth indicated in the Contract Drawings. Depth of the planting hole includes the depth indicated for the compacted setting layer at the bottom of the excavation, where the top of the plant's root collar is one-inch (1") higher than finished grade or as further directed by the Landscape Architect:

b). Compacted Setting Layer: Provide a crown of a minimum six-inch (6") depth of native planting soil.

3. Container-Grown Plant Material:
   a). Excavate the planting hole to the width and depth indicated on the Contract Drawings. Depth of the planting hole includes the depth indicated for the compacted setting layer at the bottom of the excavation, where the top of the plant's root collar is one-inch (1") higher than finished grade or as further directed by the Landscape Architect:
   b). Compacted Setting Layer: Provide a crown of a minimum six-inch (6") depth of native planting soil.

4. Field Grown/Specimen Trees:
   a). Excavate the planting hole to the width and depth indicated on the Contract Drawings. Depth of the planting hole includes the depth indicated for the compacted setting layer at the bottom of the excavation, where the top of the plant's root collar is one-inch (1") higher than finished grade or as further directed by the Landscape Architect:
   b). Compacted Setting Layer: Provide a crown of a minimum six-inch (6") depth of native planting soil.
   c). In areas where special subsurface drainage for planting is indicated, tie drainage pipes, as required, into the drain system.

B. Obstructions: Notify the Owner and Landscape Architect immediately if unexpected rock, debris, contaminants, obstructions, or other items that are detrimental to the healthy sustained growth of Plant Material is encountered in the excavation process.
   1. Hardpan Layer: If encountered, drill six-inch (6") diameter holes into free-draining strata or to a depth of ten-feet (10'), whichever is less, and backfill with free-draining material.

C. Drainage: Notify the Owner and Landscape Architect if subsoil conditions show evidence of unexpected water seepage or retention in planting holes.

3.3 PLANTING PLANT MATERIAL

A. Bare Root Plant Material: Set Bare Root Plant Material plumb and in center of the excavated hole, with top of root ball set properly at the adjacent finish grade as indicated. Set Bare Root Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.
   1. Thoroughly soak the roots of the Bare Root Plant Material in clean water for a minimum of twelve (12) hours but no more than twenty-four (24) hours to fully hydrate the root mass. Do not soak above the root crown.
   2. Remove wood shavings or other material used to keep the exposed root mass in a moist condition.
   3. Carefully place the Plant Material stock on the specified setting layer of compacted native soil, with the top of root mass set approximately one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide an orientation of the Plant Material that is confirmed and acceptable by the Landscape Architect. During the process of determining an acceptable orientation of the Plant Material, carefully handle the Plant Material by its trunk.

4. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:
   a). ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 328401 "Soil Preparation").
   b). ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 328401 "Soil Preparation").
   c). Add Mycorrhizal Inoculum to the excavated native soil, (per Section 328401 "Soil Preparation"), per the Manufacturer's latest printed instructions.
      1). The Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
         a). The cost of providing modifications to the Amended Planting Soil Backfill Mixture shall be borne by the Contractor.
5. Backfilling the excavated planting hole:
   a). Place the Amended Planting Backfill Mixture around the Plant Material root mass in the excavated planting hole. Place the Mixture in six-inch (6") lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets.
   b). Maintain the Plant Material plumb while working the Mixture around the root mass. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
   c). Add the Fertilizer Tablets and other amendments, (per Section 328401 "Soil Preparation") as required, at the prescribed application rates (as indicated per Section 328401 "Soil Preparation") or if not indicated, per the Manufacturer's latest printed instructions.
   d). Place the final layers of the Amended Planting Backfill Mixture, tamping accordingly, to the top of the root mass.
   e). Dish and tamp top of the Mixture to form a three-inch (3") deep watering basin centered on the Plant Material's trunk to the rim width of the planting hole.
   f). Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329301 "Landscape Planting Accessories"). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.
6. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329301 "Landscape Planting Accessories" for type and requirements.

B. Balled and Burlapped Plant Material: Set the Balled and Burlapped Plant Material plumb and in center of the excavated hole, with top of the root ball raised above adjacent finish grade as indicated. Set Balled and Burlapped Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.

1. Carefully place the Balled and Burlapped Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation of the

Plant Material, handle the Plant Material by its root ball; avoid handling the Plant Material by its trunk.

2. Once orientation is accepted, carefully remove the burlap and wire baskets from the tops of the root ball and partially from the sides, but do not remove from under the root ball. Do not damage the root ball or any part of the plant. Plant Material shall be rejected if the root ball is cracked or broken before or during the planting operation.
3. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:
   a). ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 328401 "Soil Preparation").
   b). ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 328401 "Soil Preparation").
   c). Add Mycorrhizal Inoculum to the excavated native soil, (per Section 328401 "Soil Preparation"), per the Manufacturer's latest printed instructions.
      1). The Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
         a). The cost of providing modifications to the Amended Planting Soil Backfill Mixture shall be borne by the Contractor.
4. Backfilling the excavated planting hole:
   a). Place the Amended Planting Backfill Mixture around the root ball in the excavated planting hole. Place the Mixture in six-inch (6") lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets.
   b). Maintain the plant plumb while working the Mixture around the root ball. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
   c). Add the Fertilizer Tablets and other amendments, (per Section 328401 "Soil Preparation") as required, at the prescribed application rates indicated herein this Article or if not indicated, per the Manufacturer's instructions.
   d). Place the final layers of the Mixture, tamping accordingly, to the top of the root ball. Do not place the Mixture on top of the root ball.
   e). Dish and tamp top of the Mixture to form a three-inch (3") deep watering basin centered on the Plant Material's trunk to the rim width of the planting hole. Do not cover the top of the root ball with the backfill mixture.
   f). Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329301 "Landscape Planting Accessories"). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.
6. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329301 "Landscape Planting Accessories" for type and requirements.

C. Container-Grown Plant Material: Set Container-Grown Plant Material plumb and in the center of the excavated planting hole, with top of the root ball raised above adjacent finish grade as indicated. Set Container-Grown Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.

1. For plastic container stock (4" pot, 1-gallon, 5-gallon, 15-gallon, etc.), carefully remove the plant container prior to setting the plant in the excavated hole so as not to damage root ball. Tip container to horizontal position and shake carefully to remove Plant Material. Support root ball during installation to prevent cracking or shedding of soil.
2. Set the Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation of the plant material, carefully handle the Plant Material by its container; avoid handling the Plant Material by its trunk.
   a). Plant Material with a damaged root ball upon removal of the container, or if the root ball fails to thoroughly hold the soil as it is removed from the container, or if the plant is mishandled or damaged during planting operations, shall be rejected.
3. For wooden boxed container stock, carefully set whole boxed container of the Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation, carefully handle the Plant Material by its container; avoid handling the Plant Material by its trunk or branches. Once orientation is accepted, remove the steel strapping and the sides of the wooden container so as not to damage the root ball or any part of the plant. Do not remove the bottom of the wooden container. Discard sides.
   a). Plant Material with a damaged root ball upon removal of the container, or if the root ball fails to thoroughly hold the soil as it is removed from the container, or if the plant is mishandled or damaged during planting operations, shall be rejected.
4. Scarification: After removing container from plant, scarify the sides of the root ball to a depth of one-inch (1") at four (4) to six (6) equally-spaced locations around the perimeter of the root ball or at twelve-inch (12") intervals on sides of wooden boxed container stock. Cut and remove circling roots over 3/8 in. diameter.
5. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing/blending the following:
   a). ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 328401 "Soil Preparation").
   b). ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 328401 "Soil Preparation").
   c). Add Mycorrhizal Inoculum to the excavated native soil, (per Section 328401 "Soil Preparation"), per the Manufacturer's latest printed instructions.
      1). The Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
         a). The cost of providing modifications to the Amended Planting Soil Backfill Mixture shall be borne by the Contractor.
6. Backfilling the excavated planting hole:
   a). Place the Amended Planting Backfill Mixture around the root ball in the excavated planting hole. Place the Mixture in six-inch (6") lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets. Foot tamp the backfill, as required.

b). Maintain the plant plumb while working the Mixture around the root ball. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
c). Add the Fertilizer Tablets and other amendments (per Section 328401 "Soil Preparation") as required, at the prescribed application rates indicated herein this Article or if not indicated, per the Manufacturer's instructions.
d). Place the final layers of the Mixture, tamping accordingly, to the top of the root ball. Do not place the Mixture on top of the root ball.
e). Dish and tamp top of the Mixture to form a three-inch (3") deep watering basin centered on the Plant Material's trunk to the rim width of the planting hole. Do not cover the top of the root ball with the backfill mixture.
f). Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329301 "Landscape Planting Accessories"). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.

8. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329301 "Landscape Planting Accessories" for type and requirements.

D. Field-Dug Specimen Plant Material: Set Field-Dug Specimen Plant Material plumb and in the center of the excavated planting hole, with top of the root ball raised above adjacent finish grades as indicated. Set Field-Dug Specimen Plant Material in the proper spacing and/or alignment(s) as indicated on the Contract Documents, or as further directed at the Project Site by the Landscape Architect.
1. After excavation of the planting hole, provide subsurface piping drainage as necessary. Tie subsurface drainage into storm drainage system, where required.
2. Carefully set the Field-Dug Specimen Plant Material stock on the specified setting layer of compacted native soil, with the top of root ball set one-inch (1") above the finished grade to allow for settlement of the Plant Material within the excavated planting hole. Provide the orientation of the Plant Material that is confirmed and accepted by the Landscape Architect. During the process of determining an acceptable orientation of the Plant Material, carefully handle the Plant Material by a cradle around its root ball mass or by its planting container; avoid handling the Plant Material by its trunk.
a). For Field-Dug Specimen Plant Material delivered in a wooden boxed container, do not remove sides or bottom of the container until the Specimen's orientation is accepted by the Landscape Architect. Once orientation is accepted, remove steel strapping and the sides of the wooden container so as not to damage the root ball or any part of the Specimen. Do not remove the bottom of the wooden container. Discard sides.
1). Any Specimen with a damaged root ball upon removal of the container, or if the root ball fails to thoroughly hold the soil as it is removed from the container, or if the plant is mishandled or damaged during planting operations, shall be rejected.
3. Scarification: After removing container from plant, scarify the sides of the root ball to a depth of one-inch (1") at four (4) to six (6) equally-spaced locations around the perimeter of the root ball or at twelve-inch (12") intervals on sides of wooden boxed container stock. Cut and remove circling roots over 3/8 in. diameter.
4. Prepare the Amended Planting Backfill Mixture: Amend each cubic yard (cu/yd) of native soil excavated from the planting hole by incorporating and thoroughly mixing and blending in the following:

a). ¼ yard of Bulk Composted Organic Soil Amendment Material (per Section 328401 "Soil Preparation").
b). ½ pound of Granular Soil Conditioning Material & Fertilizer (per Section 328401 "Soil Preparation").
c). Add Mycorrhizal Inoculum to the excavated native soil, (per Section 328401 "Soil Preparation"), per the Manufacturer's latest printed instructions.
1). The Amended Planting Backfill Mixture may be modified accordingly to include additional soil amendments or fertilizers (gypsum, iron, potash, etc.) or the ratios as indicated in the Mixture indicated above may be modified.
a). The cost of providing modifications to the Amended Planting Soil Backfill Mixture shall be borne by the Contractor.

5. Backfilling the excavated planting hole:
a). Place the Amended Planting Backfill Mixture around the root ball in the excavated planting hole. Place the Mixture in six-inch (6") lifts, tamping each lift accordingly to settle the Mixture and eliminate voids and air pockets.
b). Maintain the plant plumb while working the Mixture around the root ball. When the planting hole is approximately half-backfilled, water thoroughly before placing the remainder of the Mixture.
c). Add the Fertilizer Tablets and other amendments, as required, at the prescribed application rates indicated herein this Article or if not indicated, per the Manufacturer's instructions.
d). Place the final layers of the Mixture, tamping accordingly, to the top of the root ball. Do not place the Mixture on top of the root ball.
e). Dish and tamp top of the Mixture to form a three-inch (3") deep watering basin centered on the Plant Material's trunk to the rim width of the planting hole.. Do not cover the top of the root ball with the backfill mixture.
f). Thoroughly mix together water and Plant Vitamin/Hormone Stimulant in application ratio as recommended by Stimulant Manufacture (per Section 329301 "Landscape Planting Accessories"). Apply liquid matrix in sufficient quantity to thoroughly saturate the basin to settle the Mixture, and to eliminate voids and air pockets. Should any portions of the root mass be exposed, add additional Mixture as needed to thoroughly cover the root mass.

6. Mulching: Apply mulch in watering basins as indicated on the Contract Drawings. Refer to Section 329301 "Landscape Planting Accessories" for type and requirements.

E. Plant Settling and Orientation: Plant Material that has settled deeper than the surrounding grade shall be excavated and raised to the correct level, to the satisfaction of the Landscape Architect. Plant Material installed without direction and/or approval as to its proper orientation shall be subject to excavation and acceptable orientation, to the satisfaction of the Landscape Architect.

F. Fertilizer Tablet(s) Application Rate. (See Section 328401 "Soil Preparation").

G. Labels: Remove all nursery-type labels, flags, and or identification markings from Plant Materials.

3.5 PRUNING PLANT MATERIAL

A. At no time shall Plant Material be pruned, trimmed, thinned, shaped, or topped prior to delivery. Pruning, trimming, thinning, shaping, or topping of Plant Material shall be only

conducted on the Project Site, and under the presence and direction of the Landscape Architect or approved Certified Arborist Plant Material that has been pruned and delivered to the Project Site without prior approval by the Landscape Architect or an approved Certified Arborist shall be rejected.

B. When directed by the Landscape Architect or an approved Certified Arborist, Contractor shall prune, thin, and shape plant material, according to standard horticultural practice, to preserve the natural character of the Plant Material.
   1. Pruning and remedial work shall be done per ANSI A300-Part 1 Pruning Standards.
   2. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from trees.
   3. Prune shrubs accordingly to retain natural character
   4. Provide pruning, cabling and bracing, irrigation, pest and disease control and other remedial treatments as recommended to assure the long-term health of the trees and existing vegetation, and the safety of persons and property.
   5. Newly planted trees shall be pruned near the termination of the Landscape Establishment Period, per the direction of the Landscape Architect, as required.

3.6 CLEAN UP AND PROTECTION

A. During landscaping operations, keep Work area in an orderly and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.

B. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section and directed by the Landscape Architect.

D. Scars, ruts, or other marks in the ground caused by the Contractor's Work shall be repaired.

E. Remove equipment and implements of service, and leave the entire Project Site area in a neat, clean, and Owner-approved condition. Sidewalks, driveways, pavements, and site areas shall receive a broom-clean treatment or other cleaning treatment as directed by the Owner and/or Landscape Architect.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Contractor shall remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.8 FINAL REVIEW

A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. Refer to Section 329302 "Landscape Establishment Period", for requirements.

END OF SECTION 329300

SECTION 329301 - LANDSCAPE PLANTING ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete exterior Landscape Planting Accessories installation, as shown in the Contract Drawings, and as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, furnishing and installing the following:
   1. Mulches.
   2. Stakes and Guys.
   3. Miscellaneous Materials (Herbicides, Vitamin Stimulant/Root Hormone, etc.).

C. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 328401 – Soil Preparation
   2. Section 329219 – Seeding and Mulching
   3. Section 329300 – Exterior Plants
   4. Section 329302 – Landscape Establishment Period.

1.3 DEFINITIONS

A. “Plant Material(s)” refers to living plant species, inclusive of trees, shrubs, groundcovers, vines, ornamental grasses, cacti/succulents, espaliers, annuals, perennials, etc. for the Project.

B. “Planting Area” (PA) as denoted on the Contract Drawings shall refer to areas to be installed with Plant Material(s), or areas where existing vegetation shall be protected.

C. Acceptance: Wherever the terms “accepted”, “approved”, “acceptable”, or “directed” are used herein, they shall mean acceptance by the Owner and Landscape Architect.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
   1. Product literature, supplied by Manufacturers indicating that their products comply with specified requirements. Certificates shall include grade(s), analysis, amount(s), supplier(s), grade(s), typ(s), size(s), as applicable.

C. Samples: Submit the following physical Samples to the Owner or Landscape Architect.
   1. 0.50 cubic foot of Landscape Mulch Material (i.e. Shredded Wood Mulch, Aggregate Mulch, etc.) for each color and texture of material required for Project.

2. One (1) set of Tree Tying Materials for each type used, as applicable.

D. Submittals under this Article (including Samples) will be rejected without the benefit of review by the Owner and Landscape Architect if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is missing or not presented in the format as requested.

E. No Work shall proceed under this Section until Submittal requirements indicated herein have been reviewed accordingly by the Owner and Landscape Architect.

1.5 QUALITY ASSURANCE AND CONTROL

A. Installer Qualifications for all items indicated herein this Section:
   1. Engage an experienced Installer who has completed Landscape Planting Accessories work similar in material, design, and extent to that indicated for this Project and with a record of successful installation.
      a) Requirement: Licensed Landscape Contractor in the State of North Carolina
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that installations under this Section are in progress.

B. Observation: Owner and Landscape Architect may observe installation of Landscape Planting Accessories at Project Site for compliance with requirements for type, size, and quality. Owner and Landscape Architect retain right to observe Landscape Planting Accessories for defects and to reject unsatisfactory or defective material at any time during progress of Work. Contractor shall remove rejected Accessories immediately from Project site.

C. Manufacturer’s Directions: Follow Manufacturer’s directions and drawings in cases where the Manufacturers of articles used in this Section furnish directions covering points not shown in the Contract Drawings and Contract Specifications.

D. Contract Drawings and Contract Specifications:
   1. Comply with the intent and meaning of Contract Drawings and Contract Specifications taken as a whole, not taking advantage of any readily perceived error or omission, shall any exist.
   2. Figures and dimensions on the Contract Drawings shall take precedence over measurements by scale, and detailed drawings shall take precedence over general drawings.
   3. Refer any errors and/or discrepancies in or between Contract Drawings and Contract Specifications to the Landscape Architect for adjustments before proceeding with the Work. The Contractor shall assume responsibility for proceeding with Work without referring.
   4. Landscape Architect shall interpret the meaning of the Contract Drawings and Contract Specifications in the event of conflict, and their decision shall be final.

E. Pre-installation Conference: Conduct conference at Project Site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide new, unused Materials indicated under this Section. Store and secure properly to prevent damage.

B. Deliver Landscape Planting Accessories so as to not delay Work, and install only after preparations for installation have been completed.

1.7 COORDINATION, SCHEDULING, AND OBSERVATIONS

A. Utilities: Determine location of above grade and underground utilities and perform Work in a manner which will avoid damage to utilities. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to installing Landscape Planting Accessories are encountered, such as rubble fill, adverse drainage conditions, or obstructions, cease installation operations and notify the Owner and Landscape Architect for further direction.

C. Installation: Perform installation of Landscape Planting Accessories only when weather and soil conditions are suitable in accordance with locally accepted practices.

D. Construction Site Observations: Periodic site observations shall be made by the Owner and Landscape Architect during the installation of Work under this Section. The Contractor shall request, in writing, at least one (1) week in advance of the time when mandatory site observation(s) by the Owner and Landscape Architect are required.

1.8 SUBSTITUTIONS

A. Substitutions shall be in accordance with Division I.
   1. Specific reference to Manufacturer's names and products specified herein are used as standards of quality. This implies no right to the Contractor to substitute other materials without prior written approval by the Owner and Landscape Architect for Work under this Section.

B. Landscape Planting Accessories substituted and installed by the Contractor, without prior written approval by the Owner and Landscape Architect, may be rejected. Contractor shall not be entitled to be compensated by the Owner where the Contractor has installed rejected substitutions without receiving prior written approval.

C. Contract Price: Substituted Landscape Planting Accessories shall not increase the Contract price.

1.9 LANDSCAPE ESTABLISHMENT PERIOD

A. Refer to Section 329302 "Landscape Establishment Period", for requirements under this Article.
   1. During the duration of the Landscape Establishment Period, continuously maintain Landscape Planting Accessories by tightening, holding plumb, and/or repairing Staking and/or Guying supports, providing adequate depths and coverage requirements of Landscape Mulching Materials, monitoring drainage within Tree Root Aeration Units,

hold Edging Materials and true and in proper alignment, and other requirements, as required, to establish healthy, viable landscape Planting Materials; until Final Acceptance of Work is granted.

PART 2 – PRODUCTS

2.1 LANDSCAPE MULCH MATERIAL

A. Organic Wood Mulch: Organic Wood Mulch, free from deleterious materials, debris, and weed seed. Suitable as a top dressing of trees, shrubs and groundcovers, consisting of following:

1. Type: Shredded cedar, redwood, fir, or hardwood commercial wood bark products, composted with humus and leaf materials. Organic Wood Mulch shall be graded and to average dimensions of one-inch (1") to three-inches (3") in length, and flat in cross section.
   a). Minimum organic matter content at 80%.
   b). pH between 5.0 and 8.0.
   c). Salt content shall be less than 4 millimho/cm @ 25 ˚ C. on a saturated paste extract.
   d). Boron content of the saturated extract shall be less than 1.0 parts per million.
   e). Calcium carbonate shall not be present.
   f). Carbon:nitrogen ratio is less than 100:1.
   g). Compost shall be aerobic without malodorous presence of decomposition products.
   h). Maximum particle size shall be 2 inches. A maximum of 5% shall pass a No. 2 screen.
   i). Maximum total permissible pollutant concentrations in amendment (in parts per million (PPM) on a dry weight basis:
      1). Arsenic 20 ppm
      2). Molybdenum 30 ppm
      3). Cadmium 15 ppm
      4). Nickel 50 ppm
      5). Chromium 150 ppm
      6). Selenium 25 ppm
      7). Cobalt 50 ppm
      8). Silver 10 ppm
      9). Copper 150 ppm
      10). Vanadium 50 ppm
      11). Lead 150 ppm
      12). Zinc 150 ppm
      13). Mercury 10 ppm
2. Coverage depth:
   a). Refer to Part III indicated herein this Section.
3. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a) Triangle Landscape Supply, Raleigh, NC. 919-274-1555
   b) Riverside, Asheville, NC. 828-251-5777
   c) Carolina Mulch Plus, NC. 828-884-9100
   d). Or equal, as approved by the Landscape Architect.

2.2 STAKES AND GUYS

A. Tree Staking Assembly:

1. Wooden Stake Tree Staking Assembly: Complete tree staking Unit, consisting of Lodge Pole Pine Tree Stakes with Tree Straps

    a). Tree Stakes: Lodge Pole Pine Wooden Tree Stake, straight shaft, shaved and cut, cleaned and bare of branches and stubs, free of loose knots, bends, splits, or bows. of uniform thickness, with a minimum diameter of either two-inches (2") or two-one half (2-1/2") to three-inches (3"). Lengths shall be 8'-0", 10'-0" or 12'-0", as required, to adequately and firmly penetrate the sub grade and support the tree. Stake shall have a minimum ten-inch (10") long tapered/conical driving point, and chamfered top to minimize splitting when driven. Stake shall be pressure treated (per Federal Specification TT-W-00571-J-Table 2) with an EPA-registered pesticide containing inorganic arsenic (copper chromium arsenate, meeting Federal Specification TT-W-550-Type 1) to protect it from insect attack and decay.
        1). Quantity, Size, and Length per tree:
            a). 5-gallon container stock: One (1), 2" diameter, 8'-0" long or 10'-0" long (as required) Wooden Tree Stake per tree,
            b). 15-gallon container stock (or 16" Ball & Burlap): One (1), 2" diameter, 10'-0 long or 12'-0" long (as required) Wooden Tree Stake per tree.
            c). 24" box container stock (or 1 ½" – 2 ½" Caliper or 28" Ball & Burlap): Two (2), 2" diameter, 10'-0" long or 12'-0" long (as required) Wooden Tree Stakes per tree.
            d). >24" box container stock: Two (2) 2-1/2" or 3" diameter, 10'-0" or 12'-0" long (as required) Wooden Tree Stakes per tree.
        2). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
            a). John Deere Landscapes, NC. 828-651-9967
            d). Or equal, as approved by the Owner and Landscape Architect.

    b). Tree Straps: Non-stretch, biodegradable, natural tan cotton color, 1" wide x 18" long, with one-inch (1") brass grommets at each end. Break strength at 260 lbs. nominal.
        1). Quantity, Size, and Length per tree:
            a). 5-gallon container stock: Provide two (2) Tree Straps for each Wooden Tree Stake.
            b). 15-gallon container stock or 16" Ball & Burlap: Provide two (2) Tree Straps for each Wooden Tree Stake.
            c). 24" box container stock or 20" – 28" Ball & Burlap: Provide two (2) Tree Straps for each Wooden Tree Stake.
        2). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
            a). *#3018 Original Treestrap®*, GCS.
            b). Or equal (no known equal).
        3). Tree Strap Wire: Smooth, galvanized annealed Steel Wire, 12 gauge. Provide Wire in adequate lengths to anchor the grommet ends of the Tree Straps to the Wooden Tree Stake.

B. Tree Guying Hardware
    1. Tree Support Guying System (above-grade application).
        a). Pre-assembled, pre-packaged, tree anchoring system, specifically manufactured to anchor trees in a primary above-grade application. System components (sized

accordingly to tree caliper) include anchors, wire rope (specify wire rope to be galvanized steel, or clear, highly visible orange, or white vinyl coated wire rope), turn buckles, tree collars, and wire rope clamps.

b). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   1). *Duckbill Tree Anchor System*, Foresight Products, LLC, 6430 E. 49th Drive, Commerce City, CO 80022, 800-325-5360,
   2). Or equal (no known equal).

c). Product Application:
   1). For trees up to 3" caliper, Duckbill Tree Anchor System #40DTS.
   2). For trees up to 6" caliper, Duckbill Tree Anchor System #68DTS.
   3). For trees up to 11" caliper, Duckbill Tree Anchor System #88DTS.

2.3 MISCELLANEOUS MATERIALS

A. Water: Per ASTM C 94, from potable domestic source, and free from deleterious materials such as oils, acids, and organic matter. Transport as required.

B. Stress Reducing Agent:
   1. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      a). *Roots Concentrate*, Roots, Inc., Independence, MO.
      b). Or equal (no known equal).

C. Wetting Agent and Soil Penetrant:
   1. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      a). *Roots NoBurn*®, Roots, Inc., Independence, MO.
      b). *Naiad-SS*,
      c). Or equal, as approved by the Owner and Landscape Architect.

D. Herbicides: EPA registered and approved, from the following:
   1. Non-Selective Post-Emergent Herbicide: Spray-applied solution containing a minimum of 41% of the active ingredient "glyphosate" (full strength), with a surfactant, mixed with water accordingly per the Manufacturer's directions.
      a). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
         1). *Roundup® PRO*, (41% glyphosate), Monsanto Company, St. Louis, MO.
      2). *Roundup® PRO* Concentrate (50% glyphosate), Monsanto Company, St. Louis, MO.
         3). *Honcho® Plus*, (41% glyphosate), Monsanto Company, St. Louis, MO.
         4). *High Yield® Kill-Zall Weed & Grass Killer*, (41% glyphosate),Voluntary Purchasing Groups, Boneham, TX.
         5). Or equal, as approved by the Owner and Landscape Architect.
   2. Selective Pre-Emergent Herbicide (Packaged dry material application): Pre-emergent control of annual grasses and broadleaf weeds in turf grass areas, and woody ornamental trees, shrubs, vines, and groundcover areas. Product to contain the active ingredient "trifluralin".
      a). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
         1). *Ronstar® 2G*, (granular), Aventis Environmental Science USA.

2). *Snapshot® 2.5 GT* (granular), (2% trifluralin), Dow AgroSciences LLC
3). *Treflan® HFP* (43% trifluralin), Dow AgroSciences LLC
4). *Treflan® TR-10*, (10% Granular trifluralin), Dow AgroSciences LLC
5). *Surflan®*, Dow AgroSciences, LLC.
6). Or equal, as approved by the Owner and Landscape Architect.

3. Selective Post Emergent Herbicide: Pre-mixed, flow-able formulation designed for product stability, uniformity in the spray solution and ease of handling. Post-emergent control of annual grasses, nutsedge, and broadleaf weeds in turf, generally with one (1) application.
   a). Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      1). *Trimec® Plus*.
      2). Ornamec® 170 Grass Herbicide.
      3). Or equal, as approved by the Owner and Landscape Architect.

E. Plant Vitamin/Hormone Stimulant
   1. Provide in a diluted liquid solution with water, at the time of watering-in recently planted plant species.
      a. Products & Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
         1. *SUPERthrive*, Vitamin Institute.
         2. *Roots2*, Roots, Inc., Independence, MO.
      b. Provide at prescribed rate and application per Manufacturer's written recommendations, per 100 gallons of water.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation practices of the Landscape Planting Accessories shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted horticultural practice, as approved by the Owner and Landscape Architect. Contractor shall notify the Owner and Landscape Architect, in writing, on the anticipated commencement date and length of duration of the landscape installation.

B. Examination: Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of Work of this Section. NO WORK UNDER THIS SECTION SHALL COMMENCE UNTIL ALL SUBMITTALS UNDER THIS SECTION HAVE BEEN REVIEWED AND APPROVED, IN WRITING. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

C. Prior to Work in this Section, Contractor shall examine previously installed Work from other trades and verify that such Work is complete and as required, to the point where the installation of the Landscape Planting Accessories may commence properly.

3.2 PROTECTION OF SITE

A. Contractor shall protect existing and new improvements and systems installed prior to installation of Landscape Planting Accessories. Maintain protection in place until completion of Work and Landscape Establishment Period.

3.3 STAKING AND GUYING

A. Staking and Guying shall be per the direction of the Landscape Architect. Staking and/or guying of trees shall be completed immediately following tree planting operations. Contactor shall provide new Tree Stake or Tree Guy assemblies; reconditioned or previously-used Tree Stake or Tree Guy assemblies shall not be permitted. Provide one (1) Tree Stake or Tree Guy assembly per tree, as required. Trees shall remain plumb and straight from installation through the Contractor Warranty period. Staking and Guying assemblies shall remain the property of the Owner.

B. Staking/Guying Methodology: Unless otherwise directed on the Contract Drawings or as directed by the Landscape Architect based on field conditions, provide the following Staking/Guying Assemblies, as measured by the size of the tree being supported:
   1. 5-gallon size Container Stock to 36" Box Tree, or for trees up to 3" caliper: Provide Staking Method. Number of stakes per tree shall be as directed herein this Section.
   2. For trees larger than 36" Box size or over 3" caliper: Provide Guying Method.
   3. Trees planted within Tree Grates: Provide Tree Staking Method, or as directed by the Landscape Architect.
   4. Multi-trunk Trees: Provide Tree Guying Method, or as directed by the Landscape Architect.
   5. Specimen-size Trees: Provide Tree Guying Method, or as directed by the Landscape Architect.
   6. Trees planted On-Structure: Provide Tree Guying Method, or as directed by the Landscape Architect.

C. Wooden Tree Staking Method:
   1. Single Wooden Tree Stake:
      a). Locate Stake at the closest point to the main trunk as possible, yet outside of the root ball and tree branch canopy.
      b). Firmly drive the tapered end of the Stake plumb into the undisturbed native sub-grade, perpendicular to the side of the prevailing wind, at the minimum depth indicated in the Contract Drawings, or deeper, as required, to firmly support the Stake and minimize any movement of the Stake. Do not damage the tree trunk nor branch canopy, nor penetrate the root ball with the Stake. Do not damage or splinter the Stake. Stake shall not touch the trunk nor branch canopy of the tree.
   2. Double Wooden Tree Stakes:
      a). Locate Stakes at the closest point to the main trunk as possible, yet outside of the root ball and tree branch canopy.
      b). Firmly drive the tapered end of one (1) of the Stakes plumb into the undisturbed native sub-grade, perpendicular to the side of the prevailing wind, at the minimum depth indicated in the Contract Drawings, or deeper, as required, to firmly support the Stake and minimize any movement of the Stake. Do not damage the tree trunk or branch canopy, nor penetrate the root ball with the Stake. Do not damage or splinter the Stake.
      c). Install the other Stake in similar fashion, directly opposite from the first Stake (180 degrees), and equidistant from the tree trunk.

d). Installed Stakes shall not touch the trunk nor branch canopy of the tree.

3. Tying to Wooden Tree Stakes:
   a). Tree Straps: Wrap and twist the Tree Strap around the tree trunk, at the lowest point where the tree gains the highest support, per the direction of the Landscape Architect. Secure the Strap with wire; thread the wire through the grommet ends of the Strap and twist wire to secure. Wrap other end of wire around the Stake, twist, and secure it to the Stake. Repeat for other Stake(s), as required. Cut off and bend back excessive wire beyond the twists to the Stake(s) to provide a safe condition. The tree shall be supported accordingly to assure a straight, firm position of the tree canopy, yet to allow enough slack to avoid rigid restraint of the tree.
   b). Once the tree is thoroughly staked, carefully remove the nursery stake(s). Backfill and tamp the nursery stake void(s) with planting soil.

D. Guying: Install guys per the Manufacturer's latest printed instructions.

3.4 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Wood Mulch:
   1. Apply the following average thickness of Organic Wood Mulch, and finish level with adjacent finished surfaces. Do not place Mulch directly against trunks or stems of Plant Materials. Remove Mulch that is placed against the growing bases or within the basal nodes of plants.
      a). Thickness: Three (3") inches.
   2. While settlement and/or decomposition of the Organic Wood Mulch may occur during the duration of the Contract, the Organic Wood Mulch thickness as indicated shall be consistent throughout the duration of the Contract. The Contractor shall provide additional Organic Wood Mulch, as needed, and as directed by the Landscape Architect, to maintain the specified constant thickness of the Organic Wood Mulch, until Acceptance of Work is granted.

3.5 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Apply Anti-Desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
   1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again two (2) weeks after planting.

B. Apply Stress Reducing Agent, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

C. Apply Wetting Agent & Soil Penetrant, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

D. Apply Herbicides, as required and directed by the Landscape Architect, per Manufacturer's latest printed instructions.

E. Apply Plant Vitamin/Root Stimulant per the Manufacturer's latest printed instructions. Refer to application requirements per Section 329300 "Exterior Plants".

3.6 CLEAN UP AND PROTECTION

A. For Work under this Section, keep Work area in a clean, orderly, and safe condition. Contractor shall remove trash caused from his Work on a weekly basis throughout the duration of the Work.

B. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged Landscape Planting Accessories as directed.

C. Upon completion of his Work under this Section, the Contractor shall remove rubbish, waste, debris, excess construction materials, and other items resulting from construction operations offsite as described herein this Section and directed by the Owner and Landscape Architect.

3.7 FINAL REVIEW

A. Final Review under this Section shall be performed upon completion of the Landscape Establishment Period. Refer to Section 329302 “Landscape Establishment Period”, for requirements.

END OF SECTION 329301

SECTION 329302 - LANDSCAPE ESTABLISHMENT PERIOD

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work, as required to make a complete Landscape Establishment Period, as specified during progress of the Work, after installation, for the designated period of one (1) year after Preliminary Acceptance, as specified herein this Section.

B. Work under this Section consists of, but is not necessarily limited to, products installed but not furnished under this Section, as follows:
   1. Section 328401 – Soil Preparation
   2. Section 329219 – Seeding and Mulching
   3. Section 329300 – Exterior Plants
   4. Section 329301 – Landscape Planting Accessories.

1.3 SUBMITTALS

A. Quality Control Submittals:
   1. Schedule of maintenance operations and monthly status report, including list of equipment, materials proposed for the job, and watering schedule(s).
   2. Licenses, permits and insurance required by the local jurisdiction, the State, or Federal government, pertaining to maintenance work
   3. Monthly record of herbicides, insecticides and disease control chemicals used for the Project.
   4. Written application recommendation by a licensed agricultural pest control advisor for weed, pest and disease controls restricted by the Director of Agriculture proposed for this Work.

B. Project Closeout Submittal: Include in a single, 3-ring binder, a landscape maintenance manual for the Owner, containing an indexed collection of all schedules, records and permits listed above, including documentation of accepted condition of planting and irrigation at Final Acceptance.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Experience: Contractor or subcontractor performing Work under this Section shall have a full-time employee assigned to the Project as foreman for the duration of the Contract. Employee shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience or training in entomology, pest control, soils, fertilizers and plant identification. Employee shall speak English fluently.

2. Labor Force: Landscape maintenance labor force shall be thoroughly familiar with, and trained in, the Work to be accomplished, and shall perform the task in a competent, efficient manner acceptable to the Owner.

B. Requirements:
1. Supervision: Landscape Maintenance Foreman shall directly supervise the Work force during duration indicated herein this Section. Notify Owner of changes in supervision.
2. Identification: Provide proper identification during duration for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner.

1.5 PROJECT / SITE CONDITIONS

A. Site Visit: At beginning of the designated Landscape Establishment Period, visit and tour the site with the Owner's Representative, Landscape Architect, and other interested parties, to clarify the scope of Work, and understand existing project/site conditions.

B. Documentation of Conditions: Document the general condition of installed plant materials, recording those which are healthy and thriving, and unacceptable materials which are damaged, dead, and/or dying and in need of replacement.

1.6 SEQUENCING AND SCHEDULING

A. Perform Work under Landscape Establishment Period during hours mutually agreed upon between Owner and Contractor.

B. Work force shall be present at the Project Site at a minimum duration of at least once per week, and at other times, as necessary, to perform specified Work, in accordance with the approved schedule under the Landscape Establishment Period

1.7 WARRANTY

A. Specific Requirements: A one year warranty period of all planting establishment.

B. Refer also to the following Sections:
1. Section 329219 – Seeding and Mulching
2. Section 329300 – Exterior Plants

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Materials and equipment as required to perform Work under this Section shall be provided by Contractor.

B. Water: Clean, potable and fresh, as available from Owner.

C. Fertilizers:
   1. Fertilizer Tablets: Tightly compressed, slow-release and long-lasting complete fertilizer tablets, bearing manufacturer's label of guaranteed analysis of chemicals present. Refer to Section 328401 “Soil Preparation”, for requirements.
   2. Balanced, once-a-season application, controlled-release Fertilizer(s), with a blend of coated pills which supply controlled-release nitrogen, phosphorus and potassium, and uncoated, rapidly soluble pills containing nitrogen and phosphorus.

D. Herbicides, Insecticides, and Fungicides:
   1. Provide materials with original manufacturers' containers, properly labeled with guaranteed analysis.
   2. Use non-staining materials.

E. Replacement Tree Guys, Stakes, Ties and Wires: Match originally accepted existing materials installed on the Project.

2.2 EQUIPMENT

A. General: Use only the proper tool(s) required for each task under this Section. Maintain tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage.

B. Insect/Disease Prevention: Provide measures to prevent introduction of insect or disease-laden materials onto the Site. Refer to Section 329300 “Exterior Plants”.

PART 3 - EXECUTION

3.1 COMMENCING THE LANDSCAPE ESTABLISHMENT PERIOD

A. Preliminary Review: As soon as planting is substantially completed per documents, hold a preliminary review to determine the condition of the work.

B. Date of Review: Notify Landscape Architect at least 5 workings days prior to anticipated date of review.

C. Commencing the Landscape Establishment Period: The date on which the Landscape Architect issues a letter of Preliminary Acceptance to the Contractor.

3.2 PREPARATION

A. Protection:
   1. Protect new landscape planting areas from damage during duration of Landscape Establishment Period, until Final Acceptance.
   2. Provide temporary protection fences, barriers and signs, as required, for protection.

B. Replacements:
   2. Immediately treat or replace plant materials as directed, which become damaged or injured as a result of Contractor's operations or negligence at no additional cost to Owner.
   3. Replacement plant materials shall match size and variety of plant material being replaced.

3.3 PLANTING

A. Watering Basins:
   1. Maintain watering basins around the perimeter of the installed plant materials so that enough water can be applied to establish and maintain adequate soil moisture through the root zone of the plant materials. Re-dish and tamp basins accordingly which have become damaged or have failed since installation.
   2. For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.
   3. Mulch Maintain originally specified thickness of mulch material to reduce evaporation and frequency of watering.
   4. During rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.
   5. At the end of the rainy season, re-dish and tamp watering basin at trees and shrubs.

B. Settlement of Plant Materials: Reset/replant sunken or settled plant materials to proper grades and in upright position.

C. Weed Control:
   1. Planting areas throughout site shall be weed-free at all times, including areas between plants and along watering basins.
   2. Use only recommended and legally-approved herbicides to control and maintain weed growth.
   3. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.

D. Pruning:
   1. Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay one another.
   2. Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Reduce toppling and wind damage by thinning out crowns.
   3. Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.
   4. No stripping of lower branches of young trees will be permitted.
   5. Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth. Do not cut back to fewer than six (6) buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.
   6. Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.
   7. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.
   8. Make pruning cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts one- inch (1”) diameter or larger parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.

9. Branches too heavy to handle shall be precut in three (3) stages to prevent splitting or peeling of bark. Make the first two (2) cuts eighteen inches (18") or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.
10. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.
11. Clip shrubs to be hedged when branches project two-inches b (2") beyond limit of clipped hedge shown on the Contract Drawings.
12. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to other plant materials.

E. Staking and Guying of Trees:
1. Adjustments: Inspect stakes and guys periodically (minimum once per month) throughout duration of Landscape Establishment Period to check for rubbing of staking materials on trunks or branches causing bark wounds.
2. Repair and replace faulty staking and guying materials as shown and as specified.

F. Maintenance of Existing Plant Materials to Remain:
1. General: Conform to applicable paragraphs regarding pruning, watering, spraying and fertilizing of new plant materials as indicated herein this Section.
2. Symptoms: Be alert to symptoms of construction damage to existing plantings as evidenced by wilting, unseasonal or early flowering or loss of leaves, and insect or disease infestation due to declining vigor.
3. Notification: Submit in writing of evidences of declining vigor immediately upon discerning the problem. Take appropriate interim measures to mitigate the severity of the problem as specified in this Section.
4. Proposal: Submit written proposal and cost estimate for the correction of all conditions before proceeding with permanent correction work.

3.4 GROUNDCOVERS (Established from Seed Mix)

A. Weed Control:
1. Control weeds, preferably by hand removal, with pre-emergent herbicides and with selective systemic herbicides.
2. Minimize hoeing of weeds in order to avoid plant damage.

B. Fertilization:
1. Recently installed plant materials: Verify with Owner actual completion date of planting installation and rate of prior application of fertilizers.
2. New Plant Materials: Place Planting Tablets beside the root ball about one-inch (1") from root tips.
3. Established Plant Materials: Do not use complete fertilizers unless soil test shows specific nutrient deficiencies.

C. Mowing and Edging:
1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.
2. Ground covers which lend themselves to mowing shall be mowed to specified height above finished grade in order to renew growth, improve density and attractiveness.

D. Replacements:

1. Replace dead and missing plants after obtaining Owner's agreement to pay for replacement.
2. Damages due to Contractor's negligence shall be paid for without charge to Owner.

3.5 TURF GRASS

A. Weed Control:
1. Control broadleaf weeds with selective herbicides.
2. In areas where crabgrass has infested the turf grass, apply a selective post-emergent herbicide as soon as possible, and prior to flowering.
3. Apply pre-emergent herbicides prior to crabgrass germination.
4. Do not irrigate for 48 hours after application of herbicidal sprays.
5. Coordinate application of herbicides with thatch control and reseeding schedule as described below.

B. Mowing and Edging:
1. Mow Turf Grass areas when they reach two-inches (3-4") in height
2. Trim edges at least twice a month or as needed for neat appearance. Vacuum clippings.
3. Reseeding of Lawn Areas: Match existing seed mix of adjacent areas.
4. Renovating of Existing Lawns (where applicable)
   a). Thatch Control: Maintain thatch layer at 1/2 in. depth or less. Verticut as required.
      1). Three (3) weeks before verticutting turf grass, apply nitrate fertilizers.
      2). Perform verticutting operations preferably in the fall months, but otherwise during the spring months. Remove all debris from verticutting. Overseed as needed.
      3). Overseeding must not be followed by application of pre-emergent herbicides for at least four (4) to six (6) weeks. Normally this means that turf grasses invaded by weeds shall be renovated and overseeded in the fall, and treated for weed control in the following late winter.

D. Aeration:
1. Do not perform aeration work during season of active weed germination.
2. Aerify compacted areas to improve water penetration when needed, using a piston-driven aerifier with hollow tines. Rake up and remove all resulting soil cores. Fertilize and irrigate immediately after clean up of cores.

E. Fertilization:
1. Recently seeded/sodded Turf Grass areas: Verify with Owner previous applications of fertilizer(s).
2. Established Turf Grass areas: Apply a slow release (3 to 5 months) fertilizer (21-8-8; N-P-K) once in spring and again in the fall at the following rates:

Program	1000 sq. ft.	Acre
Optimum	15 lbs.	650 lbs.
Medium	12 lbs.	500 lbs.
Low	8 lbs.	350 lbs.

3. Apply fertilizer when turf grass is dry and preferably after mowing. Do not apply during hot weather or when turf grass is under stress. Water immediately after application.
4. Apply only nitrogen unless a soil test shows a specific nutrient deficiency.
5. If soil pH gets below 6.0, then a basic fertilizer such as calcium nitrate may be preferable to an acidic fertilizer. Follow the soil chemist's recommendation when deficiencies appear.

3.6 INSECTS, PESTS, AND DISEASE CONTROL

A. Inspection: Inspect plant materials for signs of stress, damage and potential trouble from the following:
   1. Presence of insects, moles, gophers, ground squirrels, snails and slugs in planting areas.
   2. Discolored or blotching leaves or needles.
   3. Unusually light green or yellowish green color inconsistent with normal green color of leaves.

B. Personnel: Only licensed, qualified, trained personnel shall perform spraying for insect, pest and disease control

C. Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.

3.7 TERMINATION OF THE LANDSCAPE ESTABLISHMENT PERIOD

A. Final Acceptance Procedure:
   1. Work will be accepted by the Owner upon satisfactory completion of all Work, including Landscape Establishment Period, but exclusive of replacement of materials under the Warranty Period.
   2. Submit a written request to Owner for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.

B. Corrective Work:
   1. Work requiring corrective action or replacement shall be performed within 10 calendar days after the Final Review.
   2. Perform corrective Work and materials replacement in accordance with the Contract Documents, Work shall be made by the Contractor at no cost to the Owner.
   3. After corrective Work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.
      a). Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

C. Conditions for Acceptance of Work at End of Maintenance Period:
   1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.
   2. Replace plant materials not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

D. Final Acceptance Date: The date on which the Owner issues a Letter of Final Acceptance. Upon Final Acceptance, the Owner will assume responsibility for maintenance of the Work

3.8 CLEANING

A. General: Dispose of pruned plant materials, vacuum turf grass clippings and leaves, sweep walkways and rake smooth mulched areas. Remove from the site containers and other evidence of maintenance activities.

3.9 CLOSE OUT

A. Landscape Maintenance Record: Submit binder to Owner with documentation and records required and utilized during the Landscape Establishment Period.

B. Keys and Identification: Return keys and identification materials supplied by Owner for the purpose of site access.

END OF SECTION 329302

DIVISION 33

UTILITIES

SECTION 33 11 00 WATER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete installation of ductile iron water lines in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All water pipe excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

C. All waterline installation shall conform to this specification and any standards and specifications that have been adopted by the local water authority. It is the contractor's responsibility to verify with the local water authority if any superseding standards and specifications are applicable.

D. All materials that come in contact with potable water shall meet the requirements of NSF61.

1.02 SUBMITTALS

A. The Contractor shall provide six (6) copies of shop drawings or submittals for the following:

1. All sizes and types of pipe on the project.

2. Pipe fittings, valves, meters and boxes, vaults, backflow preventers, and necessary appurtenances.

1.03 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall unload pipe so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a large size and shall not be rolled or dragged over gravel or rock during handling. When any joint or section of pipe or other material is damaged during transporting, unloading, handling or storing, the undamaged portions of the pipe or material may be used or if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

B. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

1.04 WARRANTY

All materials shall be guaranteed to be free from defects in materials and workmanship for a period of one (1) year after final acceptance by the Owner.

PART 2: PRODUCTS

2.01 MATERIALS

A. DUCTILE IRON PIPE

1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

2. As specific specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

3. Ductile Iron Pipe shall be manufactured in accordance with AWWA C151. All Ductile Iron Pipe shall be 350 psi Class unless otherwise specified and shall be lined with a cement mortar lining not less than 1/16" thick conforming to AWWA C104. Pipe wall thickness for all Ductile Iron Pipe shall conform to "Thickness Design for Ductile Iron Pipe," AWWA C150. The standard laying condition shall be type 2. The exterior of all Ductile Iron Pipe shall have a protective coating of a coal tar or asphaltic material a minimum of 5 mils thickness conforming to AWWA C110 and C115.

   a. Flanged Joints:

      i. Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

      ii. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

iii. Ductile Iron Flanged joint pipe shall have a thickness of Class 53 minimum and shall conform to AWWA C110 and AWWA C115. Pipe shall be ordered in lengths needed as no pipe shall be cut, threaded or flanged in the field. All pipe shall have 125 lb. flanges conforming to AWWA C110 unless otherwise specified.

iv. In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required. Steel or tap bolts shall be cadmium plated, with good and sound, well-fitting threads, so that the nuts may be turned freely by hand. Cadmium plating shall be by an approved process with a plate thickness of 0.0003" to 0.0005".

v. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together. Bolts and gaskets shall be furnished by the installer of piping for joints connecting the piping with equipment and piping is furnished by the installer or not.

b. Mechanical Joints:

i. All mechanical joint pipe shall be manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be 350 psi Class as determined by AWWA C150 unless otherwise noted.

ii. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

iii. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

c. Slip Joints:

i. Slip or "push-on: joints shall be manufactured in accordance with AWWA C151. Pipe thickness shall be 350 psi Class as determined by AWWA C150.

ii. Bells of "slip" joint pipe shall be contoured to receive a bulb shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. No joint may exceed a maximum deflection of 4%.

4. Fittings:

a. All ductile iron pipe fittings for pipe shall be mechanical joint type in accordance with AWWA C110 and AWWA C111 for underground piping. Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C110 for exposed piping. All flanges shall be Class 125 unless otherwise noted.

b. All fittings shall be lined with cement mortar not less than 1/16" thick in conformance with AWWA C104 and suitable for a minimum of 250 psi working pressure unless otherwise specified.

c. All mechanical joints shall be manufactured in accordance with AWWA C111.

B. POLYVINYL CHLORIDE (PVC) PIPE

1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

2. As specific specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

3. Pressure Rated PVC Pipe shall be manufactured in accordance with ASTM 2241. All Pressure Rated PVC Pipe shall have a standard dimension ratio (SDR) as indicated in the drawings. The exterior of all PVC Pipe shall bear a stamp which shows SDR and size.

    a. All pipes shall have slip or "push-on" joints which are manufactured in accordance with AWWA C151. Pipe shall have a bell with integral rubber gasket.

    b. Bells of "slip" joint pipe shall be contoured to receive a bulb shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until the assembly mark on the pipe barrel is flush with the end of the bell. No joint may exceed a maximum deflection of 4%.

4. Fittings:

    a. Fittings for all PVC pipe shall be ductile iron pipe fittings, mechanical joint type in accordance with AWWA C110 and AWWA C111 for underground piping.

    b. All fittings shall be lined with cement mortar not less than 1/16" thick in conformance with AWWA C104 and suitable for a minimum of 250 psi working pressure unless otherwise specified.

    c. All mechanical joints shall be manufactured in accordance with AWWA C111. The Contractor shall provide suitable 3" plugs with stainless steel threaded nipples and sleeves for connection of fittings.

5. All valves and appurtenances shall comply with NSF61/NSF372.

6. All non-ferrous pipe shall be installed with 19-gauge Trace Safe tracer wire or approved equal. Tracer wire will be installed one foot above the top of the pipe and shall be connected to valve boxes and appurtenances per manufacturer requirements.

PART 3: EXECUTION

3.01 INSTALLATION

A. EXCAVATION

1. Trenches will be defined as all excavation for the installation of water pipe, hydrants, valves, water services, water taps, and other unclassified excavation as may be deemed necessary by the Engineer.

2. The excavation shall be done to the lines, grades, typical sections, and details shown on the plans or established by the Engineer. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Engineer.

3. All excavation shall be by open cut unless otherwise authorized by the Engineer. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with #67 washed stone. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary. Maximum trench width, unless as otherwise authorized by the Engineer, as measured at a depth of 2'-0" above the top of the pipe shall be 30" or 10" clearance from each side of the pipe, whichever is greater.

4. Sheeting, Bracing Trenches, and Trench Boxes:

   If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides of the trench to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required, for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and

bracing in place. The Contractor shall provide all means necessary to comply with the latest OSHA requirements.

5. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the Owner will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom. If the Engineer is of the opinion, that at any point, sufficient or proper supports have not been provided, he may order additional supports put in at the Contractor's expense, but compliance with such orders shall not release the Contractor from responsibility for the sufficiency of such supports.

6. Excavated materials to be used for backfill will be approved by the Engineer, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance.

7. Materials which are excess to the needs of the project will be disposed of by the Contractor.

8. In order to protect existing pavement structures and to make clean-up easier the Contractor shall place a 6" layer of sand on all asphalt or concrete surfaces prior to placing excavated material.

9. Pipe Foundations:

    a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the plans for the type of pipe being installed. Unless otherwise noted all pipe shall be installed using a "Type 2" trench foundation as defined in AWWA C151.

    b. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustment will require the approval of the Engineer. When an Inspector is present on the site and is so requested by the Contractor, he shall check the position of grades and lines but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.

c. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.

d. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and #67 washed stone of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.

e. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6". #67 washed stone shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

f. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Engineer, within limits established on the plans, and backfilling with #67 washed stone as approved by the Engineer.

g. The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.

h. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Engineer will require the pipe to be laid on a washed stone or concrete cradle foundation. Such foundations whether washed stone or a poured concrete cradle, shall be placed by the Contractor and compensation will be allowed the Contractor for the work.

B. INSTALLING PIPE AND APPURTENANCES

1. Laying Pipe:

a. All piping is to be installed in strict accordance with the manufacturer's recommendations and AWWA C600 and the contract material specifications. Installation manuals from various material suppliers will be furnished the Engineer for his review and approval prior to installation of any materials. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

b. No pipe shall be laid except in the presence of the Engineer or his Inspector, or with special permission from the Engineer.

c. Proper tools, implements and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean and free of defects. It shall be laid on the prepared foundations, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line.

d. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

e. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the center line of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

f. All pipe joints shall be constructed in strict accordance with the pipe manufacturer’s specifications and materials and any deviation must have prior approval of the Engineer.

g. The maximum deflection per joint of flexible joint pipe shall be that deflection recommended by the manufacturer. However, at no time will a deflection greater than 4° be allowed.

h. All water lines shall have a minimum cover of 3'-0" unless otherwise approved by the engineer. All water lines shall have a minimum 18" vertical separation from storm sewer and shall have a minimum of 10'-0" horizontal separation from sanitary sewer or 18" vertical separation with the water line over the sewer line. In the event these separations cannot be met, both water line and sanitary sewer shall be constructed of ductile iron pipe as directed by the Engineer or as shown on the drawings.

2. Thrust Blocks:

a. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed by the Engineer, or as per City of Asheville standards. Thrust blocks shall be made of ready mix concrete having a compressive strength of 28 days of 4000 psi and shall bear directly against the undisturbed trench wall. Where possible, the concrete shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a 20 mil polyethylene film placed between the fittings and the concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Engineer. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

b. Concrete for thrust blocks shall consist of a ready mix of Portland Cement, Fine Coarse aggregate and water to produce concrete with a minimum compressive strength at 28 days of not less than 4000 psi when tested in accordance with ASTM C39 or C42. Sakrete or any similar material will not be permitted under any circumstances.

C. BACKFILLING AND COMPACTION

1. Backfill trenches immediately after approval of the pipeline construction.

2. Use select backfill carefully placed in uniform layers not exceeding 6” in thickness to a depth of 2’-0” over the top of the pipe. Place material and fill the area under the pipe haunches. Place each layer, moisten as necessary; then uniformly compact by use of hand, pneumatic, or mechanical tampers exercising care to prevent lateral displacement. Areas of backfill 2’-0” over top of pipe to top of trench, shall be backfilled with a select material containing no rocks larger than 6” in the greatest dimension and shall be free of material with an exceptionally high void content. The initial backfill shall meet the same requirements except no rocks over 4” in diameter will be allowed.

3. Moisten backfill as necessary above 2’-0” over the top of the pipe and place in 8” layers. Compact each layer with hand, pneumatic or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.

4. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the maximum dry density as determined by Standard Proctor Test for the various types of backfill material for the full trench depth in non-paved areas. In paved areas, backfill shall be compacted to 98% of the maximum dry density as determined by Standard Proctor Test for the top 24” below subgrade. Methods of backfilling shall be in strict accordance with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Engineer. Select backfill material shall be used when requested by the Engineer.

5. Roadways and Road Crossings:

   Use select backfill placed in uniform layers not exceeding 6” in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (98% for the top 2’-0” of sub grade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and type as the adjacent roadway.

6. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from roots, stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

7. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the Owner. Pipe which becomes miss-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor at no cost to the Owner.

8. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

9. Cleanup:

   a. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

   b. Cleanup and seeding is part of the pipeline installation. No more than 3,000 L.F. of water line may be laid prior to completion of cleanup of the first section of pipeline laid. To facilitate this the Owner reserves the right to withhold up to 30% of the unit price bid for water line if in the opinion of the Owner and Engineer completed sections have not been properly cleaned.

3.02 QUALITY CONTROL

A. TESTING

1. General: Perform all hydrostatic testing in accordance with AWWA C600, Section 4, unless otherwise specified. When a section of pipe of a length deemed adequate by the Engineer is ready for testing, blow the line free from air and conduct a leakage test. All new water service connections, from taps on the main up to and including meter yokes, meter setters and spool piece for meters in vaults, shall be installed and included in the hydrostatic testing and disinfection processes.

2. Buried Lines: Whenever conditions permit in the opinion of the Engineer, test pipelines before the trench is backfilled. All joints may then be examined during open trench test and all leaks entirely stopped. Should the Contractor wish to minimize the maintenance of

lights, and barricades and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe. The Contractor, however, remains responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints of pipe.

3. Exposed Lines: Test all exposed lines prior to field painting.

4. Temporary Bulkheads: Furnish, install and remove all temporary bulkheads, flanges, or plugs necessary to permit the required pressure test. Install corporation stops at all high points on the line for blowing lines free from air. Install corporation stops at the test pump location. Install a test pump and means for accurate measurement of water introduced into the line during testing. Keep pump, meters, and gages in use during pressure and leakage tests.

5. Test Pressure and Allowable Leakage: Keep the section to be tested full of water for a period of 24 hours before the pressure and leakage tests are conducted.

6. Hydrostatic Testing: A section of line which is to be hydrostatically tested, shall be slowly filled with water at a rate which will allow complete evacuation of air from the line. Hand pumps shall not be used for the pressure testing of water mains.

    a. The hydrostatic test shall be witnessed by the Water Engineering Division during the full two-hour duration.

    b. The line shall be tested to a minimum pressure of 200 psi with a maximum of 250 psi at the lowest elevation for a duration of 2 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10 psi or less. Pressure shall be maintained at a minimum of 200 psi +/- 5 psi at the highest point throughout the duration of the test by pumping additional water into the test section as often as necessary. At the end of the test period, the leakage shall be measured with an accurate water meter furnished by the City, or other approved means.

    c. The line to be tested must utilize a backflow prevention assembly. All water for testing must be drawn through this assembly. Prior to connecting to the existing water line the

new water line extension shall be pressure tested, disinfected and a clear water sample obtained.

d. The allowable leakage shall be no more than indicated in the table below. Allowable leakage based on the formula:

L=[S*D*(P)^1/2)]\148,000

L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE (GPH)													
Avg. Test Pressure PSI	**Pipe Diameter in Inches**												
	3	4	6	8	10	12	14	16	18	20	24	30	36
250	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85
225	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65
200	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44
175	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22
150	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98
125	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72
100	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43

e. All visible leaks are to be repaired regardless of the amount of leakage.

7. Defective Materials and Workmanship: Carefully examine all exposed pipe fittings, valves, hydrants, and joints during the test. Locate and repair leaks and replace defective materials if the water loss during the test periods exceeds the allowable leakage. Make the necessary repairs, replace defective material and repeat the hydrostatic test until the leakage does not exceed the allowable leakage as defined herein.

B. STERILIZATION

1. All new water service connections, from taps on the main up to and including meter yokes, meter setters and spool piece for meters in vaults, shall be installed and included in the hydrostatic testing and disinfection processes.

2. All additions or replacements to the water system shall be chlorinated before being placed in service. Such disinfection shall take place under the continuous supervision of the Engineer or Engineer's Inspector. The maximum total length of water main which may be disinfected at the same time is 3000 linear feet.

3. Disinfection, flushing and sampling of a completed line shall be carried out in the following manner:

   a. Taps with extended copper tubing will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These additional taps will not be necessary where a suitable permanent tap is already available as approved by the City.

   b. Prior to introducing the chlorine solution into the pipe, all blow-offs shall be checked to confirm that all air has been expelled from the pipe and the pipe is filled with water. During the introduction of chlorinated solution into the pipe, the operation of blow-offs shall be carefully controlled to make sure the solution enters all main lines, branch lines, and service lines thoroughly and that no air is introduced.

   c. All gauge pressure and residual chlorine field test equipment shall be properly calibrated. All equipment used in the disinfection process shall be cleaned and suitable for potable water application.

   d. A solution of water containing high test sodium hypochlorite (70% available chlorine) shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after disinfection. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 feet section of line to produce the desired concentration of 50 ppm.

PIPE SIZE, INCES	POUNDS HIGH TEST HYPOCHLORITE (70%) PER 100 FEET OF LINE
6	0.88
8	1.56
10	2.42
12	3.50

14	4.76
16	6.22
20	9.76
24	14.00

e. Once the new main is uniformly chlorinated at the required concentration as confirmed by the Water Engineering Division Inspector, entrances and blow-offs shall be properly secured and the solution shall be retained in the system for a minimum of 24 hours, during which time all intermediate valves and hydrants shall be operated several times to insure disinfection of the inside faces of these appurtenances. At the end of the 24-hour period, the Inspector shall check entrance points and blow-offs to insure that the pipe is still full of solution without trapped air and the solution at each point checked has retained a chlorine residual of not less than 10 mg/l.

f. Following the 24-hour period, with the approval of the Inspector, the chlorine solution shall be thoroughly flushed from the new main. Flushing shall not be completed until the residual chlorine measured by the Inspector at the end points of the new main has a measured chlorine residual within +/- 0.5 mg/l of the water supplied for flushing from the active water main.

g. Disposal of the chlorinated solution during flushing shall comply with all federal, state, and local regulations. Where a sanitary sewer is located nearby, with the approval of the sewer authority, the chlorinated solution may be discharged to the sanitary sewer with a positive air gap to prevent backsiphonage. Disposal directly to surface waters without removal of chlorine is strictly prohibited.

h. After flushing is completed as described in f) above, the new water mains shall be isolated without introducing air by closing all entrance and blow-off points and allowing the new water mains to sit for another 24-hour period. At the end of this 24-hour period, an authorized employee of an accredited testing firm shall collect samples from randomly selected end points of the new water mains and perform bacteriological analysis of the samples in a certified laboratory. Results of the testing shall be documented and certified by the signature of the laboratory technician and Water Production Supervisor or Superintendent. Test results shall be provided to the contractor and Water Engineering Division. The disinfection process is not completed

until the results of all testing are certified as negative for bacteriological contamination.

i. If the bacteriological tests fail to produce satisfactory results, the new main shall be reflushed by repeating steps f) through h) above. If bacteriological tests fail the second time, the entire disinfection process shall be repeated.

4. For mains required to be immediately returned to service after disinfecting, take a bacteriologic sample after connection or repair to provide a record by which the effectiveness of the procedure used can be determined.

END OF SECTION

SECTION 33 12 00 WATER VALVES AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This specification covers the requirements for furnishing and installing valves and other appurtenances for the various water system improvements shown on the Drawings.

B. Furnish all labor, equipment, materials and incidentals necessary to install and complete water valve and appurtenance installation in accordance with the plans and specifications. All valves and appurtenance material shall be of the type and class specified herein.

C. All water valve and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

D. All valves and appurtenances shall conform to current NCDENR Standards and Specifications.

1.02 SUBMITTALS

The Contractor shall provide six (6) copies of shop drawings or submittals for the following:

1. All valves, valve boxes, hydrants, air relief valves, tapping sleeves, meters, manholes, or any other items required for completion of the project.

1.03 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall unload valves and appurtenances so as to avoid deformation or other injury thereto. The Contractor shall store valves and appurtenances above storm drainage levels. All valves shall be drained and so stored as to protect them from freezing.

B. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

1.04 WARRANTY

All materials shall be guaranteed to be free from defects in materials and workmanship for a period of one (1) year after final acceptance by the Owner.

PART 2: PRODUCTS

2.01 MATERIALS

A. BALL VALVES

Ball valves shall be installed on existing/new 2" water main and service lines and all conform to AWWA C800. Valves shall be made of heavy brass components with a PTFE coated ball on a "blow-out" proof stem with double O-ring seals, and shall be rated for 300 psig working pressure. Operating nut shall be "curb key" design for quarter turn open or close and shall open left. Ball valves shall be as required on the Approved Manufacturers Products List.

B. GATE VALVES

All gate valves shall be designed for a minimum working pressure of 200 psi unless otherwise specified. Valves shall have a clear waterway equal to the full nominal diameter of the pipe. Valves shall be opened by turning counterclockwise. Each valve shall have the initials or name of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by hand wheel for above ground installations or 2" square operating nut for below ground installations. Valves shall have an arrow cast in the metal indicating the direction of opening.

Valves to be installed underground (Buried) shall be of the non-rising stem type and shall have mechanical joint connections.
Valves installed above ground or in structures shall have rising stems with outside stem and yoke and 18" diameter minimum hand wheel and shall have flanged ends with 125# flanges unless others noted.

1. Gate Valves Smaller than 2"

    a. Gates valves smaller than 2" shall be all brass, single disc type, double seat tapered wedge type built to manufacturer's standards with material and construction conforming to AWWA C-500.

    b. Each valve shall have a 2" operating nut. Valves shall have screwed ends conforming to NPT standards.

2. Resilient Seated Wedge Valve

a. Gate valves 2" through 24" diameter size shall be of the ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509 and AWWA C-500. All valves shall be from one manufacturer and parts interchangeable.

b. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509 and C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.

c. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.

d. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

e. Valves larger than 12" diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

3. Double Disc Type Gate Valves

a. Gate valves larger than 24" diameter size shall be of the ductile iron body, double disc parallel seat type meeting the requirements set forth in AWWA C-500. All valves shall be from one manufacturer and parts interchangeable.

b. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces.

c. The gates shall be high strength cast iron, sturdily proportioned without pockets on the backs. All cam surfaces shall open to the bottom. Gate rings shall be rolled into a dovetail groove under pressure to make a single insertable finish.

d. Valves shall use bottom wedging type design with a two-part floating wedge contact. The wedge and hook shall be separate castings and not a single piece.

e. Valve stems shall be cast bronze. The stuffing box shall use “O”-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

f. Valves shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve. Valves shall have bronze rollers, tracks, and scrapers.

g. All valves shall be supplied with a bypass as a part of the valve. Bypass shall be a minimum of 3” diameter with a 3” resilient seated wedge valve.

C. VALVE BOXES

All valve boxes shall be cast iron and shall conform to ASTM A48. Valve boxes shall be of the adjustable screw type with a base to fit the valve yoke with a removable cover with the word "water" cast thereon.

D. FIRE HYDRANTS

1. GENERAL:

a. All fire hydrants shall meet or exceed the requirements of AWWA C-502, be listed by Underwriters Laboratories, Inc. and have Factory Mutual Research approval. All hydrants shall be rated 250 PSI working pressure minimum and be tested to 500 PSI minimum. The rated working pressure shall be cast on the hydrant barrel. Hydrants shall be of the compression type, constructed such that the main valve closes with water pressure to assure no loss of water in the event of damage to the upper portion of the hydrant. The diameter of the main valve seat shall be four and one-half inches (4 1/2") minimum. The hydrant shall open counter clockwise against the pressure and close clockwise with the pressure.

b. The bonnet assembly shall have a lubrication reservoir which is sealed from the waterway and all external contaminants by the use

of "O" ring seals. A port to add lubricant to the reservoir, without removal of the bonnet, is required.

c. Fire hydrant shall be manufactured with 1 1/2-inch Pentagon operating nut and thrust nut made of low zinc bronze complying with ASTM B-61, B-62 or B-96, with thrust bearings located both above and below the thrust collar and with operating nut protected by a cast iron weather shield. In lieu of the bronze operating nut, an integral ductile iron operating nut and weather shield will be acceptable.

d. Hydrants shall be a 3-way type with two (2) outlet nozzles, two and one-half inches (2 1/2") NST and (1) Steamer nozzle four and one-half inches (4 1/2") NST. All nozzles shall be made of low zinc brass complying with ASTM B-61, B-62 or B-96. All nozzles shall be mechanically locked into the barrel and have "O" ring pressure seals. Caps shall be provided with chains and chain hooks.

e. The hydrant shall have a traffic "breakaway" coupling which is designed to fracture when the hydrant is impacted by a vehicle. The breakaway coupling shall be made of cast iron or steel and shall allow for 360-degree rotation of the upper barrel to position the nozzles without removing the breakaway coupling or shutting down. All pins, clips, and or retainer rings associated with the "breakaway" coupling shall be stainless steel.

f. The main valve seat shall have bronze to bronze seating arrangement of low zinc bronze complying with ASTM B-61, B-62 or B-96. A bronze seat ring shall be threaded into bronze sub-seat located in the hydrant elbow. All "O" rings sealing the main valve seat ring shall bear against a non-corrodible low zinc bronze surface.

g. The main valve assembly shall include double drain valves to operate automatically each time operated without the aid of springs, pins or toggles. The valve upper plate and valve lower plate shall be made of ductile iron or low zinc bronze complying with ASTM B-61, B-62 or B-96. The entire valve and stem assembly must be capable of removal and reassembly by the use of a small lightweight wrench without disassembly of the upper barrel.

h. The shoe casting, lower barrel casting, and flanges below ground shall be manufactured in accordance with ASTM A- 126, Class B,

Grey Iron or Ductile Iron. All ferrous metal surfaces in the hydrant shoe are to be fully coated with a minimum four (4) mills epoxy not to exclude the lower valve plate assembly.

i. The hydrant will have three and one-half foot (3 1/2') of bury, unless otherwise noted. The hydrant will have a six inch (6") inlet connection of the (mechanical joint) type, unless otherwise noted. Painting and coating of the hydrant shall be as prescribed in AWWA C-502, latest revision. The color above the ground line flange shall be YELLOW.

j. Fire hydrants shall be as required in the Approved Manufacturers Products List.

E. AIR RELIEF VALVE

1. The air release valve shall fully conform to AWWA C512 (latest revision) and suitable for use with clean water. It shall be float operated and automatically release accumulated air from the pipeline or system while in operation and under pressure.

2. Valves with 1" (25mm) or larger connection size shall be compound lever type with adjustable seat, smaller size valves shall be simple lever type.

3. The valve's venting orifice diameter shall be selected for 300 PSI (2,069 KPa) maximum working pressure.

4. The valve body and cover shall be rated for 300 PSI (2,069 KPa) and made from cast iron conforming to ASTM A126 Class B.

5. The float ball, orifice and internal linkage mechanism shall be made from Type 316 stainless steel. Non-metallic components are not acceptable.

6. The seat shall be replaceable and made from Buna-N rubber or other suitable elastomer compounds.

7. The exterior of the valve shall be shop coated with enamel primer.

F. MANHOLE SECTIONS AND APPURTENANCES

1. Precast concrete manhole bases, risers and cones shall conform to ASTM C478, latest revision, for precast reinforced concrete manhole sections. Tapered sections and transition sections, where required, shall be of

eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

2. Minimum compressive strength of concrete shall be 4000 psi and the maximum permissible absorption shall be 6.5%. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes. Precast manhole sections shall fit together readily and shall have a self-contained "0"-ring rubber gasket conforming to ASTM C443.

3. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer and his inspector. The manhole sections shall be perpendicular to their longitudinal axis, within the limits listed in ASTM C478.

4. Castings for manhole frames and covers shall be tough, even grained soft gray iron, free from burnt on sand and other injurious defects and conform to the requirements of ASTM A48, latest revision, Class 30, with "WATER" cast into the cover.

5. Brick for manholes and other structures shall conform to applicable requirements of ASTM C62, latest revision, Grade SW.

G. TAPPING SLEEVE AND VALVE

1. Tapping sleeves shall consist of two piece split ductile iron, jointed by bolts manufactured of high strength cast iron and incorporating a longitudinal compound rubber gasket. The sleeves shall include split end gasket and two piece mechanical joint glands suitable for the class of pipe around which sleeves are to be placed. Glands will be joined by steel bolts and fastened to the bell openings of the sleeves to form totally enclosed rubber water tight seals around the periphery of the pipe and along the longitudinal joints.

2. The sleeves shall have flanged outlets which will accommodate the tapping valves. Valves will be identical to resilient wedge gate valves elsewhere specified with inlet and outlet ends adaptable to the tapping machine and to provide mechanical joint connections to discharge pipes.

H. HYDRAULIC CHECK VALVE

1. GENERAL: Check valves shall be swing-check type conforming to AWWA C508. Valves conforming to AWWA C508 shall have iron body and cover and fully bronze mounted stainless steel hinge pins. Valves shall have clear port opening. Valves shall be spring loaded and shall have flanged ends.

2. CASTING MARKINGS: Cast integral with either the bonnet or the body, the manufacturer's identification, the size of valve, the year of manufacture, and the maximum working pressure.

3. PAINTING: Coat all ferrous parts of the valves, except finished or bearing surfaces, with 2 coats of coal-tar varnish pipe dip or other approved material. After the valves are assembled and tested apply a third coat to the exterior.

4. TESTING: Test each valve at the manufacturer's plant for performance in water tightness and resistance to distortion under internal pressure. Subject each valve to hydrostatic tests under pressure at the working pressure cast on the valve and at 350 PSI.

I. All valves and appurtenances shall comply with NSF61/NSF372.

PART 3: EXECUTION

3.01 INSTALLATION

A. EXCAVATION

1. The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, watergates, sewer services, water taps, drainage structures, drainage ditches and other unclassified excavation as may be deemed necessary by the Engineer.

3. The excavation shall be done to the lines, grades, typical sections, and details shown on the plans or established by the Engineer. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be

maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Engineer.

4. All excavation shall be by open cut unless otherwise authorized by the Engineer. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with suitable bedding material thoroughly compacted in place. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary. Maximum trench width, unless otherwise authorized by the Engineer, as measured at a depth of 2'-0" above the top of the pipe shall be 18" clearance on each side of the pipe.

5. Sheeting, Bracing Trenches, and Trench Boxes:

   If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides of the trench, in such manner as the Engineer may direct to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required as directed by the Engineer for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and bracing in place.

6. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the Owner will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom. If the Engineer is of the opinion, that at any point, sufficient or proper supports have not been provided, he may order

additional supports put in at the Contractor's expense, but compliance with such orders shall not release the Contractor from responsibility for the sufficiency of such supports.

7. Excavated materials to be used for backfill will be approved by the Engineer, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance.

B. INSTALLING VALVES AND APPURTENANCES

1. Thrust Blocks:

a. All plugs, caps, tees, bends, reducers and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed by the Engineer. Thrust blocks shall be made of concrete having a compressive strength of 28 days of 4000 psi and shall bear directly against the undisturbed trench wall. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Engineer. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

b. Concrete for thrust blocks shall consist of a mix of Portland Cement, Fine Coarse aggregate and water to produce concrete with a minimum compressive strength at 28 days of not less than 4000 psi when tested in accordance with ASTM C39 or C42. Sakrete or any similar material will not be permitted under any circumstances.

2. Valves:

Before setting each valve, the Contractor shall make sure the interior is clean and test opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the plans, and at the exact

locations shown. Trench backfill shall be tamped thoroughly for a distance of 3'-0" on each side of valves boxes.

3. Valve Boxes:

A valve box shall be installed over each underground valve. All boxes shall be set plumb with their top flush with finished grade.

4. Fire Hydrant:

Fire hydrants shall be located as shown. Each hydrant shall be connected to the main with a 6" branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18" above the finished grade. Hydrants shall be thoroughly blocked with concrete or shall be rodded to the 6" branch tee. Unless otherwise specified, the backfill around hydrants shall be thoroughly compacted to the final grade immediately after installation in order to put the hydrant into service as soon as practicable. Not less than seven (7) cubic feet of clean crushed stone shall be placed around the base of the hydrant to insure drainage of the hydrant barrel. A cap block shall be set under the fire hydrant foot for a solid bottom.

5. Air Relief Valves:

Each air relief valve shall be installed at the exact location shown in a plastic meter box with cast iron lid.

6. Jumper:

A backflow prevention and testing device or a "jumper" is required at all potable water tie-in while water main extension is under construction per CDC detail.

C. BACKFILLING AND COMPACTION

1. Backfill trenches immediately after approval of the pipeline construction.

2. Roadways and Road Crossings:

Use select backfill placed in uniform layers not exceeding 6" in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (98% for the top 24" of subgrade beneath pavements). Replace removed paving and

base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

3. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the Standard Proctor Test (98% for the top 24" of subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Engineer. Select backfill material shall be used when requested by the Engineer.

4. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

5. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the Owner. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor at no cost to the Owner.

6. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

7. Cleanup:

   Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

3.02 QUALITY CONTROL

A. TESTING

Testing of valves and appurtenances shall be incidental to the testing of the water lines, and shall be performed as part of that testing.

END OF SECTION

SECTION 33 12 13 DOMESTIC WATER SERVICE CONNECTION

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered under this section shall consist of furnishing all materials, labor, equipment and services for the complete installation of a domestic water service connection from the water main line to the property to be served.

PART 2: PRODUCTS

2.01 MATERIALS

A. The service line shall be constructed of Type "K" flexible copper tubing.

B. Corporation stops shall be constructed of brass.

C. Meter box shall be of round style and made of Polyvinyl Chloride Plastic with a minimum wall thickness of .375". Meter box shall be sized to accept a 5/8" water meter and shall have a minimum inside diameter of 18" with a 30" depth. Meter box shall have a non-locking cast iron lid.

D. The inlet and outlet pipes that pass through the box wall shall be brass and shall be locked in place with brass hex nuts on straight external pipe threads. The inlet and outlet of these nipples shall have external tapered pipe threads and shall be protected by Polyethylene Cap Plugs. An In-Line quarter turn shut off valve with internal tapered pipe thread inlet and water meter coupling outlet shall be used upstream of the water meter. The valves shall be soft seating with a padlock wing. The valves internal components shall be removable from the top of the valve body. An In-Line Dual Check Valve with independent acting checks shall be used downstream of the water meter. The check valve shall have a meter coupling inlet and shall be contained inside the box. The internal parts of the check valve shall be removable without disconnecting the check valve the outlet piping. All brass materials used in contact with the water shall have a minimum copper content of 80% and a maximum zinc content of 10%.

E. All domestic water services and connections shall conform to current local municipality standards and specifications.

PART 3: EXECUTION

3.01 INSTALLATION

A. The standard service connection shall connect to the main at a brass corporation stop tapped to the main line.

B. The water service line shall be constructed of Type "K" flexible copper tubing placed at a depth providing a minimum cover of 3’-0”.

C. The meter box unit shall be a complete unit with all pipe nipples, valves, yoke, and bottom installed and connected prior to delivery.

D. Meters shall be provided and installed by the local municipality. Meters shall be furnished as specified on the drawings.

END OF SECTION

SECTION 33 31 00 SANITARY SEWER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.02 SUBMITTALS

The Contractor shall provide six (6) copies of shop drawings or submittals for the following:

1. All sizes and types of pipe on the project.

2. Pipe fittings and couplings.

3. All valves, valve boxes, manholes, manhole frames and covers, air relief valves or any other required for completion of the project.

1.03 DELIVERY, STORAGE AND HANDLING

The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. The Contractor shall store the pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

1.04 WARRANTY

All materials shall be guaranteed to be free from defects in materials and workmanship for a period of one (1) year after final acceptance by the Owner.

PART 2: PRODUCTS

2.01 GENERAL

(a) All sanitary sewers fifteen inches in size and smaller shall be constructed of either Ductile Iron or PVC sewer pipe, at the option of the Contractor unless otherwise specified in the Special Conditions or shown on the plans. Sanitary sewers shall be constructed of ductile iron sewer pipe when shown on the plans. Tunnel liners and casing pipes shall be installed at railroad, street, or highway crossings when shown on the plans.

(b) All PVC, and ductile iron sewer pipe and fittings shall be suitably marked at their places of manufacture to show their class, strength, or thickness, as applicable.

2.02 PVC Pipe

Poly-Vinyl Chloride (PVC) sewer pipe and fittings shall conform to the requirements of ASTM Specification D 3034. Wall thickness shall be SDR 35. Joints shall be integral bell and spigot type with compression type rubber gaskets. Joints shall conform to ASTM specifications D-3212. Couplings for PVC pipe to PVC pipe shall be PVC "Closure" or "Stop" couplings and shall meet ASTM D 3034. Couplings for PVC pipe to Ductile iron pipe shall be as manufactured by Fernco or equal.

2.03 Ductile Iron Pipe

(a) Ductile iron pipe shall conform to the requirements of ANSI Specification A21.51. The pipe class, bedding, and loading shall comply with Municipality details. When loading conditions are beyond those shown, the Engineer will submit design computations to the District. The pipe class shall be as shown on the plans. Bedding shall be as shown on the trench details. Joints shall be "push-on" which conform to the requirements of ANSI Specification A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specification A21.10, Class 350 in sizes 24 inches and smaller and Class 250 in sizes larger than 24 inches. Joints for fittings shall be mechanical joints conforming to the requirements of ANSI Specification A21.11. All ductile iron pipe and fittings shall have a cement mortar lining of standard thickness conforming to the requirements of ANSI Specification A21.4. Couplings for Ductile Iron pipe to Ductile Iron pipe shall be Cast iron or Ductile Iron M.J. sleeves.

2.04 Wyes and Services

(a) Wyes shall be of the same material and strength as the sewers on which they are installed. Saddle type fittings are not acceptable on new construction but may be used for (4") taps on existing sanitary sewer mains of 12 inch or less diameter.

For taps on Ductile Iron Pipe (16”) and larger a style "CB" Romac tapping saddle as manufactured by Romac Industries Inc. or approved equal, may be used in lieu of a wye fitting. House services shall be constructed of four (4) inch diameter pipe. Services shall be schedule 40 PVC, or if required class 350 Ductile Iron Pipe. For taps on existing Municipality PVC or VCP sewer mains, a (4") flexible saddle as manufactured by DEW/HPI, or equal, is acceptable.

(b) Wye branches shall be placed in sanitary sewer lines at all points shown on the plans or specified herein. If such branches are not to be used immediately they shall be closed with clay, concrete, or plastic plugs with joints as specified for the sewer pipe.

(c) Wyes shall be placed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or butting on the street or alley in which the sewer is being laid, and at such other locations as may be designated by the Engineer.

(d) The Contractor, shall measure the distance to the tap or tee from the downstream manhole to obtain the information required for the "As-Built" records. As-built data shall be marked on the plans and turned over to the Owner at the end of the project. As-built information shall be kept up on a day to day basis and be available for review by Engineer at any time.

(e) The location of all wyes, cleanouts, and house sewers installed in the work shall be identified on the plans and in the field.

2.05 Pipe Laying

(a) Before sewer pipe is placed in position in the trench the bottom and sides of the trench shall be carefully prepared and the necessary bracing and sheeting installed. Each pipe shall be accurately placed to the exact line and grade called for on the plans.

(b) Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. Pipe shall be straight when placed in the trench. Curved pipe shall not be laid. Trench bottoms found to be at incorrect grade after pipe laying operations have begun shall be corrected and brought to exact line and grade. Any fill required to bring the trench bottom to grade, shall be pipe foundation material or pipe embedment material as specified herein, as applicable.

(c) Bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. The bottom of the trench between bell holes shall be carefully graded so

that the pipe barrel will rest on a solid foundation for its entire length.

(d) Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow lines. The inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water, or other foreign matter. Joint lubricants shall be compatible with the pipe and gasket materials and shall be as recommended by the pipe manufacturer.

(e) All jointing of pipe and fittings shall be in accordance with the pipe manufacturers recommendations.

(f) Any leaks or defects discovered at any time after completion of the work shall be repaired immediately. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed shall be taken up, the joint cleaned and remade and the pipe re-laid at Contractor's expense.

(g) Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completed or before the trench has been backfilled. The Contractor shall not open up at any time more trench than his available pumping facilities are able to dewater.

(h) As the work progresses the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid it shall be carefully inspected and all dirt, trash, rags, and other foreign matter removed from the interior. When pipe laying is not in progress (for any period exceeding 4 hours), the contractor shall place a watertight plug in the last section of pipe which has been laid. The Contractor shall install temporary watertight plugs in the proposed sewer line at any manhole that is incomplete, at the open end of the pipeline prior to leaving the job site daily and elsewhere as dictated by good engineering and construction practices. All installed pipe shall be backfilled or otherwise securely tied down to prevent flotation in the event water enters or rises in the trench. The plugs as installed shall prevent infiltration or the introduction of any foreign material into either the existing or proposed systems. Upon completion of all construction, the Contractor will be responsible for the complete removal of all watertight plugs.

(i) Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed.

2.06 Deflection Tests

(a) After backfilling trenches all sewer pipes shall be lamped and visually inspected for pipe alignment. Each run of pipe must present a full circle when viewed from one of

the connected manholes. Any run of pipe which does not present a full circle will be removed and reinstalled.

(b) After backfilling trenches all PVC sewer pipe shall be tested for initial diametric deflections by the use of a Go-No-Go type mandrel which is acceptable to the Engineer. The initial diametric deflection shall not exceed five percent (5%) of the base inside diameter as defined in ASTM D-3034. Deflection test will be performed after trench is no longer subject to construction traffic loading and a minimum of thirty (30) days after completion trench backfill.

Nominal Pipe Size	Pipe I.D. (SDR 35)	Required Mandrel O.D.
8"	**7.665"**	**7.28"**
10"	**9.563"**	**9.08"**
12"	**11.361"**	**10.79"**
15"	**13.898"**	**13.20"**

(c) The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced. Such sections shall be re-tested for deflection after completion of backfill.

(d) Mandrel testing may be performed by the District at any time prior to the expiration of the one-year warranty. Any pipe which refuses the mandrel shall be replaced by the contractor as described above.

2.07 Leakage and Infiltration

(a) All pipe and manhole joints shall be as near watertight as it is practicable to construct them with the material and methods specified herein. Any leaks into the sewer shall be repaired or corrected as authorized by the Engineer regardless of infiltration test results. **The District reserves the right to TV any section of the sewer system to locate point sources of infiltration, either in the pipe or inside manholes.** When directed by the Engineer, any desired section shall be isolated and tested separately.

(b) No sooner than 10 days following completion of backfill, the Contractor along with the Engineer, will be required to determine the level of the ground water table. If the ground water table is above the top of the pipe, the sewer line shall be tested for infiltration. If ground water table is less than 2 feet above the top of the pipe, the

sewer line shall be low pressure air tested. Each test shall be as performed as follows:

1. **Infiltration**

The infiltration into each section of the sewer shall be measured in wet weather by the temporary installation of suitable metal or wooden weirs as authorized by the Engineer. These weirs shall be furnished, installed and removed by the Contractor. Infiltration tests limits shall be applied to single reaches of pipe, up to one mile in length, of the same diameter. For pipes 8" through 15" in diameter, infiltration into the sewer system (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours. For all pipe sizes larger than 15" in diameter, infiltration into the sewer system (including manholes) shall not exceed 100 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours.

2. **Air Testing of Gravity Sewers**

The Contractor shall conduct low pressure air tests on all completed sections of gravity sewer. Air tests for PVC, DIP, and VCP lines will be performed in accordance with ASTM C828. Air tests for Concrete pipe 24 inches in diameter and smaller shall be performed in accordance with ASTM C924. Air test results will be used to evaluate materials and construction methods on the sewer line sections, and successful air tests shall be mandatory for the acceptance of the sewers 24 inches in diameter and smaller.

a) Air test will not be required on pipe with diameters exceeding 24 inches. Acceptance of pipes exceeding 24" will be based on infiltration tests and/or visual inspection of the joints.

b) The Contractor shall furnish an air compressor of the necessary capacity along with all necessary plugs, valves, pressure gages, air hoses, connections, and other equipment necessary to conduct the air tests. Plugs in sewers 18 inches in size and larger shall be connected by steel cable for thrust reaction.

c) Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C = Required Compressor Capacity (cfm)
T = Required Test Time (min) L = Length of Test Section (feet)
D = Pipe Internal Diameter (feet) Q = Allowable Air Loss Rate (cfm)

d) The following allowable air loss rates will be used for all pipe tests:

Pipe Size	Q (cfm)	Pipe Size	Q (cfm)
4"	2.0	15"	4.0
6"	2.0	18"	5.0
8"	2.0	21"	5.5
10"	2.5	24"	6.0
12"	3.0		

e) The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 psig. At 3.5 psig, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of 5 readings will be required for each test.

f) If the time for the air pressure to decrease from 3.5 psig to 2.5 psig is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air test.

Minimum Test Times for Pipe

Pipe-Size →		4"	6"	8"	10"	12"	15"	18"	21"	24"
	25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
	50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
↑	**75**	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
	100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
L										
E	**125**	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
N	**150**	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
G	**175**	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
T	**200**	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
H										
	225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
O	**250**	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54

F	**275**	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
	300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
P										
I	**325**	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
P	**350**	1:02	2:20	4:09	4:11	6:14	7:18	8:25	10:24	12:28
E	**375**	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
	400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
T										
E	**425**	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
S	**450**	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
T	**475**	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
E	**500**	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
D										
	525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
↓	**550**	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
	575	1:42	3:50	6:49	8:32	10:14	11:60	13:49	17:06	20:28
	600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

g) For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: Le = Effective Pipe Length (added to Total Test Length)
d = Diameter of Service Lateral Pipe (inches)
l = Length of Sewer Lateral (feet)
D = Diameter of Sewer Main Pipe being tested (inches)

2.08 Manholes

(a) General

(1) Manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, manholes shall be as follows:

8" to 18" pipe ..… 4' diameter .... 5" thick walls
21" to 36" pipe ..……5' diameter .... 5" thick walls
39" to 54" pipe ..……6' diameter .... 6" thick walls
54" and larger ..……8' diameter .... 8" thick walls

(2) The height or depth of each manhole will vary with the location, but it shall be

such as will place the top at the finished grade of the pavement or ground surface or to the elevations shown on the plans and the invert at the elevation shown on the plans. The number of joints shall be minimized. No riser sections for manholes up to six feet (6') tall and no more than 1 riser for each additional 4 feet in height. One additional section will be allowed for transition manholes.

(b) Drop Manholes

Drop Manholes shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class B concrete as indicated on the plans.

(c) Manhole Construction

(1) Manholes shall be composed of precast reinforced components with tongue and groove joints. Manholes shall conform to the requirements of ASTM Specification C478, except as modified herein.

(2) Concrete: Concrete shall conform to ASTM C478 and as follows:

Compressive strength:	5,000 psi minimum at 28 days.
Air Content:	5 - 7 %
Alkalinity:	Adequate to provide a Life Factor, Az = Calcium Carbonate Equivalent times Cover over Reinforcement, no less than 0.35 for bases, risers and cones.
Cementitious Materials:	Minimum of 564 pounds per cubic yard
Coarse Aggregates:	ASTM C33. Sound, Crushed, Angular Granitic Stone only. Smooth or rounded stone shall not be used. Free from organic impurities.
Chemical Admixtures: (if used)	ASTM C494. Calcium Chloride or admixtures containing calcium chloride shall not be used.

Air Entraining Admixtures (if used): ASTM C260.

Absorption shall not exceed six (6) percent.

(3) Reinforcing: Reinforcing steel shall be ASTM A615 grade 60 deformed bar, ASTM A82 wire or ASTM A185 welded wire fabric.

(4) Lifting Loops: Lift loops shall be ASTM A416 steel strand. Lifting loops

made from deformed bars shall not be allowed.

(5) Wall Thickness: The minimum wall thickness of the manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of eight (8) inches at their top. The minimum thickness of the bottom shall be six (6) inches for manholes four (4) feet in diameter and eight (8) inches for all sizes greater than four (4) feet in diameter. Suitable openings for inlet and outlet sewer pipe shall be cast or cored into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole.

(d) Manhole Components

(1) Precast Manufacturing: Precast components shall be manufactured in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate references and specified below.

(2) Certification: Precast manufacturer shall manufacture all precast components with one or more of the following testing methods.

Plant shall be certified by the National Precast Concrete Association (NPCA) Plant certification program.

Plant shall be certified by the Prestressed Concrete Institutes (PCI) Plant certification program.

Manufacturing process of components delivered shall have been randomly tested by a District approved outside agency (such as a State Department of Transportation) no less than 5 weeks prior to manufacture. Test results covering no less than one component in 100 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the District upon request. Minimum test shall cover concrete strength and absorption.

Components delivered shall be tested by a certified outside testing agency. Test results covering no less than one component in 25 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the District upon request. Minimum test shall cover concrete strength and absorption.

Joints: For joints utilizing O-Ring seals, the maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10". The manhole sections shall be joined as specified herein.

Lift Inserts and Holes: If used for handling Precast Components, lift holes and inserts shall be sized for a precision fit with the lift devices, and shall comply with OSHA Standard 1926.704.

Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of 12" or 16". Cast step holes shall be tapered to match the taper of the steps.

(3) Precast Base Sections: Base sections shall have the base slab cast monolithically with the walls, or have an approved galvanized or PVC waterstop cast in the cold joint between the base slab and the walls. Where extended base manholes are required, the width of the base extensions shall be no less than the base slab thickness. The bottom step in base section shall be a maximum of 20" from the top of the invert Bench.

(4) Precast Riser Sections: The minimum Lay length of Precast Riser Sections shall be equal to the step spacing used by that manufacturer.

(5) Precast Concentric and Eccentric Cone Sections: Precast Cone Sections shall have an inside diameter at the top of no less than 24" and no more than 26". The width of the top ledge shall be no less than eight inches (8") and no less than the wall thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.

(6) Precast Transition Cone Sections: Transition Cone Sections shall provide an eccentric transition from 60 inch and larger manholes to 48-inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees. A minimum of (6') height is required between the bench

(7) Precast Transition Top Sections: Transition Top Section shall provide an eccentric transition from 60 inch and larger manholes to 48" diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition tops shall not be used in areas subject to vehicle traffic.

(8) Precast Flat Slab Top Sections: Standard Flat Slab Top Sections shall have an access opening with an inside diameter at the top of no less than 24" and no more than 26" and shall be designed for HS-20 traffic loadings as defined in

ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.

(9) Precast Grade Rings and Brick: Precast Grade Rings or Brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than 4" in height. All brick used shall be solid shall be made from Concrete, Clay, or Shale and shall be of standard building size.

(10) Steps: Provide steps in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on 12" or 16" centers. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place. The steps shall be a Copolymer Polypropylene Plastic reinforced with a 1/2" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be a minimum of 2000 lbs when tested according to ASTM C497. The minimum width shall be 12 inches. Rubber or plastic covered steel steps shall be as manufactured by Delta Pipe Products Co., M. A. Industries, Inc., or equal. All manhole steps shall comply with the requirements of OSHA.

(11) Lifting Devices: Lifting devices complying with OSHA Standard 1926.704 for handling the Precast Components shall be provided by the Precast Manufacturer.

(12) Coatings: Where shown on the plans, the interior/exterior of the manhole walls shall be coated with 21 mils of Coal Tar Epoxy, Koppers 300M or equal. The coating shall be spray applied according to the manufacturer's recommendations by an applicator with a minimum of 5 years experience. The joints between precast sections shall not be coated. Use butyl rubber rope as specified above to seal the interior horizontal joint surface.

(13) Joint Sealing Materials: Joints shall be sealed by **TWO** Seals. Each seal shall be as described in one of the following paragraphs:

(a) Internal Butyl Rubber Rope(s) - Internal Butyl Seal(s) shall consist of a plastic or paper-backed butyl rubber rope no less than 14 feet long and no less than 1" in diameter. When manholes are larger than 4' diameter or have a larger than normal space between the joints the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl Rubber Material: Butyl rubber shall conform to Federal Specification SS-S210A, AASHTO M-198, Type B - Butyl Rubber and

as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Butyl Rubber shall be applied to clean, dry surfaces only. Use of two (2) independent wraps of Butyl Rubber qualifies for the requirement of two seals.

(b) Internal O-Ring Gasket - Internal O-Ring Gasket shall conform to ASTM C443, and be installed according to the Precast Manufacturer's recommendation.

(c) Internal Rubber Gasket - Internal Rubber Gasket shall conform to ASTM C361, and be installed according to the Precast Manufacturer's recommendation. Internal Rubber Gasket shall be F114 Manhole Gasket as manufactured by Forsheda Pipe Seal Corp. or preapproved equal.

(e) Manhole Sleeves and Entrance Joints

(1) Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipe entering and leaving precast manholes. Manhole openings shall be accurately core drilled or cast in place. Sleeve and Joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Sleeve hardware (clamps, bands, straps, draw bolts, nuts, etc.) shall be stainless steel and make a watertight union. Sleeves shall be Kor-N-Seal I, Kor-N-Seal II, or Contour Seal, as manufactured by National Pollution Control Systems, Inc., flexible connectors model 72, 73, 74, 107, 117, 126, 127, 128, 1610, or 1612 as manufactured by EPCO, or shall be as manufactured by Lock Joint a subsidiary of Gifford-Hill-American, Inc. or comparable sleeves as manufactured by the Press Seal Gasket Corporation; or equal. Flexible manhole entrance joints shall be cast into the wall of the manhole base to form a tight waterstop. Joints shall be watertight under a 30-foot head of water. Flexible manhole entrance joints shall be A-LOK Joints as manufactured by the A-LOK Products Corp., Press Wedge II as manufactured by the Press Seal Gasket Corp., or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer. Installation on steep grades may require pipe openings cast or cored with a vertical angle. Alternative entrance joint connections must be approved by Municipality prior to construction.

(f) Placing Manhole Sections

The Contractor shall excavate to the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending 6-inches beyond the manhole base.

The base shall be set plumb and level, aligning manhole invert with pipe invert.

Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom. For rubber gaskets follow manufacturer's recommendations for installation.

Risers and cones shall be set so that steps align, taking particular care to clean, prepare and seal joints.

(g) Manhole Final Finishing

After placement of manhole frame and vacuum testing, perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2" in length, width or depth (1/8" deep in inverts) with non-shrink grout. Grout the interior joints between the precast concrete sections with non-shrink grout. When manhole cone top opening is less than manhole frame base inside flange diameter, cone top shall be chamfered or grouted to prevent injury on sharp edges. Shaper edges or rough finishes shall be removed providing a smooth surface throughout the manhole. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

(h) Connection to Existing Manholes

(1) Any connection with 16-inch and smaller pipe at an existing precast or cast-in place manhole will require the Contractor to core the necessary opening through the manhole wall and install a flexible manhole to pipe connector. Connector shall be as specified elsewhere. Connections to existing brick manholes do not required coring and an opening may be carefully hammered or sawed. Connections to existing manholes with 18-inch and larger pipe may be cored or sawed as approved by the Engineer. When noted on the plans or directed in writing by the District, a connection to an existing manhole may be made without using flexible pipe connectors.

Whenever a connection is made without a flexible pipe connector, it shall utilize non-shrink grout and a brick and mortar collar. The existing manhole bench and invert shall be repaired as specified under manhole materials and installation.

(i) Manhole Inverts

(1) Manhole inverts shall be constructed of brick and cement grout or precast

concrete and shall have a "U" shaped cross section of the same diameter as the invert of the sewers which they connect. "U" shaped inverts shall be constructed to a minimum depth of 6" for 8" sewers (unless full depth is required in Special Conditions) and to full pipe diameter depth of the outlet sewer main for larger mains. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer, whether horizontal or vertical, shall be made with true tangent curve(s) with as large a radius as the size of the manhole will permit. Manhole benches shall slope a minimum of 2" to the lip of the "U" shaped invert. Provide a 1/2" radius at the intersection of 2 or more channels. The minimum concrete thickness in the invert of the channel shall be 2-inches, not including the manhole base thickness.

(2) When the fall between the inlet and the outlet holes is not available from precast company, the contractor shall construct the invert using 4000 PSI concrete or non shrink grout. Non shrink grout (minimum 2" thickness on invert channel and on bench) may be plastered over layered brick and mortar in lieu of solid non shrink grout invert.

(3) Inverts shall meet the following additional requirements:

Pipe Openings: Pipe openings shall provide clearance for pipe projecting a minimum of 2" inside the manhole. The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe.

Trough: The fall across the manhole invert shall be as noted on the plans.

Bench: Float finish benches to provide a uniform slope from the high point at the manhole wall to the low point at invert trough. Provide a radius (1/8" to 1" range is acceptable) at the edge of the bench and trough.

Gradual smooth sided depressions and high spots shall be allowed so long as diameter of invert channel ranges from 1/4" less than or 1/2" more than the nominal pipe diameter are maintained. Voids, chips, or fractures over 1/8 inch in diameter or depth shall be filled with a non-shrink grout and finished to a texture reasonably consistent with the bench surface.

(j) Manhole Frame and Cover Construction

(1) Manhole frames and covers shall be made of cast iron conforming to the minimum requirements of ASTM Specification A48, Class 35B. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. Defective castings

which have been plugged or otherwise treated shall be rejected. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces.

(2) All frames and covers shall comply with AASHTO HS20 loading requirements. When a frame is designated as not for use in pavement applications ("**N**") a reduced height traffic bearing frame may be used in lieu of the standard frame for the purpose of adjusting grade. All manhole frames shall be equipped to accept a cam-lock cover. However, only those frame & covers designated on the plans as watertight ("**W**") or lock down ("**L**") shall have covers equipped with cam-locks. When cam-locks are required, covers shall be furnished with two stainless steel, pentagon headed cam-locks. Frames and covers designated as watertight ("**W**"), shall have a cover equipped with a one-piece gasket permanently attached in a groove in the manhole cover. An o-ring gasket may be placed in a dove tailed groove in the bottom of the cover if cam-lock feature provides sufficient pressure to prevent cover movement and subsequent wear of gasket. Otherwise gasket shall be double edged and placed in a groove in the side of the manhole cover.

(3) All covers shall have two 5/8-inch diameter lifting bars set into the cover to allow for lifting by a chain hoist. There shall be no holes or perforations in covers. For models other than those listed as preapproved, the manufacturer's shop drawings shall be sent to the Engineer for review and acceptance by Municipality prior to manufacturing and shipping of castings to the job site.

(4) Pre-approved Heavy Duty Standard Frames include:

USF 577 Ring (with tooling for Bi-Loc Cover) as manufactured by U.S. Foundry & Mfg. Corp.

MH-RCR-3000 series (with tooling for Cam-locks) as manufactured by Dewey Brothers, Inc.

1045Z1-1040AGS (with cam-lock ramp) as manufactured by East Jordan Iron Works, Inc.

(5) Pre-approved Reduced Height Frames include model:

MH-RCR-3000SR series (with tooling for Cam-locks) as manufactured by Dewey Brothers, Inc.

1046Z1 (with cam-lock ramp) as manufactured by East Jordan Iron Works, Inc.

(6) Manhole Frame Placement

After the manhole has been set in its final position, set the manhole frames to the required elevation using no more than 12-inches of precast concrete grade rings, or bricks (maximum three layers) sealing all joints between cone, adjusting rings, and manhole frame. When grade rings are used apply a 2" X 1/4" strip of butyl between the rings, the frame, and the cone. When bricks are used, grout with Cement mortar. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing pavement adjacent thereto. Manhole Frames which are placed above final grade will have frames attached to manhole cone section by means of a minimum of three symmetrically placed 1/2-inch diameter stainless steel anchors and stainless steel washers or shall have frames recast into the manhole cone or slab by a District approved process.

(k) Manhole Submittal Data

(1) Drawings and descriptive data on manholes, (including wall thicknesses, vertical dimensions, and deflection angles), concrete used in manufacture of manholes and precast inverts, rubber gaskets, joint sealant, flexible manhole sleeves and joints, frames and covers, inverts, and manhole steps shall be submitted to the Engineer for review prior to their manufacture.

(l) Manhole Delivery, Storage, and Handling

(1) The Contractor shall coordinate delivery with the manufacturer, handle and store the Manhole Components in accordance with the ASTM C891 and the manufacturer's recommendations using methods that will prevent damage to the components and their joint surfaces.

(m) Grouts

(1) All grouts used on manhole interiors shall be "non-shrink" grouts, and Grout used on manhole exteriors shall be either "non-shrink" or standard cement mortar grouts, as specified in Item II, Concrete, of the specifications.

2.09 Vacuum Testing of Manholes

(a) The requirement for vacuum testing will be per engineer’s decision on a case by case basis; if testing required it will follow the guidelines below:

(b) Vacuum testing of manholes shall be required on no less than ten percent of the

manholes installed. In addition, no less than five (5) manholes will be tested. The District will select which manholes shall be tested after construction. Vacuum Testing each manhole prior to backfilling is recommended as most repairs must be made on the manhole exterior. Vacuum testing is not required on manholes with pipe connections in excess of 30" diameter.

(c) Vacuum test the assembled manhole after completing pipe connections and sealing. The vacuum test shall be as follows:

(1) Plug pipes with suitably sized and rated pneumatic or mechanical pipeline plugs. Place plugs a minimum of 6" beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.

(2) Position the vacuum tester head assembly to seal against the interior surface of the top of the cone section and inflate according to the manufacturer's recommendations.

(3) Draw a vacuum of 10" of mercury, close the valve on the vacuum line and shut off the vacuum pump.

(4) Measure the time for the vacuum to drop to 9" of mercury. The manhole shall pass when the time to drop to 9" of mercury meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120
Time (seconds)	60	75	90	105	120	150

(5) If the manhole fails the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make the necessary repairs and repeat the test until the manhole passes.

2.10 Existing Utilities and Separation Requirements

(a) The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction or as noted in the Special Conditions Section of this document.

(b) All utility owners will be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Owners who are members of NC OneCall may be notified by calling 1-800-632-4949 before any excavation or drilling. The Contractor will be fully responsible for damage to any utilities if the owners have not

been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the District for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

(c) Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

(d) Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

(e) When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

(f) When a sewer main or lateral crosses an existing water main or other utility, the Contractor shall make the installation in accordance with the minimum specifications of the Controlling Agency and in accordance with the following minimum requirements. When a sewer main or lateral crosses or parallels an existing utility, the following clearance requirements are to be met or ferrous sewer pipe with water tight joints shall be used for a distance of ten feet outside said point of crossing or until horizontal separation requirements are achieved.

(1) Min. Vertical Separation for Sewer Crossings:

Storm Sewers -	12" Vertical
Under Water -	18" Vertical
Over Water -	18" Vertical * Sewer over water requires that both pipes shall be ferrous pipe with a 20 foot jointless span centered at crossing. *
Cable -	24" Vertical
Power -	24" Vertical
Gas -	24" Vertical

(2) Horizontal Separations:

Storm Sewers -	5'
Water Mains -	10'
Water Supply -	100' (AS-I Waters, Class I or Class II impounded reservoirs).
Water Supply -	50' (WS-I, WS-II, WS-III, B, SA, or SB Waters – Natural High Water)
Designated Trout Streams -	25'
Other Stream, Lake or Impoundment -	10'
Building Foundation -	5'
Basement -	10'
Ground Water Lowering and Surface Drainage Ditch	10’
Swimming Pool -	10'
Private Wells -	25'
Public Wells -	50'

2.11 Deep Services and Maximum Service Grade

(a) When the depth of cut is over 8 feet and the grade of a sanitary sewer is lower than necessary to drain abutting property, and at such other locations as may be designated by the Engineer, the contractor will construct service lines at grades of up to 100 percent (45 degrees) and shall use 22 1/2 or 45-degree bends, (at each end of steep service line), to bring the service to within 8 feet of the surface.

(b) Unless required service depth is noted on construction drawings, the contractor shall contact the Engineer and request confirmation of grade prior to constructing any sewer service line at a depth greater than 8 feet or at a grade in excess of 2 percent slope.

2.12 Tie-ins to Existing Public or Private Collection Systems

(a) Tie-ins to existing public or private collection systems will be allowed when proper precautions are taken to protect the existing Municipality public collection system. Tie-ins to existing inactivated sewer lines not installed under the same contract will not be allowed without written approval from all parties involved (Municipality, contractors, contract holders, etc.).

(b) If the proposed sewer does not begin at an existing manhole, a new manhole will be "cut in" at the required location and the existing pipe(s) repaired as specified. For Extensions of the system, the new "cut in" manhole or the connection to the existing manhole will not be constructed until all other sewer construction has been completed and tested in compliance with the specifications. For connection to a private collection system, fittings and cleanouts may be substituted for "cut in"

manholes if approved by the owner of the private collection system and the State of North Carolina Department of Environment Health and Natural Resources.

(c) Pipelines or manholes which contain silt, sedimentation, or other foreign material shall not be connected to any portion of the existing public collection system or any private collection system already connected to the District system. The Contractor shall at his own expense flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

2.13 Flow Interruptions and Bypass Pumping

(a) When the flow of an existing sewer must be interrupted and/or bypassed, the Contractor shall, before beginning any construction, submit a work schedule which will minimize the interruption and/or bypassing of wastewater flow during construction. This schedule must be approved by the District, the Engineer, and (if appropriate) the owners of the private collection system and may require night, holiday, and/or weekend work.

(b) If pumping is required, an identical standby pump shall be on site in the event of failure of the primary pump. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work will be suspended until the problem is resolved to the satisfaction of the Engineer. The Contractor shall be responsible for any fines levied as a result of effluent reaching surface waters. The contractor will be required to verify his method of handling sewer flows during construction by pumping at peak flows for 1 hour as approved by the Engineer.

2.14 Repairs on New Construction

(a) All leaks shall be repaired by identifying and exposing the defective section of pipe and completing repairs. Chemical grouting or internal or external wiping of joints with cement grout are specifically not approved as methods for repairing leaks on new pipelines, regardless of the pipe material approved Methods of Repair as follows:

(b) VCP: Deflective pipe sections, including leaking joints, shall be removed and replaced with sound new pipe. The pipe shall be re-connected with approved couplings.

(c) PVC or DUCTILE IRON: Defective or damaged pipe shall be removed and replaced with sound new pipe. The pipe shall be re-connected with approved couplings. Joint leaks may be repaired with bell clamps specifically approved by the Engineer.

(d) RCP: Defective or damaged pipe shall be removed and replaced with sound new pipe. The pipe shall be re-connected with concrete collars or approved couplings. Joint leaks may be repaired with bell clamps specifically approved by the Engineer. Concrete collars or repair couplings shall be limited to one every 100 feet not to exceed three pipe repairs between manholes. Deficiencies in excess of these limitations shall be corrected by relaying the section of pipe.

(e) Manholes: Defective or damaged manhole components shall be removed and replaced with sound new components unless repairs are approved by the District.

(1) Leaks through the manhole joints or walls or around pipe collars, may be repaired with non-shrink grout applied (internally if approved by the District), otherwise externally.

(2) Leaks around boots or gaskets used to join pipe to manholes shall be repaired as recommended by the manufacturer. In the absence of specific recommendations, such leaks shall be repaired by internal grouting with non-shrink grout or external concrete collars as directed by the Engineer.

(3) Lift Holes leaving less than 2" of wall thickness shall be plugged from the outside using non-shrink grout. Penetrating lift Holes shall be plugged from the inside and outside using non-shrink grout.

2.15 Abandonment of Existing Sewers and Manholes

(a) Manholes which are to be abandoned will first have both influent and effluent lines plugged inside the manhole with watertight masonry. The manhole will then be filled with incompressible material (crushed stone or as approved), to a point three feet (3'-0") below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be backfilled to finish grade as specified under trench backfill.

(b) Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform with the standard details.

(c) Exposed sections of abandoned mains shall be removed to a point not less than 5 feet from the adjacent banks or surface waters. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point three feet (3'-0") below the finish grade. Steel piers shall be cut off three feet (3'-0") below finish grade.

(d) The minimum length of watertight masonry plugs will be the diameter of the abandoned pipe plus one foot.

2.16 Structural Demolition

(a) Prior to starting construction operations, the Contractor shall demolish and remove therefrom such buildings and other structures as are specifically designated on the plans for removal. Removal and disposal of such materials shall be done in accordance with federal, state, and local ordinances at permitted sites. All permits required shall be obtained by the Contractor.

2.17 Handling and Storage of Materials

(a) The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of all pipe, manholes and other accessories shall be kept free from dirt and foreign materials at all times.

(b) The Contractor is responsible for the delivery and site distribution of all materials.

(c) Ductile iron pipe and cast iron accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Pipe shall not be loaded, unloaded, or transported by placing lifting forks inside the barrel or the pipe. Concrete pipe, clay pipe, PVC pipe, all pipe accessories, precast concrete manholes, and manhole frame and covers will be unloaded with hoists and/or as recommended by the respective manufacturers. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

(d) In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or right-of-way, as applicable.

(e) The Contractor will string in advance no more than the amount of pipe and material that can be installed within four (4) weeks or less as approved by the Engineer. All the materials shall be placed in such a manner as not to hinder access, endanger or impede traffic, or create a public nuisance. Materials strung through residential areas (or any area with maintained lawns) shall be placed in such a manner as not to restrict normal maintenance of established lawns, and must either be installed within two (2) weeks or removed to an approved storage yard, as required by the Engineer.

(f) The Contractor will be responsible for locating and providing storage areas for

construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is received by the Engineer, the Contractor will be required to store all equipment and materials within the limits of the right-of-way and temporary construction easement provided. The materials and equipment storage shall comply with all local and state ordinances throughout the construction period.

(g) The Contractor shall be responsible for the safeguarding of materials and equipment against fire, theft, and vandalism and shall not hold the District responsible in any way for the occurrence of same.

(h) At the direction of the Engineer, the Contractor shall remove materials which have been damaged beyond repair from the site to prevent accidental placement.

2.18 Care of Coatings and Linings

(a) Precast manholes, pipe and fittings, including rings and covers, steps, straps, etc., shall be so handled that the coating or lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

2.19 Work Progress and Clean Up

(a) The project site shall be cleaned up in accordance with the requirements of the General Conditions, as the work progresses. Site clean up shall not lag pipe laying more than 1,000 feet, and site clearing and grubbing shall be limited to 3,000 feet ahead of pipe laying, unless specified or directed otherwise by the Owner or Engineer.

2.20 Owner Notice and Preparation of Site

(a) The Owner will secure rights-of-way or easements where required through private lands. The Contractor shall be responsible for any damage to buildings, walls, fences, utility poles, bridges, utilities, railroad, or other improvements encountered whether public or private. All such improvements shall be carefully protected from damage, and, in case of damage or removal, shall be completely repaired or restored to its original or better condition. All damage to such improvements and all damage to property or persons resulting from damage to such improvements shall be the responsibility of the Contractor. Special care shall be taken in trenching near buildings, roads and railroads, to avoid or minimize all delays, damage, or injury thereto.

(b) Prior to any operation, the contractor shall give advance notice to all owners and/or tenants within the project.

2.21 Use of Easements and Rights-of-Way

(a) Prior to disturbing any area, the contractor shall stake the limits of any easement and/or right-of-way. The contractor shall confine all his operations and personnel within limits of all rights-of-way and easements as shown on the plans. There shall be no disturbance whatsoever outside the easement or rights-of-way nor shall the workmen be allowed to travel at will through the surrounding private property. The contractor is responsible to note any areas where limits have been reduced from typical limits. Prior to using any areas outside the rights-of-way and easements provided, the Contractor shall provide written approval of the current property owner and submit to the Engineer for his approval. **The Contractor shall abide by all Special Conditions Detail Sheets provided in the special conditions section of the specifications.**

2.25 Protection of Designated Trees and Shrubs

(a) Trees, cultivated shrubs, and similar growth which: occupy areas outside the limits of public rights-of-way or easements OR are designated in the Special Conditions Detail Sheets to remain undisturbed, shall be carefully preserved and protected by the Contractor throughout all stages of the construction work. Adherence to the above shall be the responsibility of the contractor.

(b) The Contractor shall protect existing trees and other vegetation indicated to remain in place 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 guards to protect trees and vegetation to be left standing.

(c) The Contractor shall provide protection for roots over 1-1/2" diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

(d) The Contractor shall repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the Engineer. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

(e) The Contractor shall replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the Engineer with trees of similar size and species. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations

shall be at the Contractor's expense.

2.26 Clearing Easements and Rights-of-Way

(a) Unless otherwise specified in the Special Conditions Detail Sheets, the entire permanent easement shall be cleared.

(b) Temporary construction easements will be selectively cleared with designated landscape items carefully preserved and protected as stipulated in Special Conditions Detail Sheets.

(c) Public rights-of-way shall be cleared as shown on the plans and as stipulated in Special Conditions Detail Sheets. The Engineer will provide copies of all required tree permits.

(d) No clearing or grubbing may be performed on easements procured by Municipality or in rights-of-way except under supervision of the Project Inspector. Areas to be cleared which are occupied by trees, brush or other vegetable growth shall be cleared of such growth and suitably grubbed. All large roots or stumps shall be removed to a depth of at least two feet below original ground surface. Any pits or cavities thereby created which extend beyond the area to be excavated shall be filled with the materials and in the manner specified for trench backfill in these specifications. All stumps, limbs and trash shall be removed and disposed of at a location approved for disposal of such materials by the agency having jurisdiction.

(e) Useable timber and/or firewood may be left on the area adjoining the permanent right-of-way at the request of or with the consent of the property owner. The Contractor must obtain such requests in writing from the property owner. The request must release the District from any claims for improper disposal of timber.

(f) When the Special Conditions Detail Sheets specifies stacking timber or firewood adjacent to the permanent right-of-way, a written release is not required. The Contractor shall verify cut lengths of timber/firewood for such placement and location with the property owner.

(g) Fences removed during construction shall be replaced of the same material and to the same condition existing prior to the construction, unless provided otherwise in the Special Conditions Detail Sheets.

2.27 Hubs set by the Contractor

(a) As a minimum, centerline hubs and offset stakes will be set by the Contractor at each manhole. Cut sheets will show the vertical distance from the offset stakes to the inlet and outlet pipe inverts at each manhole.

(b) Laser beams may be used to set line and grade when the contractor provides adequate and accurate equipment for the Engineer to check line and grade at each cut stake (lock levels shall not be considered adequate). If lasers are used, grades shall be checked at each manhole. Fans may be used in conjunction with laser beams only if approved by the Engineer. The contractor shall keep close check of his laser for variations in line and grade. No variations in line or grade shall be corrected between manholes without relaying that portion of the line which has deviated from line or grade unless otherwise approved by the District Engineer.

2.31 Steel Straps and Anchors

(a) All pipe and/or pier straps shall conform to the requirements of ASTM A36 with a minimum yield strength of 36,000 P.S.I.

(b) Finished straps, anchors, and hardware (washers, nuts, etc.) shall be galvanized in accordance with ASTM A153. The entire strap and all exposed surfaces of anchors and/or bolts (and nuts) shall be furnished with two (2) evenly applied coats of rust inhibiting enamel paint, either Koppers Glamortex No. 501 Enamel (Black), Southern Coatings Rustaloy No. 0537 Enamel (Black), or equal. Anchor bolts (non-head) shall conform to ASTM A36 with tension text to be made (as required) on the bolt body or on the bar stock used for making the anchor bolts. Unless otherwise specified all other fasteners shall conform to ASTM A307 for carbon steel externally and internally threaded standard fasteners Grade A or B.

PART 3: EXECUTION

3.01 Shoring and Shielding

(a) The Contractor shall comply with OSHA trenching and excavation regulations as revised in "Subpart P" of Part 1926 in the Federal Register. Shoring and/or shielding shall be used as specified in "Subpart P" to prevent caving of trench banks and to provide a safe excavation.

(b) **The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.**

3.02 Site Grading or General Excavation

(a) Sites for pumping stations and access roads shall be graded by mechanical

equipment within the areas and to the elevations shown on the plans. Grading operations shall be conducted so that material shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in reasonably smooth and uniform planes such as are normally obtainable from the use of hand tools; but if the Contractor is not able to obtain the required degree of evenness by means of mechanical equipment, he will be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to conform to the slope lines shown on the plans or as staked by the Engineer.

(b) Topsoil from the surface of the ground to be excavated or occupied by fills, within the general area specified to be planted with grass, shall be "stripped" or removed before site grading or other excavation work is started. Topsoil so removed shall be stockpiled at a suitable location on the site of the work so that it can be reused later for planting grass as specified in these specifications. This "stripping" operation shall remove all leaves, loam, and loose topsoil which are unsuitable for foundations. The depth to which topsoil is removed shall be determined by the Engineer, but will be generally between the limits of two and six inches.

3.03 Structural Excavation

(a) Excavation for structures shall be sufficiently large for the proper placing of forms and concrete and for dewatering purposes, but shall not be excessively large in horizontal area. Banks may be sloped at a safe angle provided that such excavation does not endanger or damage existing or proposed structures, pipelines, etc. The bottom of the excavation shall be true to the required shape and elevations shown on the plans. No earth backfilling will be permitted under structures unless specifically shown on the plans. Should the Contractor excavate below the elevations shown or specified, he shall fill the void made with thoroughly compacted Class I pipe embedment materials or with Class B concrete at his own expense.

(b) When muck, quicksand, soft clay, swampy or other material unsuitable for foundations are encountered which extend beyond the limits of the excavation, such materials shall be removed and replaced with thoroughly compacted crushed stone acceptable to the Engineer or with Class B concrete.

(c) In all cases where materials are deposited along open excavation, they shall be placed so that in the event of rain, no damage will result to the work or adjacent property.

3.04 Trench Excavation

(a) Trench excavation or excavation for pipelines shall consist of excavation

necessary for the construction of sewers, conduits and other pipelines and all appurtenant facilities thereof, including manholes, inlets, outlets, pipe embedment materials, and pipe protection as called for on the plans. It shall include site preparation, backfilling and tamping of pipe trenches and around structures and the disposal of waste materials, all of which shall conform to the applicable provisions of these specifications.

(b) Trench excavation shall be made in open cut and true to the lines and grades shown on the plans or established by the Engineer, unless tunneling or boring is shown or specified. When practical the banks of the trenches shall be cut in vertical, parallel planes equidistant from the pipe center line. The horizontal distance between such planes, or the overall width of trench, shall vary with the size of the pipe to be installed. The overall width of trench shall be of the dimensions shown on the plans. When sheeting is used, the distance between vertical planes shall be measured from the inside faces of the sheeting. When vertical banks for trench excavation are not practical to construct or create dangerous conditions to workmen, the banks may be sloped provided that such excavation does not damage adjacent structures. When trench banks are sloped, such banks shall be cut to vertical planes as specified above for that part of the ditch below the level of 12 inches above the top of the pipeline. The bottom of the trench shall be level in cross section and shall be cut true to the required grade of the pipe except where concrete cradles or pipe embedment materials are shown on the plans, specified or authorized by the Engineer, in which case the excavation shall extend to the bottom of the cradle or pipe embedment materials.

(c) Bell holes for bell and spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of joints in the pipe.

(d) Excavation for manholes and other pipeline structures shall be as specified for structural excavation.

(e) When muck, quicksand, soft clay, swampy or other material unsuitable for foundations or subgrade are encountered which extend beyond the limits of the excavation, such material shall be removed and replaced with pipe foundation material as specified elsewhere in these specifications.

(f) All work shall be performed so as to cause the least possible inconvenience to the public. Temporary bridges or crosswalks shall be constructed where necessary to maintain vehicular or pedestrian traffic. Crosswalks and bridges shall have handrails or other features necessary for safe use by the public.

(g) In all cases where materials are deposited along open trenches, they shall be placed so that in the event of rain, no damage will result to the work or adjacent

property.

3.05 Dewatering Excavated Areas

(a) The Contractor shall provide and maintain ample equipment with which to remove all water from every source which enters excavations for structures and pipelines. Dewatering operations shall ensure dry excavations and the preservation of the elevations of the bottoms of the excavations shown on the plans.

(b) Surface drainage shall not be allowed to enter excavated areas.

(c) Where the areas to be excavated are located under water surfaces or near the banks of flowing streams or other bodies of water, the Contractor may adopt and carry out any method of dewatering he may deem feasible for the performance of the excavation work and for protection of the work thereafter; provided that the method and equipment to be used results in completed work which complies with the specifications and is acceptable to the Engineer. In such cases, the excavation area shall be effectively protected from water damage during the excavation period and until all contemplated construction work therein has been completed.

(d) Prior to beginning excavation for structures which are to be constructed at or below the groundwater table, groundwater levels shall be lowered and maintained at workable levels. For structures other than manholes this level must be at least three (3) feet below the bottom of such structures until construction and backfilling operations have been completed.

(e) The Contractor shall be responsible for damage to structures caused by hydrostatic displacement during construction operations.

(f) The Special Conditions may contain additional requirements for dewatering excavated areas.

3.06 Borrow Excavation

(a) Wherever the backfill or embankment requires a volume of material that is in excess of the volume of suitable material available from the authorized excavations, such excess volume shall be obtained from other sources. Where borrow pits on the construction site are specifically designated on the plans, borrow excavation shall be obtained there from; otherwise, the Contractor shall provide suitable borrow material from areas accessible to the work. Before a borrow pit is opened the quality and suitability of the material to be obtained there from shall be approved by the Engineer.

(b) Borrow pits shall be properly cleared and grubbed and all objectionable matter

shall be removed from the borrow pit material prior to its placement in the backfills.

(c) Borrow shall be excavated so that the remaining surfaces and slopes will be reasonably smooth and even and will provide adequate drainage over the entire area. Drainage ditches shall be constructed where necessary to provide outlets of water to the nearest natural channel so that the formation of pools in the borrow pit area will be avoided. Sides of borrow pit cuts shall be left at two to one slope unless otherwise authorized by the Engineer.

(d) The contractor shall furnish to the District written approval for the use of the Borrow Pit site. Upon completion of work the Borrow Pit shall be restored to a condition acceptable to the landowner.

3.07 Rock Excavation

(a) The removal of sound, solid rock of whatever nature which occurs in its original position in ledges, bedded deposits or stratified and unstratified masses within the excavation limits shown on the plans, and which is of such hardness or texture that it cannot be loosened, or broken down and removed without resort to drilling and blasting methods, shall be classified as rock excavation.

(b) The removal of hardpan, chert, clay, soft or disintegrated shale, and of other rock materials and boulders less than one cubic yard in volume, shall not be classified as rock excavation although the Contractor may elect to excavate same by drilling and blasting methods. The excavation and removal of all such materials shall be classified as common excavation.

(c) The removal of existing pavements, sidewalks, driveways, manholes and similar structures called for on the plans shall be performed under these specifications and shall not be classified as rock excavation.

3.08 Rock in Pipe Trenches

(a) Rock encountered in trench excavation for sewers and other pipelines shall be removed for the overall width of trench which shall be as shown on the plans. It shall be removed to a minimum depth of six (6) inches below the bottom of the pipe. Where pipelines are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle as shown on the plans.

(b) After the Engineer has examined the completed excavation, and has taken the necessary measurements for volume determination, the space below the ultimate

pipe grade shall be filled with pipe embedment materials as required, compacted to proper grade and made ready for pipe laying.

3.09 Drilling and Blasting

(a) Prior to commencing any blasting operations the Contractor shall: notify the Engineer, notify the official from the list below (if applicable) and obtain blasting permits as required. The Contractor must furnish certification of insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

BLASTING PERMITS:

City of Asheville -	FIRE MARSHAL (259-5636)
Biltmore Forest -	PUBLIC WORKS DIRECTOR (274-3919)
Black Mtn. & Montreat -	FIRE DEPT. (669-8074)
Weaverville -	FIRE MARSHAL (645-3500)

(b) Drilling and blasting methods used in rock excavation shall be optional with the Contractor but shall be conducted with due regard to the safety of persons and property in the vicinity of the work and in strict conformity with all laws, ordinances or regulations governing blasting and the use of explosives. Rock excavation near existing structures of all types shall be conducted with the utmost care, and every precaution shall be taken to prevent damage to such structures. Any damage or injury of whatever nature to persons or property caused directly or indirectly by blasting operations shall be promptly repaired, replaced or compensated for by the Contractor at his own expense and to the entire satisfaction of the persons injured or the owners of the property damaged.

(c) Where future units or pipe trenches are adjacent to structures requiring rock excavation, the rock shall be drilled and blasted (not excavated) for a distance of approximately 10 feet from the present construction, as shown on the plans or as authorized by the Engineer.

(d) The Contractor shall not be allowed to blast within any rights-of-way maintained by any Public agency without specific approval of the controlling agency and only in accordance with their respective requirements.

3.10 Pre-Blast Survey, Vibration Monitoring, and Post-Blast Survey

(a) Prior to conducting any blasting operations, the Contractor shall conduct a preblast survey of all structures within 300 feet of the proposed sewer line, along the entire route of the proposed sewer.

(b) The pre-blast survey shall consist of 35 mm color photographs of all observable exterior and interior surfaces. The photographs shall be bound in a notebook, with a photo index describing the location of each photograph to facilitate easy comparison of a given structures condition. Existing defects in structures shall be photographed and appropriately documented. The Contractor shall furnish a copy of the survey results, including photographs, to the Owner, prior to beginning blasting operations.

(c) All blasting operations conducted within 300 feet of existing structures shall be monitored. In areas where several structures are located adjacent to blasting a sufficient number of seismic units shall be deployed to allow for comprehensive documentation of blasting operations. The resultant seismic data shall be provided to the blasters to allow for blast design changes based on the location of the next blast and the resultant vibration levels for the previous shot. A copy of all resultant seismic data shall be provided to the Owner.

(d) In the event of a damage claim arising from blasting, the Contractor shall conduct a post-blast survey of all structures that are a part of the claim. The Contractor shall furnish a copy of the post-blast survey results, including photographs to the Owner.

(e) The pre-blast survey, vibration and over pressure monitoring, and post-blast survey, if necessary, shall be conducted by a professional seismic consultant.

(f) All photographs and/or negatives shall be kept on file by the Seismic Consultant and shall be available to the District upon request.

(g) Separate payment will not be made for the pre-blast survey, vibration and over pressure monitoring, nor the post-blast survey, nor any other work related to the blasting or excavation of rock, but this work shall be considered incidental to, and included in, the unit bid prices for sewer pipe, as listed in the bid schedule.

3.11 Backfilling Trenches

(a) The backfilling of pipeline trenches shall be started immediately after the pipe work has been installed. The initial backfill material (above pipe embedment materials), shall be placed to a height of two (2) feet above the top of the pipe.

(b) Where the trench extends along or across streets, roadways, usable alleys, or sidewalks the trench shall be completely backfilled (above pipe embedment materials) with either compacted earth or class I pipe embedment material. Unless otherwise specified in the Special Conditions or shown on the plans, such

trenches shall be backfilled with compacted earth. Backfill materials shall be as specified herein. Earth shall be deposited in 6 inch layers (before compaction) and thoroughly compacted with power tools to 95% standard proctor in unpaved areas. In paved areas, the top 24" below subgrade shall be compacted to 98% standard proctor.

(c) Where excavation has been made within the limits of easements across private property, the top one (1) foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stones, and/or other objectionable materials. Backfill material shall be carefully placed and compacted to 85% standard proctor.

(d) Any deficiency in the quantity of materials for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor.

(e) The Engineer may provide the services of a field technician of a recognized commercial testing laboratory during the compaction of the trench backfill to make density determinations. The field technician shall report the test results to the Contractor and Engineer on the project site as soon as these results are known. The results of all density tests shall be reported in writing and shall include the date of test, test location, depth below finished grade, wet density, moisture content, dry density, percent compaction of test sample, and maximum dry density used for comparison. Should any test fail, the cost of any subsequent test will be at the expense of the contractor.

(f) Where pipe trenches are cut across or along pavement the Contractor shall construct a temporary surface over the cut which will not disintegrate under traffic and which shall be maintained in good condition under traffic until the permanent pavement has been constructed.

(g) Backfilling around structures shall be done in the manner specified above for pipe trenches by power tamping for the full depth of cut from the bottom of the finished grade.

(h) All backfilling shall be done in such manner as will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be opened up and repaired and then re-backfilled as herein specified.

(i) The Contractor shall replace all surface materials and shall restore paving, curbing, sidewalks, gutters, shrubbery, fences, sod, and other surfaces disturbed, to a condition equal to that before the work began, furnishing all labor and materials incidental thereto as provided elsewhere in these specifications.

3.12 Disposal of Materials

(a) All materials removed by excavation which are suitable for the purpose shall be used whenever practicable for fills, embankments, backfilling pipe trenches, and for such other purposes as may be shown on the plans or authorized by the Engineer. All materials not used for such purposes shall be considered as waste materials and disposed of by the Contractor.

(b) Waste materials may be deposited in spoil banks on the site of the work if space is available. Such "on site" spoil bank locations shall be authorized by the Engineer. Waste materials shall not be left in unsightly piles but shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with adequate openings to permit surface drainage of adjacent lands. Where "on site" disposal is not practical, the Contractor shall be responsible for "off site" disposal. See Special Conditions – Disposal of Unusable Materials.

(c) On completion of any part of the work proper disposal shall be made of all surplus or unused materials within the construction limits of such work and the surface of the work left in a neat and workmanlike condition.

3.13 Maintenance

(a) All excavated areas, backfills, embankments, trenches, access roads, grading, and ditches shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. Where trench backfill has settled, trenches shall be re-backfilled.

3.14 Special Conditions

(a) The Special Conditions may contain specifications regarding the use of crushed stone, payment for rock excavation, and construction methods for any unusual excavation work not included in the above specifications.

3.15 Pipe Embedment Materials

(a) Pipe embedment materials when required shall be Class I material. Where pipes are installed below groundwater levels or where the trench is subject to inundation, Class I material shall be placed to the top of the pipe. Class I materials shall be graded crushed limestone, or granite, 1/4" to 3/4" in size. Materials under 1/4" shall be limited to no more than 3% by weight.

(b) Pipe embedment materials shall be placed to support the full length of the barrel of the pipe at exact line and grade.

(c) Pipe embedment materials shall be placed in the pipe trench to the trench width and depth shown on the plans. Where rock has been removed from the pipe trench, it shall be placed to a minimum depth of six (6) inches below the bottom of pipe.

(d) Class I materials when placed in the pipe trench do not require compaction.

(e) All other materials shall be mechanically tamped and compacted to the percent required herein, as noted in the special conditions, or as shown on the drawings.

3.16 Backfill Material

(a) Backfill material shall be of a relatively non-plastic nature and shall be sufficiently close to optimum moisture content to achieve specified compaction requirements. Backfill material shall exhibit no tendency to flow or behave in a plastic manner under blows of a mechanical tamp. Material which does not meet these requirements shall be removed from the site and replaced with suitable backfill materials.

(b) Initial backfill material and Select material shall consist of fine loose earth, free of large clods, stones, vegetable matter, debris, and/or other objectionable material.

(c) The remainder of the backfill shall be the same type material as the initial backfill except that a broken stone content of not more than fifty (50) percent by volume will be allowed provided that the stones are thoroughly mixed with earth. Maximum individual stone size shall be 0.75 cubic feet.

3.17 Pipe Foundation Material

(a) Pipe foundation material shall be quarry run crushed limestone or granite ranging in size from fines to a maximum size of six (6) inches. The material shall be power tamped in six (6) inch layers.

(b) Pipe foundation material shall be used in local areas where unsuitable materials such as muck, quicksand, soft clay, or swampy material make it necessary to provide a satisfactory pipe foundation.

(c) Pipe foundation material used as described above will be measured for payment only in specific locations where its use is authorized in writing by the Engineer before this work is performed.

4.02 QUALITY CONTROL

A. TESTING

1. Line Cleaning

   a. Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe line shall be ready for use by the Owner and shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications.

   b. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Engineer that all installations are correct and acceptable.

2. Inspection and Testing (Gravity Sewer)

   a. Alignment and grade between manholes shall be tested by the Engineer by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All defects disclosed as a result of this test shall be corrected by the Contractor at his expense.

   b. PVC pipe shall pass a go-no go Mandrel sized to 95% of the pipe diameter with the pipe in place and properly backfilled. All pipe which will not pass the Mandrel shall be relaid or replaced by the Contractor at no additional cost. The allowable deflection (less than 5%) shall be calculated using the pipe stiffness formula in ASTM D 2321. The mandrel test shall not take place until the final backfill has been in place for 30 days (minimum).

   c. When the sewers are completed they shall be inspected by the Engineer for conformance with the provisions of the plans and specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped and the remaining infiltration will be measured using a V-notch weir and/or other devices, which shall be furnished by the Contractor. The Contractor shall also furnish all required assistance for measuring the infiltration.

   d. If infiltration into the whole system or any segment thereof exceeds 100 gallons per 24 hours per inch of diameter per mile of sewer,

necessary corrective measures shall be taken by the Contractor to limit the infiltration to the maximum specified above. The Engineer shall decide the number and length of segments of sewer line on which the testing shall be performed.

e. All gravity sanitary sewer lines shall be subjected to a low pressure air test to determine the presence of damaged pipe or faulty installation. The Contractor will furnish all facilities and personnel for conducting the test(s).

f. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the Engineer. The test shall be performed as described under state and local municipality standards and specifications.

i. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C=Required Compressor Capacity (cfm)
T=Required Test Time (min)
D=Pipe Internal Diameter (feet)
L=Length of Test Section (feet)
Q=Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

PIPE SIZE	Q (cfm)	PIPE SIZE	Q(cfm)
4”	2.0	15”	4.0
6”	2.0	18”	5.0
8”	2.0	21”	5.5
10”	2.5	24”	6.0
12”	3.0		

ii. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the

groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.

iii. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air tests.

Minimum Test Time for Pipe

LENGTH TESTED	Pipe Size	4”	6”	8”	10”	12”	15”	18”	21”	24”
	25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
	50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
	75	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
	100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
	125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
	150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
	175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
	200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
	225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
	250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
	275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
	300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
	325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
	350	1:02	2:20	4:09	5:11	6:14	7:18	8:25	10:24	12:28
	375	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
	400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
	425	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
	450	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
	475	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
	500	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
	525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
	550	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
	575	1:42	3:50	6:49	8:32	10:14	12:00	13:49	17:06	20:28
	600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

iv. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added

to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: L_e=Effective Pipe Length (added to Total Test Length)
d=Diameter of Service Lateral Pipe
l=Length of Sewer Lateral
D=Diameter of Sewer Main Pipe being tested

g. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of leakage, and repair or replace all defective materials or workmanship. The repaired section(s) of line shall be re-tested to insure conformance with the requirements of these contract specifications.

h. Other tests may be required by the Engineer, such as exfiltration and compaction of backfill over pipes. In this event the results shall meet the minimum standards that the manufacturer states are obtainable.

3. Inspection and Testing (Force Main)

a. When the sanitary sewer force main is completed, the Engineer shall inspect the line for conformance with the provisions of the drawings and specifications, particularly with respect to alignment and depth.

b. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Force mains shall be tested in sections not to exceed 4,00 lineal feet per test section. The Contractor shall install sufficient additional valves if not shown on the drawings to allow testing.

c. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 100 pounds per square inch for a period of two hours unless otherwise specified. Pressure shall be applied to the main by means of a hand

pump for small lines or by use of a gasoline pump or fire engine for larger lines.

d. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measure of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.

e. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per 24 hours.

f. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

g. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings, structures or on bridges.

h. The Contractor shall notify the Engineer when the work is ready for testing with all testing done in the presence of the Engineer. All labor, equipment, water and materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

4. Inspection and Testing (Manholes)

Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the Engineer.

B. FINAL ACCEPTANCE

1. The Engineer will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main and manholes, included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc. from the site(s) and leave the same in a neat, orderly condition acceptable to the Engineer.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective specifications and as shown on the drawings.

4. "As-built" information shall be provided to Engineer from Contractor's North Carolina registered Surveyor at completion of project. As-built data shall be marked on the plans and turned over to the Owner at the end of the project. As-built information shall be kept up on a day to day basis and be available for review by Engineer at any time.

END OF SECTION

SECTION 33 41 00 DRAINAGE MATERIALS

PART 1: GENERAL

1.01 SCOPE OF WORK

This section covers providing and installing the storm drainage and underdrainage collection systems, including pipe culverts, French drains and appurtenant structures. Storm drainage systems shall be constructed as shown on the Contract drawings and as specified herein.

1.02 DELIVERY, STORAGE AND HANDLING

A. UNLOADING AND HANDLING

All pipe and storm drainage material shall be unloaded and handled with reasonable care. Pipe shall not be rolled or dragged over gravel or rock during handling. When any joint or section of pipe is damaged during unloading or handling, the undamaged portions of the joint or section may be used where partial lengths are needed, or if damaged sufficiently, the Engineer will reject the joint or section as being unfit for installation and the Contractor shall remove such rejected pipe from the project.

1.03 SUBMITTALS

A. The Contractor shall submit for approval of the Engineer shop drawings, which describe in detail the materials to be utilized before ordering. Six (6) copies of shop drawings shall be submitted. Prior to submittal all shop drawings are to be reviewed by the Contractor, and shall be stamped and signed as to compliance with the referenced specification. Any variance to the specification shall be noted.

The following shop drawings shall be submitted:

1. Drainage Pipe
2. Underdrain Pipe
3. Underdrain or Pipe Bedding
4. Drainage Structure Castings
5. Precast Drainage Structures
6. Frame, grate and hoods

1.04 WARRANTY

All pipe and materials shall be warranted for a period of one (1) year following installation and acceptance by the Owner.

PART 2: PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe shall conform to ASTM C-76, latest revision. Pipe shall be Table III or Table IV with Wall B, unless otherwise noted. All pipe shall have interior surfaces free from roughness, projection, indentations, offset or irregularities of any kind.

B. Joints shall be sealed with a plastic cement putty meeting Federal Specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant. Joint material for reinforced concrete pipe shall comply with ASTM C 443 and shall be either "O" ring type joints utilizing a rubber "O" ring, or bell and spigot type utilizing a mastic joint material equal to Ram-Neck.

2.02 CORRUGATED METAL PIPE

A. All corrugated metal pipe shall be aluminized type 2 corrugated steel conforming to AASHTO M-274 latest revision unless otherwise called out on the design drawings. If called out as bituminous coated, pipe will conform to AASHTO M190, latest revision. Pipe shall be fully bituminous coated with an asphalt paved invert. Bituminous coating, shall consist of asphalt cement having a minimum thickness of 0.04" measured at the crest of the corrugations. Paved inverts in corrugated metal pipe, shall consist of asphalt cement applied on the inside of the pipe for one quarter of its circumference (bottom of pipe when installed). The pavement shall have a minimum thickness of 0.50" tapering to 0.1" at the sides. If pipe is called out as plain, non-coated, it shall conform to AASHTO M-36 latest revision.

B. Corrugated metal pipe shall have 2-2/3" x 1/2" corrugations and shall be of the following minimum gauges:

18" and smaller pipes.....16 gauge
21" - 30" pipes.....14 gauge
36" - 48" pipes.....12 gauge
56" and larger pipes .....10 gauge

Corrugated Metal Pipe shall have rerolled ends to accommodate corrugated coupling bands. Coupling bands shall conform to NCDOT 932-3(A) installed with a minimum of two corrugations per pipe. Dimple bands shall not be used.

2.03 HIGH DENSITY POLYETHYLENE PIPE

All HDPE shall be water tight type "S" Hancor Blue Seal or approved equivalent and installed according to manufacturers specifications. Pipe manufactured for this specification shall comply with the requirements for test methods, dimensions and markings found in AASHTO Designations M252, M294, and MP7. Pipe and fittings shall be made from virgin PE compounds which conform with the applicable current edition of the AASHTO Material Specifications for cell classification as defined and described in ASTM F667. Pipe shall have smooth wall interior unless otherwise specified.

The fittings shall not reduce or impair the overall integrity of function of the pipeline. Fittings may be either molded or fabricated. Common corrugated fittings include in-line joint fittings, such as couplers and reducers, and branch or complimentary assembly fittings such as tees, wyes and end caps. These fittings may be installed by various methods such as snap-on, bell and spigot, bell – bell and wrap around couplers. Couplers shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation of the joints. Only fittings supplied or recommended by the manufacturer shall be used. Where designated on the plans or project specifications, an elastomeric gasket meeting the requirements of ASTM F477 shall be supplied.

Installation of the pipe specified above shall be in accordance with either AASHTO 30 or ASTM D2321 and as recommended by the manufacturer, with the exception that minimum cover in traffic load areas shall be 12” for pipe diameters between 4” and 48” and 18” for pipe diameters 60” and greater.

2.04 CASTINGS

Castings shall be sound and free from warp, holes and other defects that impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arises. Machined joints, where required, shall be milled to a close fit. Provide all necessary lugs and brackets so that work can be assembled in a neat, substantial manner.

2.05 AGGREGATE FOR UNDERDRAINS

Aggregate for underdrains shall be washed stone, standard size number 67 per North Carolina Department of Transportation specifications, Section 905.

PART 3: EXECUTION

3.01 PREPARATION OF PIPE FOUNDATION

A. LINES AND GRADES

The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustments will require the approval of the Engineer. When an Inspector is present on the site and

is so requested by the Contractor, he shall check the position of grades and lines; but the Contractor shall be responsible for the finished drain line being laid to exact and proper line and grade.

B. PIPE FOUNDATION

1. Whenever the nature of the ground will permit, the excavation at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe.

2. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6". A suitably tamped and shaped foundation of suitable earth shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

3. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Engineer, within the limits established on the plans, and backfilling with either a suitable local material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel or a combination of sand and crushed stone or gravel approved by the Engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

C. WATER IN TRENCHES

The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing; and no pipes shall be laid until the water has been removed from the trench. The Contractor will not be permitted to drain water through the storm drain within a period of twenty-four (24) hours

after the pipe has been laid, and the open end of the pipe in the trench shall be kept closed with a tight fitting plug to prevent washing of dirt or debris into the line. Water so removed from the trench must be disposed of in such manner as not to cause injury to work completed or in progress.

D. SPECIAL FOUNDATIONS

Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, a Geotechnical Materials Testing Engineer will be required to examine the materials and make recommendations for necessary repairs to subgrade.

3.02 LAYING PIPE

A. GENERAL

All piping is to be installed in strict accordance with the manufacturer's recommendations. Installation manuals from various material suppliers shall be furnished to the Engineer for his review and approval prior to installation of any material. The Engineer may augment any manufacturer's installation recommendations, if in his opinion it will best serve the interest of the Owner.

B. LAYING PIPE

1. No pipe shall be laid except in the presence of the Engineer or his inspector, or without special permission from the Engineer. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be carefully given a final inspection to see that it is clean, sound and free of defects. It shall be laid on the prepared foundation to produce a straight line on a uniform grade, each pipe being laid as to form a close abutted joint with a preceding pipe, so as to form a smooth and straight inside flow line. Each pipe will be tested for its exact position after it is in its final position. The pipes shall be fitted together in order to insure sufficient space for joint gaskets, and other jointing material. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

2. When cutting short lengths of pipe, a pipe cutter as approved by the Engineer will be used, and care will be taken to make the cut at right angles to the center line of the pipe, or on the exact skew as shown on the

plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or course file to match the manufactured taper.

3. When coupling bands for annular or helical corrugated metal pipe are used, the pipe sections shall be joined and fully bolted so that the circumferencial and longitudinal strength will be sufficient to preserve the alignment, prevent separation of the sections, and to prevent infiltration of backfill material.

3.03 BACKFILLING

A. The backfill around the pipe shall be placed in layers not to exceed 6" loose and compacted to 95% Standard Proctor test for all areas and 98% for top 24" below subgrade directly beneath subgrade in paved areas. From the bottom of the trench to the centerline of the pipe the backfill material shall be compacted by approved hand tamps. From the centerline of the pipe to the top of the trench other mechanical tamps as approved by the Engineer may be used. The Engineer shall approve all backfill material. Select backfill material shall be used when called for on the plans.

B. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, roots and limbs, chunks of highly plastic clay, or other objectionable materials.

C. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

D. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the Owner. Pipe, which becomes misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations shall be removed and replaced by the Contractor at no cost to the Owner.

3.04 TESTING

A. Upon completion, installed lines shall show a full circle of light when "Lamped" between catch basins. This test shall be performed by the Engineer.

B. Other tests may be required by the Engineer, such as exfiltration and compaction of backfill over pipes. In this event the results shall meet the minimum standards that the manufacturer states are obtainable.

C. One compaction test performed directly above storm pipe placed in areas under pavement shall be conducted every 300 LF of storm pipe placed and shall meet testing requirements noted in section 2220 of the specifications.

END OF SECTION

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes materials, labor, apparatus, tools, equipment, temporary construction, transportation, and services necessary for and incidental to performing the proper completion of Work for Drainage, including trenching, laying, bedding, and backfilling Perforated and PVC drain pipe, fittings, and inlets, and constructing PVC drain pipe and perforated subdrain pipe as shown in the Contract Drawings, and as specified herein this Section.

B. Related Sections: The following Sections contain requirements that relate to Work in this Section:
   1. Section 312000 – Earth Moving.

C. Examine all sections of the specifications for work related to this section. Provide all work there under as required for the support and accommodation of related work.

D. Other items of work or details not specifically mentioned above that are required by the plans, Standard Specifications, or these Technical Specifications, shall be performed, placed, constructed, or installed.

1.3 REFERENCES

A. Standard Specifications - Standard Specifications of the State of North Carolina, Department of Transportation.

PART 2 - PRODUCTS

2.1 PVC DRAIN PIPE

A. See Contract Drawings for size, layout and locations.

2.2 PERFORATED SUBDRAIN PIPE

A. See Contract Drawings for size, layout and locations.

PART 3 - EXECUTION

3.1 MATERIAL REPLACEMENT

A. Remove and replace any trenching and backfilling material which does not meet the specifications, at the Contractor's expense.

3.2 SHEETING, SHORING, AND BRACING OF TRENCHES

A. Trenches shall have sheeting, shoring, and bracing conforming to NC/OSHA requirements and local jurisdiction.

3.3 LOCATION OF EXCAVATED MATERIAL

A. During trench excavation, place the excavated material only within the working area. Do not obstruct any sidewalks or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

END OF SECTION 334600

SECTION 33 49 00 MINOR DRAINAGE STRUCTURES

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered by this section consists of the installation of drainage catch basins, together with all necessary metal grates, covers, frames, and other hardware, in accordance with the requirements shown on the plans and the provisions of these specifications.

1.02 QUALITY ASSURANCE

All plastic surface drainage structures and other fabricated materials shall be manufactured by suppliers with at least five (5) years of experience in the manufacture of similar materials.

1.03 SUBMITTALS

SHOP DRAWINGS

The Contractor shall submit at least six (6) copies of shop drawings to the Engineer, including dimensional drawings, materials of construction; catalogue cut sheets, and other pertinent information.

1.04 DELIVERY, STORAGE AND HANDLING

All materials shall be delivered, stored and handled in strict accordance with the manufacturer's recommendations, and in a manner, which preserves the structural integrity of the materials.

1.05 WARRANTY

All materials and equipment shall be warranted to be free from defects in workmanship and materials for one (1) year after final acceptance.

PART 2: PRODUCTS

2.01 MATERIALS

A. Storm Inlet Structures

1. Concrete and masonry shall meet the requirements of the appropriate section of NCDOT Standard Specifications for Roads and Structures

(latest Edition). All concrete shall be Class A or B 4000 psi minimum unless otherwise indicated on the plans, meeting the requirements of Section 900 and constructed in accordance with Section 825. Masonry shall meet the requirements of Section 940 and construction in accordance with Section 830 and/or 834.

2. Where necessary to fit field conditions, the dimensions of the structure and footings shall be varied as directed by the Engineer.

3. Plastic (PVC) surface drainage structures shall conform to the dimensions and depth referenced on the Construction drawings. The required ductile iron frame shall be provided from the manufacturer as an integral part of the surface drainage structure. All pipe junctions internal to the box shall be made by means of thermal molding and shall be water tight. Connections to stormwater conveyance pipe shall be water tight and shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main structure of the catch basin. The Ductile Iron frame and grate shall be manufactured in a way that allows them to rest securely on the rim of the Plastic catch basin and shall conform to ASTM A536 grade 70-50-05 for Ductile Iron.

B. FITTINGS AND CONNECTIONS

1. Where fittings enter the masonry, they shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned.

2. Pipe connections shall be made using manufacturer provided bell and spigot type joints. Any sump that exists in the structure shall be filled with an approved material to ensure that there is no standing water in the surface drainage structure.

3. Metal frames for grates and covers shall be set elastomeric rings on the plastic surface drainage structure. The surrounding concrete shall be set at line and grade per the construction plans to allow proper drainage into the structure while allowing the top of the structure to be removed for maintenance if necessary.

C. BACKFILL

After the structure has been completed, and all forms, falsework, sheeting, and bracing have been removed, the excavation shall be backfilled with approved material compacted to a density of 95% standard proctor for areas unpaved and and 98% for the last 24” under subgrade in paved areas. Backfilling shall not be

done until the concrete or brick masonry has cured for at least seven (7) curing days, unless otherwise permitted by the Engineer. Please refer to the project grading specifications for allowable soil types and compaction procedures.

D. PIPE COLLARS AND PIPE PLUGS

Pipe collars and pipe plugs shall be constructed in accordance with the details shown on the plans or as directed by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

A. Drainage structures shall be built to the lines, grades and dimensions as shown on the plans. The Contractor shall adjust the final grades in the field as necessary to provide positive drainage to the structures or to match final pavement or grade elevation.

B. Excavations for drainage structures shall be made with care so as not to disturb the surrounding areas more than necessary. All excavations shall be maintained water free until completion of the drainage structure, including backfilling. The Contractor shall provide adequate pumping capacity as required.

C. Place 6" of #57 washed stone under structures. Where the foundation material is found to be of poor supporting value, the existing foundation material shall be removed by undercutting to the depth directed by the Engineer and backfilled with suitable material secured from locations along the project or from a borrow pit. The backfill placed in the undercut area shall be compacted to a degree satisfactory to the Engineer.

3.02 QUALITY CONTROL AND FIELD TESTING

The Contractor shall demonstrate to the Owner and Engineer that all drainage structures operate as intended and designed. All drainage structures shall be field tested by the Contractor in the presence of the Engineer prior to final acceptance. All drainage structures will be cleaned of debris and sediment before being turned over to the Owner.

END OF SECTION

F O R M O F P R O P O S A L

Lake Norman State Park- Campground Expansion & Improvements

Contract: _____

NC Dept. of Natural and Cultural Resources Bidder: _____

16-14408-01 Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

.

The Bidder proposes and agrees if this proposal is accepted to contract with the

NC Dept. of Natural and Cultural Resources

in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

Lake Norman State Park- Campground Expansion & Improvements

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, and the

North Carolina State Construction Office and Mathews Architecture, P.A.

with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

SINGLE PRIME CONTRACT: _____

Base Bid:

_____ Dollars($) _____

General Subcontractor:

_____ Lic _____

Plumbing Subcontractor:

_____ Lic _____

Mechanical Subcontractor:

_____ Lic _____

Electrical Subcontractor:

_____ Lic _____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" the base bid.

GENERAL CONTRACT:

Alternate No. A-1 Camp Cabin “C1”

Add _____ Dollars($)

Alternate No. A-2 Camp Cabin “C2”

Add _____ Dollars($)

Alternate No. A-3 Camp Cabin “C3”

Add _____ Dollars($)

Alternate No. A-4 Camp Cabin “C4”

Add _____ Dollars($)

Alternate No. A-5 Camp Cabin “C5”

Add _____ Dollars($)

Alternate No. A-6 Camp Cabin “C6”

Add _____ Dollars($)

Alternate No. A-7 Camp Cabin “C7”

Add _____ Dollars($)

UNIT PRICES

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents. Refer to section 01300 for additional information regarding Measurements and Quantities.

GENERAL CONTRACT:

No. 1 Trench Rock Excavation cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 2 Mass Rock Removal cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 3 Undercut Excavation cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 4 Soil Replacement (offsite) cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 5 Soil Replacement (onsite) cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 6 Offsite Borrow cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 7 Select Backfill cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 8 Concrete Paving cubic yards Unit Price ($)_____

GENERAL CONTRACT:

No. 9 Topsoil / Soil Amendments cubic yards Unit Price ($)_____

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.**NOTE**: A contractor that performs all of the work with its own

workforce may submit an Affidavit (**B)** to that effect in lieu of Affidavit (**A)** required above. The MB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

*** OR ***

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

Note: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

_____
(Proprietorship or Partnership)

By:_____
Signature

Name: _____
Print or type

Title_____
(Owner/Partner/Pres./V.Pres)

Address_____

_____

ATTEST:

By:_____

Title:_____
(Corp. Sec. or Asst. Sec. only)

License No._____

Federal I.D. No. _____

Email Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5_____ Addendum No. 6_____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

REQUEST FOR SUBSTITUTION FORM

TO: Mathews Architecture, P.A.
34 Wall Street, Suite 307
Asheville, NC 28801
Phone: 828/253-4300 Fax: 828/253-4567

FROM: _____
Name of manufacturer

_____
Street address

_____
City and State

_____
Phone number and name of person to contact

PROJECT: **Lake Norman State Park- Campground Expansion & Improvements**
Lake Norman State Park. 759 State Park Road, Troutman, NC 28166

1. Specification Section and Paragraph numbers of original product or installation specified: _____.

   Original Product or installation specified:
   A. Name and Model No._____
   B. Description:
   _____

2. Proposed Substitute
   A. Name and Model No.:
   _____
   B. Description: _____
   _____
   C. Attach applicable performance and test data.
   D. Numbers of applicable reference standard._____
   E. Attach a color chart or samples if applicable or requested.
   F. Attach installation instructions.

3. Manufacturer's Reputation: Attach the following:
   A. Evidence of reputation for prompt delivery.
   B. Evidence of reputation for efficiency in servicing products.

4. Comparison: Attach a detailed comparison of significant qualities of the proposed substitution with product specified.

Request for Substitution (continued)

5. Changes in Work: Attach data relating to changes required in other parts of the work and to construction performed by the owner and separate contractors to accommodate the proposed substitution.

6. Changes in Schedule: Attach a statement indicating the substitution's effect on the construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall contract time.

7. Previous Installation: Provide the following information on similar projects on which proposed substitution was used; list projects in the Asheville and surrounding area:

	Name and Address of Project	Date of Installation	Name, Address & Phone Number of Architect
A.			
B.			
C.			
D.			

8. Cost Data: Attach accurate cost data on proposed substitution in comparison with product specified, including a proposal of the net change if any in the contract sum.

9. In making request for substitution, Contractor represents that:

   A. He has examined the Drawings and Specifications and has determined that, to the best of his knowledge, the proposed substitution is appropriate for the use intended in the Drawings and Specifications and that it is equal to or better in every respect to that required in the Contract Documents.

Request for Substitution (continued)

B. He will provide the same warranty for substitution as for product or method specified.

C. He will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects.

D. He waives all claims for additional costs or time related to substitution, which consequently become apparent.

E. Cost data is complete and included all related costs under his Contract.

_____

Name of manufacturer and signature of manufacturer's representative Date

_____

Name of installer and signature of installer's representative Date

_____

Name of installer and signature of contractor's representative Date

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT _____ _____ as principal, and _____, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the State of North Carolina* through _____ as obligee, in the penal sum of _____ DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this ____ day of _____ 20__

WHEREAS, the said principal is herewith submitting proposal for and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the _____ day of _____ in the year of 20__ by and between _____ _____ hereinafter called the Party of the First Part and the State of North Carolina, through the_____ _____ hereinafter called the Party of the Second Part.

WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

_____

_____

_____

Consisting of the following sheets:

_____

_____

_____

_____

Dated: _____ and the following addenda:

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and shall fully complete all work hereunder within _____ consecutive calendar days

from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

_____

_____($_____).

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in _____ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

The State of North Carolina through*

(CORPORATE SEAL)

_____
(Agency, Department or Institution)

Witness:

_____

By:_____

Title: _____

FORM OF PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness: _____

Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Attest: (Corporation)

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

_____
(Surety Company)

Witness:

By: _____

_____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C. Regional or Branch Office Address

FORM OF PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Attest: (Corporation)

Title_____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
(Surety Company)

Witness:

By: _____

_____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

APPROVAL OF THE ATTORNEY GENERAL

CERTIFICATION BY THE OFFICE OF STATE BUDGET AND MANAGEMENT

Provision for the payment of money to fall due and payable by the

_____

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This _____day of _____ 20___.

Signed _____
Budget Officer

STATE OF NORTH CAROLINA
COUNTY SALES AND USE TAX REPORT
SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: _____ Page __1____ of _____

PROJECT: _____ FOR PERIOD: _____

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

* Attach subcontractor(s) report(s)
** Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the _____ day of _____, 20____

_____
Signed

_____
Notary Public

_____
Print or Type Name of Above

My Commission Expires: _____

Seal

NOTE:
This certified statement may be subject to audit.

STATE OF NORTH CAROLINA
SALES AND USE TAX REPORT DETAIL

CONTRACTOR: _____

SUBCONTRACTOR _____ FOR PERIOD: _____

PROJECT: _____

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				$	$	
				TOTAL:	$	

* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($)_____.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ❑ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ❑ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ❑ **10** - **(20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires _____