

SECTION 02220 – CU-SOIL STRUCTURAL SOIL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item includes all work required to furnish and place CU-Soil (a structural soil) to the depths and locations shown on the plans or as directed by the Engineer. This structural soil is an aggregate/soil/tackifier hydrogel mixture designed to meet engineering requirements for proctor density and CBR values to support pavement, while allowing better drainage and increased soil volume, supportive of tree growth. Work shall cover all costs for spreading, rough grading, and fine grading of the structural soil.

1.2 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Product labels/data sheets.
2. Proof of product license

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The structural soil shall conform with “CU-Soil” as patented by Cornell University, Patent #5,849,069. CU-soil is a mixture of crushed stone, clay loam and Hydrogel which is a potassium propenoate-propenamide copolymer. Licensed producers include the following:
- Frank Paolangeli, Ithaca, New York; (607) 273-8139; Cell: (607) 279-0315
 - Sultana Sand & Stone, Inc., Brooktondale, New York; (607) 539-7868; Contact: Mr. Kim Whetzel
 - East Coast Mine, Quogue, NY
 - Tully Environmental Co. d/b/a/ Evergreen Recycling of Corona, NY
 - Ascape Landscape, New City, NY
1. The CU-Soil mix shall have a moisture content of 10% (AASHTO T-99 optimum moisture).
 2. The pH of the material shall be between 5.5 and 6.0.
 3. Gradation: The structural soil material shall consist of three components mixed in the following proportions by weight:
 - a. Crushed Stone: 100 parts
 - b. Clay Loam: 20 parts
 - c. Hydrogel: 0.03 parts
 4. Crushed Stone shall be granite or sandstone (no limestone shall be used) and shall be narrowly graded from 19mm to 38mm, highly angular with no fines and in the following proportions:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
38mm	90 to 100
25mm	20 to 55
20mm	10

5. Clay loam shall meet the following requirements:
 - a. Not less than 25% or more than 30% of the clay loam by weight shall be sand. 100% of the sand fraction shall pass the 2mm sieve and 100% shall be retained by the 50 um sieve.
 - b. Not less than 20% or more than 40% of the clay loam by weight shall be silt. The particle size distribution for the silt shall be 2um to 50um.
 - c. Not less than 25% or more than 40% of the clay loam by weight shall be clay. The particle size distribution for the clay shall include all particles smaller than 2um.
 - d. Not less than 2.75% or more than 5% of the clay loam by weight shall be decayed organic matter (humus) as determined by ASTM F-1647. If organic amendments are needed to obtain the specific organic matter content of the topsoil, the organic matter source shall be peat, composted leaves (leaf mold) or other approved organic amendments. Peat shall be sphagnum peat having ash content not exceeding 15%, as determined by ASTM D-2974. Leaf mold must be substantially free of sticks, stones, roots, plastic, glass, metal, and other debris. One-hundred (100%) percent of the leaf mold must pass a 0.5inch screen. The leaf mold chemical analysis shall conform to the following:
 - i. The soluble salt content (conductivity) must be less than 150 MHOS per cubic meter for a 1:5 leaf mold to water ratio.
 - ii. The pH shall not exceed 6.8.
 - iii. The carbon/nitrogen ratio shall fall between 12:1 and 25:1.

6. The Hydrogel/Wetting Agent shall be potassium propenoate-propenamide copolymer hydrogel such as:
 - a. Gelscape, Amereq Corporation, NY
 - b. Soilmoist, JRM Chemical Inc., Cleveland, OH
 - c. Supersorb, Aquatrols Corporation, Cherry Hill, NY
 - d. Or Approved Equal

PART 3 – EXECUTION

3.1 SITE QUALITY CONTROL

- A. Do not proceed with the installation of the CU Soil material until all walls, curb footings and utility work in the area have been installed. Confirm that the sub-grade is at the proper elevation and compacted as required. Sub-grade elevations shall slope parallel to the finished grade.

- B. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event

that fuels, oils, concrete, washout silts or other material harmful to plants have been spilled into the sub-grade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required sub-grade compaction.

- C. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use ½” plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
- D. Do not deliver or place soils in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter the site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.

3.2 PLACEMENT

- A. The structural soil shall be placed to the line and grade shown on the plans or as directed by the Engineer.
 - 1. Install CU-soil in 6-inch lifts and compact each lift. Compact all materials to 95% compaction from a standard AASHTO Compaction Curve (AASHTO T 99).
 - 2. No placement or compaction shall occur when moisture content exceeds 2 percent above the optimum compaction moisture content as determined by AASHTO T 99 (ASTM D698).
 - 3. Protect CU Soil during delays in compaction with plastic or plywood as directed by the Engineer.
 - 4. Field tested permeability shall be within 0.5 and 1.0 inches per hour.
- B. After the initial placement and rough grading of the CU Soil but prior to the start of the fine grading, the contractor shall request the review of the rough grading by the Engineer. The Engineer reserves the right to conduct infiltration/permeability testing prior to continuance of work.
- C. The Contractor shall set sufficient grade stakes for checking the final grades. Adjust the finish grades to meet field conditions as directed. Fill all dips and remove any bumps in the overall plane of the slope.
- D. All fine grading shall be inspected and approved by the Engineer prior to the installation of other items to be placed on the CU Soil.

END OF SECTION

SECTION 02370 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 Description of Work

- A. The work of this section includes all temporary erosion and sediment control and related and incidental operations, including:
 - 1. Furnish, install, routinely inspect, and maintain silt fence
 - 2. Maintenance and repairs of erosion and sediment control measures
 - 3. Rock filters and sediment basins
 - 4. Temporary seeding
 - 5. Removal of erosion and sediment control measures

1.2 Quality Assurance

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction. Construction operations shall be carried out in a manner such that soil erosion, air pollution, and water pollution is minimized. State, County, and Municipal laws concerning pollution abatement shall be followed.
- C. The contractor shall conform to the recommendations and standards set forth in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
- D. The Contractor shall take action to remedy unforeseen erosion conditions and to prevent damage to adjacent properties as a result of increased runoff and/or sediment displacement. Stockpiles of wood chips, crushed stone, and other mulches shall be held in readiness to deal immediately with emergency problems of erosion. All erosion control checks and structures shall be inspected after heavy rainfalls, and if damaged, repaired or replaced.

PART 2 - PRODUCTS

- 2.1 All materials and products shall meet the approval of the engineer. Cut sheets for all items shall be submitted for review and approval prior to installation.
 - A. Approved Temporary Seed Types: Rye grass, cereal grasses or other quick growing species suitable to the area as a temporary cover, which will not compete with the grasses specified for permanent cover.
 - B. Silt Barrier Fence: Class 3 geotextile materials with 2"x2" anchoring pots
 - C. Flow Filter Bag (inlet protection): as specified in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment

Control, August 2005 or latest edition.

- D. Coarse Aggregate (inlet protection): AASHTO #57 or equivalent.
- E. Sediment Filter Bag: as specified in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
- F. Straw Mulch

PART 3 - EXECUTION

3.1 General Requirements:

- A. The Contractor shall conform to the recommendations and standards set forth in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
- B. Erosion and sediment control measures shall be inspected weekly and after every precipitation event.
- C. Install erosion and sediment control products according to manufacturer's directions.
- D. Inspect silt barrier fence after every precipitation event.
- E. Remove sediment when it has reached ½ of the above ground height of the silt barrier fence.
- F. All graded or cleared areas shall receive temporary seeding and straw mulch if subject to erosion for a period of 72 hours or more.
- G. Prepare area to be seeded by hand raking and grading prior to seeding.
- H. Mulch newly seeded areas to prevent erosion prior to seed germination and stabilization. Seeding shall be as specified above in Part 2.1.A., or approved equal.
- I. Provide adequate maintenance of erosion and sediment control measures conforming to requirements in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
- J. Remove sediment from inlet protections and asphalt roadways after each major storm event.

END OF SECTION

SECTION 02520 – PCC SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under these items the Contractor shall construct or replace Portland Cement Concrete sidewalks and/or driveways as shown on the plans or as directed by the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. The requirements of the following sections of the current NYSDOT Standard Specifications, Construction and Materials, shall apply unless otherwise indicated in the contract documents:

Portland Cement	701-01
Coarse Aggregates	703-02
Concrete Sand	703-07
Welded Wire Fabric	709-02
Admixtures	711-08
Water	712-01

- B. Concrete for the lower course of two-course sidewalks and driveways shall comply with the requirements for Class A concrete, as defined in the aforementioned NYSDOT Standard Specifications, Table 501-3, "Concrete Mixtures". This concrete shall attain a minimum compressive strength of 3500 psi when tested at twenty-eight (28) days in accordance with ASTM C39-80. The air content of the freshly mixed concrete shall be six (6%), plus or minus one (1%) percent and the slump shall be three and one half (3 -1/2") inches plus or minus one half (1/2) inch.
- C. Non-woven geotextile (drainage filter fabric) shall conform to the following:
- | | |
|--|-----------------|
| a. Minimum flow rate of 110 gal/min/ft ² | ASTM D-4491-99A |
| b. Grab tensile strength min 150 lb | ASTM D-4632-91 |
| c. Mullen Burst strength min 300 psi | ASTM D-3786-87 |
| d. Puncture strength min 90 lb | ASTM D-4833-00 |
| e. Apparent opening size 60-70 US Sieve | ASTM D-4751-99A |
| f. Non-woven geotextile shall be Mirafi 160N, or approved equal. | |

PART 3 – EXECUTION

3.01 CONSTRUCTION DETAILS

A. Excavation

1. Existing deteriorated concrete shall be removed and disposed off the line of work to the satisfaction of the Engineer.

B. Subgrade

1. The subgrade shall be that portion of the ground surface directly beneath the sidewalk slab. Up to 3" of subgrade excavation shall be included in this payment item.
2. The subgrade shall be dressed to a plain surface containing no large stones, roots, sod or rubbish, and shall slope downward toward the roadway one-quarter (1/4") inch per foot laterally, and to such longitudinal grade as may be shown on the plans.
3. After the grading is completed, the surface shall be compacted and, if necessary, all soft or spongy areas shall be removed and replaced with suitable fill material. Fill material shall conform to the requirements of Granular Subbase, as specified in the NYSDOT Standard Specifications, Type 4 subbase or equal approved by the Engineer.

C. Formwork

1. Forms shall be of lumber with nominal thickness of two (2") inches, or of steel of equal rigidity and strength. No forms shall be less than five (5") inches in depth for sidewalks or seven (7") inches for driveways and corners. Flexible strips may be used on curves. The forms shall be staked or otherwise held to the established grade of walk. All forms shall be properly cleaned and wood forms shall be thoroughly wetted, and metal forms oiled, before depositing any material against them.
2. The total thickness of walks shall be five (5") inches and shall consist of a wearing surface course one (1") inch thick placed upon a base course four (4") inches thick. Driveways shall have a total depth of seven (7") inches and shall consist of a wearing course one (1") inch thick placed upon a base course six (6") inches thick.
3. Contraction (tooled) joints shall be placed between expansion joints at equal intervals not exceeding six (6') feet. These joints shall be formed either by the use of division plates (steel), one-eighth (1/8") inch thick, or by approved methods of cutting a groove in the surface of the finished concrete.
4. Where the sidewalk line intersects a building, walk, permanent structure or other location as designated by the Engineer, a one-half (1/2") inch, non-extruding pre-molded expansion joint shall be provided, and placed at intervals not exceeding twenty (20') feet in sidewalks.

5. Expansion joints shall be pre-molded strips of asphaltic felt of the required thickness, as wide as the thickness of the walk, and laid in one piece as long as the full length of the slab.
6. Expansion joints shall extend from the surface to the subgrade, be at right angles to the sidewalk surface and be constructed prior to placing the concrete.
7. Expansion joints shall be filled with a one-part, non-priming, self-leveling polyurethane sealant. Approved products include Sonneborn Sonolastic SL 1 or approved equal.

D. Placing

1. Concrete shall not be placed upon a dry or dusty subgrade. The subgrade shall be sprinkled or lightly wetted before placing the concrete. No concrete shall be placed on a frozen subgrade or when the temperature is or predicted to be within twenty-four (24) hours, less than forty (40°) degrees Fahrenheit, except with written permission of the Engineer.
2. After the concrete course has been brought to the established grade, it shall be struck off and worked with a float in a manner that will thoroughly consolidate it so that the surface has a true contour. The upper edges of the concrete shall be rounded to a radius of one-quarter (1/4") inch.
3. When wet spots occur, finishing operations should be delayed until the water either disappears or is removed with a squeegee. If a squeegee is used, cement should not be removed with the water. Under no conditions shall dry cement or sand be used to absorb this moisture or to hasten the hardening.

E. Curing

1. Concrete shall be allowed to cure for at least three (3) days before forms are removed. Forms shall be carefully removed from the sidewalk so no edge will be broken, and the area adjacent to the sidewalk shall be immediately refilled to the grade of the new sidewalk.
2. All walks shall be protected by suitable coverings and shielded from traffic and the elements for at least three (3) days and shall not be open to traffic until the Engineer so directs.
3. All concrete walks, curbs, and driveways shall be sprayed with a white pigmented membrane curing compound immediately after finishing. Vapor-proof membranes used for curing will not require wetting. A list of approved membrane curing compounds is included in these contract documents.
4. The Contractor shall provide protection for all concrete placed in cold weather by covering with straw, tarpaulins, insulated blankets, or other approved material, and/or heated by salamanders, if needed to keep concrete temperatures above forty

(40°) degrees Fahrenheit to obtain specified concrete strengths.

F. Testing

1. The Owner will employ a qualified third party testing laboratory to perform quality control testing of concrete and mortar used in the construction of sidewalks and driveways.
2. For each concrete placement of fifty (50) cubic yards or less, one series of compressive strength samples shall be fabricated. A series shall consist of three (3) test cylinders of base concrete and two (2) sets of test cubes of mortar topping. (Note that each set contains three (3) cubes.) One (1) concrete cylinder and one (1) set of mortar cubes shall be tested at seven (7) days, and two (2) cylinders and one (1) set of mortar cubes shall be tested at twenty-eight (28) days. Concrete cylinders shall be fabricated in accordance with ASTM C31-69 (1975), and tested in accordance with ASTM C39-80. Mortar cubes shall be fabricated and tested in accordance with ASTM C109-80. Copies of these tests results will be made available to the Engineer and Contractor.
3. Slump tests and air entrainment tests shall be taken on the concrete and mortar as directed by the Engineer in accordance with ACI and ASTM standards.
4. At the discretion of the Engineer, core samples may be taken for testing of thickness and compressive strength. The cost of coring and testing of cores shall be borne by the Owner, and copies of test results shall be made available to the Contractor.
5. If the average thickness of the concrete sidewalk as determined by the measurements of all cores taken on the work is deficient by more than one-quarter (1/4") inch, a deduction will be made from the contract price in the form of a change order. The amount of deduction shall be determined by the Engineer.
6. Any part of the concrete sidewalk or driveway which is deficient in depth by more than one-half (1/2") inch will not be accepted, and at the option of the Owner said sidewalk (or driveway) may be taken up and replaced according to the specification, at the Contractor's expense.
7. Sections of sidewalk for which core or cylinder or cube tests show the strength to be less than ninety (90%) percent of the compressive strength required will not be accepted and shall be replaced at the Contractor's expense.

3.02 NAME PLATE/CONTRACT NUMBER

- A. The Contractor, as required by City Ordinance, shall imprint the concrete work at the beginning, end, corners and every 250 feet, with the Contractor's (and sub-contractor's) name, year of construction, and the contract number under which the work is performed.
- B. The Contractor's imprint numbers shall not be less than two (2) inches nor more than three

(3) inches tall. Letters shall be not less than one (1) inch nor more than two (2) inches tall.

- C. The Contractor shall be restricted from imprinting the Contractor's name promiscuously, and shall be guided as to the location of same by the Engineer or the Resident Engineer.

3.03 PROTECTION OF SURVEY MONUMENTS AND UTILITIES

- A. The Contractor shall comply with the requirements of the City's standard SUPPLEMENTAL CLAUSES OF GENERAL APPLICATION to protect City survey monuments and various utilities in or adjacent to the line of work.

3.04 PERIOD OF MAINTENANCE

- A. The Contractor shall remedy, without cost to the Owner, any defects which may occur during a period of two (2) years from the date of completion and acceptance of work performed under this contract, provided such defects are caused by defective or inferior material and/or workmanship.

END OF SECTION

SECTION 02521 - SIDEWALK/DRIVEWAY SEALANT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under this payment item the Contractor shall install a one-part, non-priming, self-leveling polyurethane sealant to fill expansion joints in sidewalks, driveways or bus pads as directed by the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. A one component, non-priming, urethane, self-leveling, (pour grade) sealant for use in contraction and expansion joints in sidewalks, pavements, decks or other concrete structures shall be used. Approved products include Sonneborn Sonolastic SL 1 or approved equal.
- B. The sealant material shall fully comply with:
1. Federal Specification TT-S-00230C, Type 1 Class A
 2. ASTM C-920, Type S, Grade P, Class 25, Use T, M.
- C. The material used shall meet the following properties:

<u>Property</u>	<u>Test Method</u>	<u>Value (average)</u>
Tensile Strength	ASTM D412	350 Al
Elongation	ASTM D412	800%
Hardness-Shore A	Shore Durometer	43+/-2
Shrinkage		
Weatherability (1000 Hours)	Atlas 6500 Watt Xenon Arc	Excellent
Low Temperature Flexibility	ASTM D746	-40 degrees Fahrenheit
Service Temperature Range		-40 to 180 degrees Fahrenheit

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

- A. Surfaces shall be prepared as directed by the Manufacturer's Instructions.

- B. Joints surfaces shall be structurally sound, clean, dry, and free of all loose aggregate, paint, oil, grease, asphalt, wax, mastic compounds, waterproofing compounds or form release materials prior to the application of the sealant.

3.02 APPLICATION PROCEDURE

- A. The joint sealant should be installed in accordance with Manufacturer's recommendations.
- B. Fresh concrete must be fully cured before installing the sealant material.
- C. Fill joints from the bottom; avoid bridging of the joint which may form air voids. Ideally, the temperature at the time of application should be the median between surface temperature extremes. Thus, the joint width would be at the mid-point of maximum and minimum opening, providing for maximum efficiency of sealant with subsequent joint movement.
- D. Protect joint from dirt and traffic until cured.

3.03 PERIOD OF MAINTENANCE

- A. The Contractor shall remedy, without cost to the Owner, any defects which may occur during a period of two (2) years from the date of completion and acceptance of work performed under this contract, provided such defects are caused by defective or inferior material and/or workmanship.

END OF SECTION

SECTION 02522 – PORTLAND CEMENT CONCRETE CURBS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under these items the Contractor shall construct Portland Cement Concrete Curbs as shown on the plans or as directed by the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. The requirements of the following sections of the current NYSDOT Standard Specifications, Construction and Materials, shall apply unless otherwise indicated in the contract documents:

Portland Cement, Type II	701-01
Coarse Aggregates	703-02
Concrete Sand	703-07
Admixtures	711-08
Water	712-01

- B. Concrete for curbs shall comply with the requirements for Class A concrete, as defined in the aforementioned NYSDOT Standard Specifications, Section 501.

PART 3 – EXECUTION

3.01 CONSTRUCTION DETAILS

- A. Excavation
 - 1. Existing deteriorated concrete shall be removed and disposed off the line of work to the satisfaction of the Engineer.
- B. Subgrade
 - 1. The subgrade shall be dressed to a plain surface containing no large stones, roots, sod or rubbish.
 - 2. After the grading is completed, the surface shall be compacted and, if necessary, all soft or spongy areas shall be removed and replaced with suitable fill material. Fill material shall conform to the requirements of Granular Subbase, as specified in the NYSDOT Standard Specifications and as shown on the drawings.
- C. Formwork
 - 1. Forms shall be of lumber with nominal thickness of two (2") inches, or of steel of

equal rigidity and strength. Forms shall be free of warp and of such construction that there will be no interference to inspection for grade and alignment. All forms shall extend to the full depth of the curb and be secured so that no displacement will occur during placement of concrete. All forms shall be properly cleaned and wood forms shall be thoroughly wetted, and metal forms oiled, before depositing any material against them.

2. Curbs shall be cast in segments having a uniform length of approximately 10 feet. The joints between segments shall not exceed 1/4 inch in width.
3. Expansion joints shall be 11/16 inches wide and contain Premolded Resilient Joint Filler as specified in Section 705-07 of the NYSDOT Standard Specifications.

D. Placing

1. Concrete shall not be placed upon a dry or dusty subgrade. The subgrade shall be sprinkled or lightly wetted before placing the concrete. No concrete shall be placed on a frozen subgrade or when the temperature is or predicted to be within twenty-four (24) hours, less than forty-five (45°) degrees Fahrenheit, except with written permission of the Engineer.
2. Concrete shall be compacted with an immersion type mechanical vibrator.

E. Curing

1. Concrete shall be allowed to cure for at least three (3) days before forms are removed. Forms shall be carefully removed from the curb. The front form may be removed before the other forms in order to facilitate finishing the curb and removal of the joint dividers.
2. All concrete curbs shall be sprayed with a white pigmented membrane curing compound immediately after finishing. Vapor-proof membranes used for curing will not require wetting. A list of approved membrane curing compounds is included in these contract documents.
3. The Contractor shall provide protection for all concrete placed in cold weather by covering with straw, tarpaulins, insulated blankets, or other approved material, and/or heated by salamanders, if needed to keep concrete temperatures above forty-five (45°) degrees Fahrenheit to obtain specified concrete strengths.

F. Testing

1. The Owner will employ a qualified third party testing laboratory to perform quality control testing of concrete and mortar used in the construction of curbs.
2. For each concrete placement of fifty (50) cubic yards or less, one series of compressive strength samples shall be fabricated. A series shall consist of three (3) test cylinders of base concrete and two (2) sets of test cubes of mortar topping. (Note that each set contains three (3) cubes.) One (1) concrete cylinder and one (1)

set of mortar cubes shall be tested at seven (7) days, and two (2) cylinders and one (1) set of mortar cubes shall be tested at twenty-eight (28) days. Concrete cylinders shall be fabricated in accordance with ASTM C31-69 (1975), and tested in accordance with ASTM C39-80. Mortar cubes shall be fabricated and tested in accordance with ASTM C109-80. Copies of these tests results will be made available to the Engineer and Contractor.

3. Slump tests and air entrainment tests shall be taken on the concrete and mortar as directed by the Engineer in accordance with ACI and ASTM standards.
4. Sections of curb for which cylinder or cube tests show the strength to be less than ninety (90%) percent of the compressive strength required will not be accepted and shall be replaced at the Contractor's expense.

3.02 PERIOD OF MAINTENANCE

- A. The Contractor shall remedy, without cost to the Owner, any defects which may occur during a period of two (2) years from the date of completion and acceptance of work performed under this contract, provided such defects are caused by defective or inferior material and/or workmanship.

END OF SECTION

SECTION 02650 - ASPHALT CONCRETE TOP AND BINDER COURSES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This includes all work required to furnish and install Asphalt Concrete, Type 7 Top Course and Type 3 Binder course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.
- B. The depth shall be as designated on the Contract Drawings.
- C. This Work also includes:
 - 1. All minor adjustments to City-owned valve boxes, drainage structure frames & grates and manhole rims (less than twelve (12) inches) necessary to finished grade prior to surface application.
 - 2. All necessary maintenance and control of traffic and public notification.
 - 3. The pavement surface area to be treated shall be cleaned by a rotary power broom.
 - 4. The application of tack coat to all structures, vertical edges and the binder course (or other subbase beneath).
 - 5. All incidental work related to this item.

1.2 SUBMITTALS

- A. Informational Submittals: Manufacturer's Certificate of Compliance with Section 400 of the NYSDOT Standard Specifications for the following materials:
 - 1. Aggregate: Gradation, source test results as defined in Section 400 of the NYSDOT Standard Specifications.
 - 2. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
 - 3. Prime Coat: Type and grade of asphalt.
 - 4. Tack Coat: Type and grade of asphalt.
 - 5. Additives.
 - 6. Mix: Conforms to specified NYSDOT Standard Specification formula.

1.3 QUALITY ASSURANCE

- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- C. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction (such as NYSDOT and/or City of Syracuse).
- D. Materials and workmanship shall conform to applicable requirements of NYSDOT Specifications.

1.4 MAINTENANCE AND REPAIR

- A. The two (2) year guarantee for defective or inferior material and/or workmanship shall include the pavement base as well as the wearing surface placed thereon if both were constructed by the Contractors. The guarantee shall include also all structures built and paid for as part of the contract such as manholes, sewers, and basins, as well as Portland Cement concrete sidewalks and driveways, curbs, gutters, and headers.
- B. Where necessary, temporary repairs shall be made during the winter when it is impractical to make permanent repairs. Permanent repairs in such cases shall be made as soon as weather conditions permit.
- C. The guarantee covers all the work over trenches which existed previous to the letting of the contract for the pavement, as well as those which were made by the Contractor in the course of carrying out the provisions of this contract. If the pavement settles over such trenches, the Contractor shall lay and restore the pavement over these in a thorough and workmanlike manner to conform in grade and cross-section with the adjoining pavement.
- D. The right is reserved by the Engineer to allow one or more openings to be made in any portion and the paving done by other persons than this Contractor during the term of this guarantee. In this case, however, the Contractor will not be held responsible for any settlement or other defects in the portion of the pavement re-laid, which in the opinion of the Engineer are due to said opening and repaving. Nothing herein contained shall be construed as affecting the guarantee of the Contractor in any manner upon the remainder of the pavement, and only as aforesaid on the portion re-laid.
- E. Where cracks or subsidence of the wearing surface indicate defects in the pavement foundation, the pavement structure shall be excavated to its full depth and replaced with new material corresponding to the specifications under which the original pavement was laid.
- F. Whenever the repairs necessary to be made at the expiration of the guarantee period in accordance with these specifications shall amount to more than fifty (50) percent of the area of any one block, the entire pavement on the block shall be taken up and re-laid with new pavement, according to the specifications for the original pavement.
- G. At the close of the guarantee period, all defects as above described shall have been corrected, and the pavement left in a good serviceable condition substantially conforming in form to the grade and cross-section originally established.

1.5 REFERENCES

- 1. New York State Department of Transportation Specifications.
- 2. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.
- 3. Contract Documents and Specifications for 2010 Annual Street Structures and Rehabilitation at Various Locations within Onondaga County and the City of Syracuse, March 2010.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphalt Concrete, Type 7 Top Course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.

- B. Asphalt Concrete, Type 3 Binder Course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.

PART 3 - EXECUTION

3.1 GENERAL

- A. Traffic Control:
 - 1. Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

3.2 LINE AND GRADE

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
- B. Shoulders: Construct to line, grade, and cross-section shown.

3.3 APPLICATION EQUIPMENT

- A. In accordance with Section 400 of the NYS DOT Standard Specifications.

3.4 PREPARATION

- A. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.5 PAVEMENT APPLICATION

- A. General: Place asphalt concrete mixture on approved, prepared base in conformance with Section 400 of the NYS DOT Standard Specifications.
- B. Tack Coat:
 - 1. Prepare material, as specified in Section 400 of the Standard Specifications, prior to application.
 - 2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
 - 3. Do not apply more tack coat than necessary for the day's paving operation.
 - 4. Touch up missed or lightly coated surfaces and remove excess material.
 - 5. Application Rate: Minimum 0.25 liter to maximum 0.70 liter of asphalt (residual if diluted emulsified asphalt) per square meter (0.05 to 0.15 gallon per square yard) of surface area.

C. Pavement Mix:

1. Prior to Paving:
 - a. Sweep primed surface free of dirt, dust, or other foreign matter.
 - b. Patch holes in primed surface with asphalt concrete pavement mix.
 - c. Blot excess prime material with sand.
2. Place asphalt concrete pavement mix in one single lift.
3. Compacted Lift Thickness:
 - a. Minimum: Twice maximum aggregate size, but in no case less than 25 millimeters (1 inch).
 - b. Maximum: 100 millimeters (4 inches).
4. Total Compacted Thickness: As shown.
5. Apply such that meet lines are straight and edges are vertical.
6. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
7. Joints:
 - a. Offset edge of each layer a minimum of 150 millimeters (6 inches) so joints are not directly over those in underlying layer.
 - b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
 - c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.
8. Succeeding Lifts: Apply tack coat to pavement surface between each lift.

D. Compaction:

1. Uniformly compact each course to target density arrived at in compaction control strip.
2. Joint Compaction:
 - a. Place top or wearing layer as continuously as possible.
 - b. Pass roller over unprotected end of freshly laid mixture only when placing of mix is discontinued long enough to permit mixture to become chilled.
 - c. Cut back previously compacted mixture when Work is resumed to produce slightly beveled edge for full thickness of layer.
 - d. Cut away waste material and lay new mix against fresh cut.

E. Tolerances:

1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
2. Completed Surface or Wearing Layer Smoothness:
 - a. Uniform texture, smooth, and uniform to crown and grade.
 - b. Maximum Deviation: 3 millimeters (1/8 inch) from lower edge of a 3.6-meter (12-foot) straightedge, measured continuously parallel and at right angle to centerline.
 - c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.
3. Transverse Slope Maximum Deviation: 6 millimeters (1/4 inch) in 3.6 meters (12 feet) from rate of slope shown.

- A. The Engineer has the right to take core samples and test them as is deemed necessary. Testing costs will be borne by the Owner and results will be made available to the Contractor. Determination of acceptance will be made by the Engineer. Full acceptance will be made if the average density of the cores taken at a location is between 92% and 97% of the mixture's average daily maximum theoretical density.

END OF SECTION

SECTION 02651 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work of this Section includes striping paint pavement markings to be applied at various locations as shown in the plans.

1.2 SUBMITTALS

- A. All submittals shall be submitted to Engineer for review and approval a minimum of two weeks prior to pavement construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Striping Paint

1. Striping paint shall be chlorinated rubber base, factory mixed, non-bleeding, fast drying, best quality, white traffic paint with a life expectancy of two years under normal traffic use.
2. Paint shall be latex, water-based emulsion, ready-mixed, complying with PS TT-P-1952.
3. Color: White or Yellow, as shown on plans
4. Color for Handicapped Markings, if required: Blue

PART 3 - EXECUTION

3.1.1 INSTALLATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Paint 4-inch wide parking striping and traffic lane striping in accordance with layouts of plan. Apply paint with mechanical equipment to produce uniform straight edges. Apply in two coats at manufacturer's recommended rates. Provide clear, sharp lines.

END OF SECTION

SECTION 02720 - DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work includes the construction of catch basins, solid and perforated stormwater piping, and other structures as shown on the plans, as well as any incidental or related operations.

1.2 SUBMITTALS

- A. Submit three copies of catalogue cuts of all fabrics and fabricated materials, including pipes, grates, etc. for approval by the Owner prior to ordering.
- B. Submit shop drawings as specified to Owner for approval prior to ordering.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction (such as NYSDOT and/or City of Syracuse).
- C. Materials and workmanship shall conform to applicable requirements of NYSDOT Specifications.
- D. References
 1. Annual Book of ASTM Standards, 2005, or latest edition; American Society for Testing and Materials, Philadelphia PA.
 2. New York State Department of Transportation Specifications.
 3. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.
 4. Contract Documents and Specifications for 2010 Annual Street Structures and Rehabilitation at Various Locations within Onondaga County and the City of Syracuse, March 2010.

1.4 PROJECT CONDITIONS

- A. Conform to all conditions and restrictions included in other sections, including erosion and sediment control, protection of vegetation, existing improvements and utilities.
 1. All work shall be in accordance with the laws of New York State.
 2. The Contractor shall apply and pay for all necessary permits and fees required in the course of his work as required by the governing codes, including NYSDOT.
 3. The Contractor shall be responsible for coordinating his work with the work of other trades. Do no work that will damage, displace, or make unnecessarily

- difficult the installation of the work of other trades.
4. The Contractor shall not cover any work until it has been inspected by the Engineer. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe

1. High Density Polyethylene Pipe (HDPE) shall conform to AASHTO M252, ASTM F-405, and ASTM F-667 for materials and fabrication, shall be smooth lined, and shall be as manufactured by ADS or approved equal. Pipe joints shall be watertight joints.
2. Continuously Perforated High Density Polyethylene Pipe (HDPE) shall have Class II perforations per AASHTO M252 (pipe diameters 3 through 10-inches) and AASHTO 294 (pipe diameters 12 inches and greater). Class II perforations shall be located in the outside valleys of the corrugations, be circular and/or slotted, and evenly spaced around the circumference and length of the pipe. The opening area shall be no less than 0.945 square inches per linear foot (pipe diameters 4 through 10-inches), 1.42 square inches per linear foot (pipe diameters 12 through 18-inches), and 1.89 square inches per linear foot (pipe diameters 24-inches and larger).
3. The joints of all precise structural units shall be sealed with a butyl-sealant system so that the joint will remain watertight under all conditions of service, including movement due to expansion, contraction and normal settlement. The bonder shall be the sole element depended upon to make the joint watertight.

B. PVC Catch Basins

1. PVC catch basins (risers) with domed ductile iron (DI) grates shall be Nyloplast or approved equal.

C. Precast Concrete Manholes and Catch Basins

1. Precast Concrete Manholes and Catch Basins shall be manufactured in accordance with ASTM C478. Frames and covers shall be heavy-duty rated, and as shown on the Drawings.

D. Anti-Seep Collars

1. Anti-seep collars shall be two-piece HDPE collars by Lane Enterprises, or approved equal. Install anti-seep collars on storm pipes approximately one foot from the edge (outside) of the infiltration bed, or as indicated on the plans.

E. Non-woven geotextile (drainage filter fabric) shall conform to the following:

- | | | |
|----|--|-----------------|
| a. | Minimum flow rate of 110 gal/min/ft ² | ASTM D-4491-99A |
| b. | Grab tensile strength min 150 lb | ASTM D-4632-91 |
| c. | Mullen Burst strength min 300 psi | ASTM D-3786-87 |

- | | | |
|----|---|-----------------|
| d. | Puncture strength min 90 lb | ASTM D-4833-00 |
| e. | Apparent opening size 60-70 US Sieve | ASTM D-4751-99A |
| f. | Non-woven geotextile shall be Mirafi 160N, or approved equal. | |

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which work is to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 EXCAVATION, BACKFILLING, AND COMPACTION – TRENCHES

- A. Grade trench bottom to a smooth, firm, stable and rock-free foundation. Remove unstable, soft, and unsuitable materials, as determined by the Engineer, and backfill with clean granular material to indicated level, per NYSDOT specifications.
- B. Backfilling includes all refilling of excavations and the tamping and rolling required for satisfactory compaction. Backfilling shall be done as promptly as possible without damage to pipe or structure in place. Backfilling will be done following inspection and approval of the work by the Engineer or Owner's representative, and only with permission of the Engineer or Owner's representative.
- C. No part of a pipe line or other structure that needs to be tested, located, or measured, shall be filled over or around until required tests and measurements have been made or witnessed by the Engineer or Owner's representative, and their permission so given to backfill. Any backfilling without authorization shall be uncovered by the Contractor at his own expense.
- D. All pipes shall be laid on an even and uniform bedding surface. The bedding shall be installed from a depth of six inches (6") below the pipe barrel. Bell holes and depressions for joints of the pipes shall be dug after the bedding materials have been properly graded. The pipe shall then be laid to its true grade and alignment. The bedding materials shall then be shovel placed and hand tamped to fill all spaces under and adjacent to the pipe to hold the pipe in its true grade and alignment during the test. The lines, grades, and joints of the pipes will be inspected before any further backfilling above the pipe is commenced. After the inspection is completed, the backfilling shall be continued in layers not exceeding six inches (6") to a height twelve inches (12") above the top of the pipe. The materials shall be placed with hand shovels and shall be solidly rammed down. Stones smaller than one inch (1") shall be used around the pipe.
- E. From twelve inches (12") above the top of the pipe, suitable backfill material, conforming to the requirements of these specifications may be used. The compaction shall be done for the full length of the pipe, and in such a manner as not to disturb or damage the pipe. Hand-operated mechanical tampers may be used for compaction. Such mechanical tampers shall have a rating of at least 300 feet/lb. of energy per blow.
- F. From one foot (1') above the top of the pipe, machine backfilling and compaction may

be used. Above this level, except for the last two feet (2'), small stones not larger than six inches (6") in their greatest dimension will be permitted, but this should not be in excess of 15% of the total volume of the backfill materials in the entire depth. Such stones shall be evenly distributed throughout the entire mass.

- G. The excavated material removed from the trenches can be used for backfilling purposes provided it meets the material classifications. In the areas where the conditions require the removal of the excavated materials, all the backfilling shall be done using crushed stone backfill. The backfilling materials should compact readily by the usual methods of tamping and puddling. Unsuitable materials, such as clay that will crumble under light pressure by hand, frozen materials, ashes, cinders, tree stumps and other organic and unsuitable materials shall not be used for backfilling. Organic soil will not be permitted as backfill.
- H. The materials backfilled in trenches shall be deposited in layers not exceeding six inches (6"). All backfill shall be properly moistened or dried to within 2% of the optimum moisture content as determined by ASTM D-1557. Each lift shall be compacted to 95% maximum density. The degree of compaction shall be checked by a state-certified testing agency, and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the Resident Engineer. The fill shall be compacted to elevations and limits indicated on the plans.
- I. The compaction shall be continued to the desired elevations. The trenches shall be molded to a height of one foot (1') after compaction with suitable materials. All the backfilling and compaction shall be continued without interruption to completion. The areas shall be properly cleaned and all the excess material shall be properly disposed of from the work area.

3.3 PIPE LAYING

- A. All pipes shall be unloaded, handled, and stored in conformance with the manufacturer's recommendations.
- B. Bedding and laying of pipe shall be in accordance with the pipe manufacturer's recommendations. Pipe joints shall be made in accordance with joint manufacturer's recommendations.
- C. All pipe shall be laid on a minimum six inch (6") thickness of NYSDOT No. 2 aggregate, unless otherwise approved by Engineer.
- D. Pipe placement and alignment shall be accomplished only in the presence of the Owner or their authorized representative. Adequate and suitable equipment and appliances for safe and convenient handling and laying of pipes shall be used. The Contractor shall give two (2) days notice of the time scheduled for the pipe laying and inspection.
- E. Prior to being lowered into the trench, each pipe and fitting shall be carefully inspected, and those not meeting specifications or are otherwise defective shall be rejected and removed from the project.
- F. If, in the opinion of the Engineer or Owner's representative, the materials furnished or the methods of installation are not in accordance with the Specifications or generally

accepted practices for that type of work, such work may be stopped by the Engineer.

- G. Pipes shall be laid true to the grades shown on the plans. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. Any pipe which has its grade or joints disturbed after laying shall be taken up and relaid. The pipe sections shall be inspected, and the interior and ends of all pipe will be cleaned before lowering into the trench. During construction, the Contractor shall use all precautions to keep the trench clean and clear of deposits and free from injury until finally inspected and accepted.
- H. Pipe shall be laid so that when completed, the interior bore will conform accurately to grades and alignment indicated by the contract documents or directed by the Engineer or Owner's representative.
- I. Before joints are made, each pipe shall be well bedded, and no pipe shall be brought into position until the preceding length has been thoroughly secured in place. Coupling or bell holes shall be dug sufficiently large to insure the making of a proper joint.
- J. The excavation into which the pipe is being laid shall be kept free from water, and no joints shall be made under water. Water shall not be allowed to rise in excavation until joint is complete. Care shall be used to secure water tightness and to prevent damage to joints during backfilling. All pipe joints shall be watertight within allowances established by these Specifications.
- K. No pipe shall be laid upon a foundation into which frost has penetrated, nor anytime when the Engineer or Owner's representative shall deem that there is a danger of formation of ice or penetration of frost at the bottom of excavation. Where the foundation is unstable or consists of rock, a stone or gravel foundation shall be placed and tamped to form an acceptable bed for the pipe.

3.4 INSTALLATION OF STRUCTURES

- A. The Contractor shall provide an excavation of sufficient size to accommodate the outside dimensions of the structure as shown on the plans. Prior to setting the unit, the Contractor shall prepare a 6-inch minimum leveling course of compacted NYSDOT No. 1A aggregate suitable for receiving the structure. The base material shall be compacted and leveled to the elevations shown on the plans.
- B. The Contractor shall provide sufficient labor and equipment to unload and place the units. Should rental of a crane be required for unloading and setting the unit, it shall be coordinated by the Contractor with the manufacturer's dispatch office in sufficient time to acquire the equipment.
- C. The completed installation shall be neat and watertight.
- D. Install PVC catch basins, Nyloplast or approved equal, as per the manufacturer's specifications.

END OF SECTION

SECTION 02725 – POROUS BITUMINOUS ASPHALT WITH INFILTRATION BED

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work of this Section includes subgrade preparation, installation of infiltration beds, asphalt treated permeable base course, and porous bituminous (porous asphalt) top course.

1.2 SUBMITTALS

- A. All submittals and testing results shall be submitted to Engineer for review and approval a minimum of two weeks prior to pavement construction.
- B. Submit a list of materials proposed for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.
- C. Submit certificates, signed by the materials producer and the paving subcontractor, stating that all materials meet or exceed the specified requirements.
- D. Submit samples of coarse aggregates for review and approval by the Engineer prior to installation.
- E. The Contractor shall provide results of all testing as required by this Section to Engineer, including, but not limited to:
 - 1. Draindown Test (ASTM Method D6390)
 - 2. Moisture Susceptibility Test using the modified Lottman Method (AASHTO T283) with the following:
 - a. Compact using 50 gyrations of Superpave gyratory compactor
 - b. Apply partial vacuum of 26 inches of Hg for 10 minutes to whatever saturation is achieved.
 - c. Keep specimens submerged in water during freeze cycle.
 - d. Required retained tensile strength (TSR) $\geq 80\%$
 - e. If the moisture susceptibility test cannot be successfully run on the porous asphalt mix, a comparable dense-graded mix (with the same top size stone and the same material sources) can be tested in accordance with AASHTO T283.
 - 3. Air Voids Test (AASHTO T269/ASTM D3203)
- F. The Contractor shall submit certification of all materials as required by this Section to Engineer, including:
 - 1. Gradation of aggregate for infiltration beds.
 - 2. Certification letter from polymer modified asphalt laboratory (if applicable).
 - 3. Test data, mix design, and Performance Grade classification of the neat asphalt.
 - 4. Certification and mixing recommendations for all asphalt additives including fibers, hydrated lime, and additives
 - 5. Recommended mixing and compaction temperatures based on testing results.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.
- B. Codes and Standards
 - 1. All materials, methods of construction and workmanship shall conform to applicable requirements of NYSDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

1.5 PROJECT CONDITIONS

- A. Protection of Existing Site
 - 1. Protect adjacent work from splashing of paving materials. Remove all stains from exposed surfaces of paving, structures, and grounds. Remove all waste and spillage.
 - 2. Do not damage or disturb existing site features, utilities, or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
 - 3. Restore damaged site features, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Owner, and authority having jurisdiction at no additional cost.
- B. Safety and Traffic Control
 - 1. Notify and cooperate with local authorities and other organizations having jurisdiction (such as NYSDOT and/or City of Syracuse) when construction work will interfere with existing roads and traffic.
 - 2. Provide temporary barriers, signs, warning lights, flaggers, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.
- C. Weather Limitations
 - 1. Do not place porous bituminous paving mixtures when surfaces are wet or when the ambient temperature is 55 degrees Fahrenheit or lower (measured in the shade and away from artificial sources of heat).
- D. Erosion and Sediment Measures
 - 1. All erosion and sediment measures must be installed prior to infiltration bed construction and maintained throughout project construction.
 - 2. It is the contractor's responsibility to maintain job conditions to prevent the deposition of sediment on infiltration beds by wind-borne deposition, tracking, stormwater runoff, etc.

3. If job conditions arise that adversely affect the infiltration bed, additional measures such as access control during construction, vacuuming of impervious and pervious surfaces, or additional site stabilization may be required.

1.6 REFERENCES

1. Annual Book of ASTM Standards, 2008 or latest edition; American Society for Testing and Materials, Philadelphia, PA.
2. New York State Department of Transportation Specifications.
3. Standard Specifications for Transportation and Methods of Sampling and Testing of the American Association of State Highway and Transportation Officials (AASHTO), 2007 or latest edition.
4. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.
5. Contract Documents and Specifications for 2010 Annual Street Structures and Rehabilitation at Various Locations within Onondaga County and the City of Syracuse, March 2010.

PART 2 - PRODUCTS

A. MATERIALS

A. Infiltration Beds

1. All aggregates within infiltration beds shall be clean and thoroughly washed and shall meet the following:
 - a. Maximum Wash Loss of 0.5% (ASTM C117)
 - b. Minimum Durability Index of 35 (ASTM D3744)
 - c. L.A. abrasion loss, 30% maximum. (ASTM C131 and C535)
 - d. Aggregate shall be 100% crushed material.
 - e. Fractured Faces, 1 side 95% minimum, 2 sides 90% minimum (ASTM D5821).
2. Unless otherwise approved by the Engineer, coarse aggregate for the infiltration beds shall be uniformly graded, crushed and washed stone as specified in the State of New York Department of Transportation Standard Specifications 703-02, size designation from Table 703-4, No. 3A.
3. Unless otherwise approved by the Engineer, choker base course aggregate for infiltration beds shall be a uniformly graded, crushed blend of 40 percent No.1 and 60 percent No.2 stone as specified in the NYSDOT Standard Specifications 703-02, size designations from Table 703-4.
4. Non-woven geotextile (drainage filter fabric) shall conform to the following:
 - a. Minimum flow rate of 110 gal/min/ft² ASTM D-4491-99A
 - b. Grab tensile strength min 150 lb ASTM D-4632-91
 - c. Mullen Burst strength min 300 psi ASTM D-3786-87

- d. Puncture strength min 90 lb ASTM D-4833-00
- e. Apparent opening size 60-70 US Sieve ASTM D-4751-99A
- f. Non-woven geotextile shall be Mirafi 160N, or approved equal.

- 5. The impervious liner between infiltration bed aggregate and adjacent pavement subbase shall be Solmax 230 (30 mil), or approved equal. Install per manufacturer’s recommendations.
- 6. Where used, structural soils noted on the plans shall be as per Specification Section 02220 – CU-Soil.

B. Asphalt Treated Permeable Base Course

- 1. Shall meet the requirements of Type 1 Permeable Base as per Table 401-1 Composition of Hot Mix Asphalt Mixtures in Section 401 of New York State Department of Transportation Standard Specifications of May 1, 2008.
- 2. Shall contain a binder meeting the requirements of PG 70-22 as specified in AASHTO MP-1.

C. Porous Bituminous Asphalt Surface Course

- 1. All aggregates in the porous bituminous asphalt mix shall meet the following:
 - a. LA Abrasion loss, 30% maximum (ASTM C131).
 - b. At least one mechanically fractured face on 100 percent of the material retained on a 1/4-inch sieve.
 - c. Flat and Elongated Particles, 5:1 – 10% maximum, 3:1 – 20% maximum (ASTM D4791)
- 2. Aggregate in the asphalt mix shall be 100% crushed and washed material and have a gradation of:

U.S. Standard Sieve Size	Percent Passing
¾" (19.1mm)	100
½" (12.7mm)	85-100
3/8" (9.5mm)	55-75
4 (4.75mm)	15-25
8 (2.36mm)	5-10
30 (600 µm)	2-5
200 (75 µm)	1-3

- 3. Fibers are recommended (but not required) to minimize draindown, increase film thickness, and improve strength and durability. If used, they shall consist of either cellulose fibers or mineral fibers which are to be treated with a cationic sizing agent to enhance dispersement of the fiber as well as increase cohesion of the fiber to the bitumen. Fiber is to be added at a dosage rate between 0.2% and 0.4% by weight of total mix.
 - a. Mineral fibers shall be from virgin, basalt, diabase, or slag with a maximum average fiber length of 6.35 mm and a maximum average fiber thickness of 0.005 mm.

- b. Cellulose fiber – Fiber length shall be 6.35 mm (max), Ash Content 18% non-volatiles ($\pm 5\%$), pH 7.5 (± 1), Oil absorption (times fiber weight) 5.0 (± 1), Moisture Content 5.0% (max).
 - 4. Hydrated lime, if required as an anti-stripping agent, shall meet the requirements of AASHTO M 303 Type 1 and shall be blended with the damp aggregate at a rate of 1.0% by weight of the total dry aggregate. The additive must be able to prevent the separation of the asphalt binder from the aggregate and achieve a required tensile strength ratio (TSR) of at least 80% on the asphalt mix. Other anti-stripping agents can also be used if approved in advance by the Engineer.
 - 5. Asphalt binder shall meet the requirements of one of the following:
 - a. Asphalt binder or modified asphalt binder with an elastomeric polymer meeting the requirements of PG 70-22 as specified in AASHTO MP-1.
 - b. Rubberized asphalt binder, if shown on plans: The base asphalt for the binder material to be used for asphalt-rubber mix shall be PG 64-22 (or other binder used locally for conventional mixes) and shall be blended with ground tire rubber to meet the requirements of 5.a. above. Rubber shall be free of wire and other contaminants. Follow local state specification for asphalt rubber binder, if available, or ASTM D 6114, “Standard Specification for Asphalt-Rubber Binder.”
 - 6. The asphalt binder content shall be between 5.75% and 6.75% by total weight as determined by testing in Part 3.
 - 7. The Contractor shall submit a certification letter for the asphalt or asphalt-rubber supplier to the Engineer before the mix is placed on the project. The certification letter from the supplier will include the following:
 - a. Type and amount of modifier, if any.
 - b. Information on the storage and stability of the asphalt binder.
 - c. Manufacturer recommended mixing and compaction temperatures.
- D. Riverstone (if used)
- 1. Clean, durable stone, free from slaty texture or cleavage planes. Crushed aggregate is not acceptable.
 - 2. Rounded and sub-rounded riverstone satisfying the following specifications:
 - a. Limestone or dolomite particles $\leq 2\%$
 - b. Abrasion resistance (ASTM-C131-96) $\leq 5\%$ loss
 - c. Soundness (ASTM-C88 or T103 or T103-91) $\leq 5\%$ loss
 - d. Porosity (ASTM - C127) $\geq 35\%$
 - e. Sample grain-size distribution (ASTM-D42)
 - 1) Pct. Passing US#18 sieve $\leq 1\%$
 - 2) Pct. Passing 1/2-inch sieve $\leq 5\%$
 - 3) Pct. Passing 1-inch sieve $\leq 15\%$
 - 4) Pct. Passing 1-1/2 inch sieve $\leq 70\%$
 - 5) Pct. Passing 2-inch sieve 100%

PART 3 - MIX PRODUCTION

3.1 POROUS BITUMINOUS ASPHALT MIX DESIGN

- A. The asphalt content, use of fibers and/or anti-strip, and aggregate gradation should be adjusted within the ranges in this specification to produce a durable mix that meets the following criteria:
1. 18 to 22 percent air voids for a compacted sample (a minimum of 16% is acceptable when using the CoreLok method)
 2. Binder draindown (ASTM D 6390) not to exceed 0.3 percent when tested at least 10 degrees above production temperatures.
 3. The retained tensile strength (TSR) of the compacted specimens in the modified Lottman method must be 80 percent minimum (using ASTM D 7064 w/ 1 freeze-thaw cycle or a surrogate dense-graded mix according to AASHTO T283).

PART 4 - EXECUTION

4.1 INSTALLATION

A. Infiltration Beds

1. Subgrade Preparation
 - a. Existing subgrade under bed area shall NOT be compacted or subject to excessive construction equipment traffic prior to installation of geotextile and aggregate.
 - b. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.
 - c. Bring subgrade of bed to line, grade, and elevations indicated on plan. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing infiltration bed aggregate. Infiltration bed bottom to be kept at level grade, unless otherwise noted on plans.
2. Infiltration Bed Installation
 - a. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his discretion before proceeding with infiltration bed installation.
 - b. Non-woven geotextile and bed aggregate shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of non-woven geotextile at no extra cost to the Owner.
 - c. Place non-woven geotextile in accordance with manufacturer's standards and recommendations. Adjacent strips of non-woven geotextile shall overlap a minimum of sixteen inches (16"). Secure non-woven geotextile at least four feet (4') outside of bed and take steps necessary to prevent any runoff or sediment from entering the bed. This geotextile edge strip shall remain in place until all bare soils contiguous to infiltration bed have been stabilized. When the site is

fully stabilized, excess non-woven geotextile along bed edges can be cut back to gravel edge.

- d. Install impervious liner as indicated between infiltration bed aggregate and adjacent pavement subbase.
- e. Install infiltration bed aggregate to grades indicated on the drawings. Install coarse aggregate in 8 inch maximum lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install perforated pipe, cleanouts/observation wells as indicated on the plans.

B. Structural Soil (if used)

1. Install structural soil as per Section 02220 – CU Soil.

C. Porous Bituminous Asphalt

1. A full job mix formula with all applicable test results must be submitted to the Engineer for review and approval at least 2 weeks before paving is scheduled.
2. Transporting Material
 - a. Transporting of mix to the site shall be in vehicles with smooth, clean dump beds that have been sprayed with a non-petroleum release agent. Truck beds should be raised after spraying to drain any puddles of release agent.
 - b. The mix shall be covered during transport to control cooling.
 - c. Haul distances shall be limited to 35 miles unless approved in advance by the Engineer.
3. Porous bituminous asphalt shall be placed within 90 minutes of being loaded.
4. Asphalt Placement
 - a. The porous bituminous surface course shall be laid with a track paver in one lift directly over the storage bed and stone base course to a 2.5 to 3-inch finished thickness.
 - b. The optimal laying temperature of the bituminous mix should be determined by the results of the Draindown Test (ASTM D6390) and the recommendations of the asphalt supplier. The typical range is between 275 degrees Fahrenheit and 290 degrees Fahrenheit.
 - c. Installation shall take place when ambient temperatures are 55 degrees Fahrenheit or above, when measured in the shade away from artificial heat.
 - d. The use of a remixing material transfer device between the trucks and the paver is recommended to eliminate cold lumps in the mix.
 - e. Modified asphalt, if used, can be very difficult to rake and work by hand; a well-heated screed and other techniques should be used to minimize the need for hand work.
 - f. Compaction of the surface course shall take place when the surface is cool enough to resist an 8 to 10-ton roller (typically between 200 and 260 degrees F). One to three passes is all that is required for proper compaction (i.e. air voids of 18 to 22%). More rolling could cause aggregate breakdown and/or a reduction in the surface porosity which is unacceptable. Additional rolling with a small roller to smooth seams and remove marks is normally required. The roller should

move slowly and uniformly to prevent displacement of the mix and rollers should not be stopped or parked on the freshly placed mat.

5. After final rolling, no vehicular traffic of any kind shall be permitted on the surface until cooling and hardening has taken place, and in no case within the first 72 hours (7 days recommended). Provide barriers as necessary at no extra cost to the Owner to prevent vehicular use; remove at the discretion of the Owner. Construction equipment shall not be permitted on the porous pavement at any time.
6. Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious bituminous paving shall be merged neatly with flush, clean line. Finished paving shall be even, without pockets, and graded to elevations shown on drawing.
7. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.
8. Repair of Damaged Paving
 - a. Any existing paving on or adjacent to the site that has been damaged as a result of construction work shall be repaired to the satisfaction of the Owner without additional cost to the Owner.

9. Quality Control

a. QA/QC Testing Requirements during Porous Asphalt Production

Test	Minimum Frequency	Testing Method
Temperature in Truck at Plant	6 times per day	---
Gradation	Greatest of: 1 per 500 tons, 2 per day, or 3 per project	AASHTO T30
Binder Content		AASHTO T164
Air Void Content		ASTM D6752
Binder Draindown	Greatest of: 1 per 500 tons, 1 per day, or 1 per project	ASTM D6390

- b. The full permeability of the pavement surface shall be tested by application of clean water at the rate of at least 5 gpm, using a hose or other distribution devise. Water used for the test shall be clean, free of suspended solids and deleterious liquids and will be provided at no extra cost to the Owner. All applied water shall infiltrate directly without ponding or surface runoff, and shall be observed by the Engineer/Owner. At least 3 random locations shall be tested, with at least 1 additional test per 10,000 SF of porous asphalt.
- c. Testing and Inspection: Employ at Contractor's expense an inspection firm acceptable to the Engineer and Owner to perform soil inspection services, staking and layout control, and testing and inspection of site grading and pavement work. Inspection and list of tests shall be reviewed and approved in writing by the Engineer prior to starting construction. All test reports must be signed by a licensed Engineer.

- d. Test in-place base and surface course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable work as directed by the Owner.
 - e. Surface Smoothness: Test finished surface for smoothness and even drainage, using a ten-foot to centerline of paved area. Surface will not be accepted if gaps or ridges exceed 3/16 of an inch.
 - f. Contractor shall vacuum-sweep porous asphalt pavement once site stabilization has occurred if materials have accumulated on the surface.
10. Grade Control
- a. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks and free of low spots to form puddles. All areas must drain.
 - b. If, in the opinion of the Owner, based upon reports of the testing service and inspection, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.

END OF SECTION

SECTION 02920 - LAWNS AND GRASSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Sodding.
 - 4. Turf renovation.

1.2 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil, existing in-place surface soil, and imported or manufactured topsoil.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the New York State Nursery Landscape Association or the American Nursery and Landscape Association.
 - 2. Experience: 5 years' experience in turf installation in addition to requirements in Division 1 Section "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Qualification of Foreman or Crew Leader: All work shall be supervised by a foreman or crew leader who is a certified landscape professional.
 - a. Landscape professional shall be a New Your State Certified Horticulturist or a Landscape Technician certified by the New York State Nursery Landscape Association.
 - b. Certification shall be current.
 - 5. Maintenance Proximity: Not more than 2 hours' normal travel time from Installer's place of business to Project site.
 - 6. Qualification of Pesticide/Herbicide Applicator: All work of pesticide/herbicide application shall be done by a person licensed by the State of New York to apply pesticides/herbicides as specified in this section.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of 3 representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.
 - a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PRODUCT HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
- C. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.6 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
 1. Spring Planting: 15 April - 15 May.
 2. Fall Planting: 1 September - 15 November.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be

obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.7 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - 1. Seeded Turf: 60 days from date of Substantial Completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 - 2. Sodded Turf: 30 days from date of Substantial Completion.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - 1. Sun and Partial Shade: Proportioned by weight as follows:
 - a. Combat Extreme™ Cold Climate
 - 25% Corgi Turftype Fescue Grass
 - 25% Solara Turftype Fescue Grass
 - 20% Houndog 6 Turftype Fescue Grass
 - 20% Rhizing Star Turftype Fescue Grass
 - 10% Appalachian Kentucky Bluegrass
 - 0.00% Weed Seed
 - b. 8-10lbs per 1000 square feet.

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - 1. Sun and Partial Shade: Proportioned by weight as follows:

25% Corgi Turftype Fescue Grass
25% Solara Turftype Fescue Grass
20% Houndog 6 Turftype Fescue Grass
20% Rhizing Star Turftype Fescue Grass
10% Appalachian Kentucky Bluegrass
0.00% Weed Seed

2.3 SOIL AMENDMENTS

- A. General: Provide soil amendments of types and in amounts recommended in soil reports from a qualified soil-testing laboratory and as directed by Architect, complying with the following.
- B. pH Adjuster: Use ASTM C 602, agricultural liming material complying with the following, or shells, to create a favorable soil pH for plant materials specified:
1. Ground Limestone: Ground agricultural limestone containing a minimum of 90 percent calcium carbonate equivalent; with minimum 90 percent passing a No. 10 sieve and minimum 50 percent passing a No. 60 sieve.
 2. Hydrated Lime: Containing a minimum of 110 percent calcium carbonate equivalent; with minimum 100 percent passing a No. 8 sieve and minimum 97 percent passing a No. 60 sieve.
 3. Burnt Lime: Containing a minimum of 140 percent calcium carbonate equivalent; with minimum 95 percent passing a No. 8 sieve and minimum 35 percent passing a No. 60 sieve.
- C. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.
- F. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 PLANTING SOILS

- A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Mix existing, native surface topsoil with soil amendments and fertilizers in amounts recommended in soil reports from a qualified soil-testing laboratory and as directed by Architect.

2.5 MULCHES

- A. Organic Shredded Leaf Mulch: Where indicated on the Plans, provide well-composted mulch from the City Department of Public Works.
 - 1. Deliver and shred leaves in quantities required for Project.
- B. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- C. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- D. Recycled Cellulose Fiber/Wood Fiber Mulch Mixture: Specially prepared mixture of biodegradable, air-dried wood fiber manufactured from wood chips or bark; and shredded paper particles composed of recycled newsprint or other recycled cellulose fiber combined with surfactant and non-toxic green dye; manufactured to be applied with hydraulic seeding equipment; and complying with the following:
 - 1. Wood Fiber: 45 to 55 percent.
 - 2. Recycled Cellulose Fiber: 45 to 55 percent.
 - 3. Moisture Content: Not more than 21 percent.
 - 4. Organic Matter: Not less than 97 percent; oven-dried basis.
 - 5. Water Holding Capacity: Not less than 900 grams of water per 100 grams of fiber.
- E. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.6 PESTICIDES/HERBICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

- b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil to a depth of 8 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Remove stones larger than 2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 8 to 10 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with non-asphaltic tackifier at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
- E. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.5 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with nonasphaltic tackifier.
 2. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 160 lbs/1000 sq. yd.

3.6 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across angle of slopes exceeding 1:3.
 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF RENOVATION

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
- I. Apply seed and protect with straw mulch, or sod, as indicated, as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow grass to a height of to 2 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE/HERBICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 02930 - EXTERIOR PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Landscape Work
 - a. Plants
 - b. Mulch
 - c. Initial maintenance of landscape materials
2. Provisions for rototilling, placing, grading, decompacting and amending soil and plant materials to construct the soil profiles as showing in Section 02940 Planting.

B. Related Sections:

1. Section 02920 - Lawns and Grasses.
2. Section 02220 - CU-Soil Structural Soil.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- H. Finish Grade: Elevation of finished surface of planting soil.

- I. **Manufactured Topsoil:** Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- J. **Pesticide:** A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- K. **Pests:** Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- L. **Planting Area:** Areas to be planted.
- M. **Planting Soil:** Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- N. **Plant; Plants; Plant Material:** These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- O. **Root Flare:** Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- P. **Stem Girdling Roots:** Roots that encircle the stems (trunks) of trees below the soil surface.
- Q. **Subgrade:** Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- R. **Subsoil:** All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- S. **Surface Soil:** Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
 - 1. **Plant Materials:** Include quantities, sizes, quality, and sources for plant materials.
 - 2. **Pesticides and Herbicides:** Include product label and manufacturer's application instructions specific to the Project.
- B. **Samples for Verification:** For each of the following:
 - 1. **Trees, Shrubs, and Plugs:** 3 samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
 - 2. **Organic Mulch:** 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

- C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Planting Schedule: Submit proposed planting schedule, indicating dates for plant tagging with Landscape Architect, digging of woody material, and installation of each type of landscape work during normal season for such work in area of site.
- E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- F. Material Test Reports: For existing native surface topsoil, existing in-place surface soil, and imported or manufactured topsoil.
- G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- H. Contractor shall submit letter notifying Landscape Architect of completion of planting work, including maintenance, and requesting inspection to determine acceptability for Substantial Completion and beginning of Warranty Period.
- I. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the New York State Nursery Landscape Association or the American Nursery and Landscape Association.
 - 2. Experience: 5 years experience in landscape installation in addition to requirements in Division 1 Section "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Qualification of Foreman or Crew Leader: All work shall be supervised by a foreman or crew leader who is a certified landscape professional.
 - a. Landscape professional shall be a New Your State Certified Horticulturist or a Landscape Technician certified by the New York State Nursery Landscape Association.
 - b. Certification shall be current.
 - 5. Qualification of Pesticide/Herbicide Applicator: All work of pesticide/herbicide application shall be done by a person licensed by the State of New York to apply pesticides/herbicides as specified in this section.

- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Selection of trees and shrubs will be made by Landscape Architect, who will tag stock at their place of growth before they are prepared for transplanting. Submit schedule for tagging to Landscape Architect for approval.
- D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- E. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
- F. Substitutions: Submit request for substitutions in writing to Landscape Architect before selection of plants by Landscape Architect. Substitutions will only be considered after review of plant availability with Landscape Architect.
- G. Preinstallation Conference: Conduct conference at Project site.

1.5 PRODUCT HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
- C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 - 1. Notify Owner no fewer than 3 days in advance of proposed interruption of each service or utility.
 - 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Planting Restrictions: Plant during one of the following periods for each planting type indicated. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Trees and Shrubs and Herbaceous Perennials:
 - a. Spring Planting: 15 April - 15 May.
 - b. Fall Planting: 1 September - 15 November.
 - 2. Bulbs:
 - a. Fall Planting: 1 September – 15 October.
 - 3. Contractor shall schedule tree selection and digging operations so as to comply with nursery industry recognition of 'Spring Dig Only' or 'Fall Hazard' plant materials. No substitutions of plant materials will be allowed for fall planting based on unavailability due to 'Spring Dig Only' or 'Fall Hazard' restrictions.

- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Period from Date of Substantial Completion: 12 months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: 12 months from date of Substantial Completion.
- B. Initial Maintenance Service for Ground Cover, Plugs, and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: 12 months from date of Substantial Completion.

- C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

2.1 PLANT MATERIAL SOURCES

- A. Plant Sources, General: Acquire plant materials from the following nurseries, unless otherwise indicated, and confirm availability with Architect. Schedule tagging visits at nurseries with Architect. Obtain Architect's approval for substitutions and sources other than those listed below.

1. Aspinalls Tree Nursery Chittenango 687-5282
2. Anthony De Marco & Sons Elbridge 689-9577
3. Cayuga Landscape Ithaca 257-3000
4. Hoadley Wholesale Nursery Auburn 253-4510
5. Manlius Shade Tree Farm Manlius 682-0653
6. Red Oak Nurseries Camillus 672-3055

- B. Plant Plugs: Acquire plant plugs from the following nurseries:

1. North Creek Nurseries, Landenberg PA (610-255-0100).
www.northcreeknurseries.com
2. Catskill Native Plant Nursery, Kerhonkson NY (845-626-2758).
www.catskillnativenursery.com

- C. Bulbs: Acquire bulbs from the following nursery:

1. Colorblends, Greenwich CT (888-847-8637).

- D. Groundcovers and Perennials: Acquire groundcovers and perennials from the following nurseries:

1. Anthony De Marco & Sons Elbridge 689-9577
2. Dickman Farms Auburn 253-3030
3. Hoadley Wholesale Nursery Auburn 253-4510
4. Lan's Flower Farm Clay 688-8584
5. Marcellus Nursery & Farm Syracuse/Marcellus 488-2632
6. Maple Hill Nursery Manlius 682-8835
7. North Creek Nurseries, Landenberg PA (610-255-0100).
8. Catskill Native Plant Nursery, Kerhonkson NY (845-626-2758)

2.2 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in

leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Plant Plugs: Furnish plugs (also known as liners or cell packs) fully rooted in containers, ranging in sizes indicated and as follows:
1. 72 per Tray: 1.5 inches long by 1.5 inches wide by 2.5 inches deep.
 2. 50 per Tray: 2 inches long by 2 inches wide by 2.5 inches deep.
 3. 32 per Tray: 2.25 inches long by 2.25 inches wide by 3 inches deep.
 4. 38 per Tray: 2.25 inches long by 2.25 inches wide by 5 inches deep.
 5. 18 per Tray: 3.25 inches long by 3.25 inches wide by 3.5 inches deep.
- E. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

2.3 SOIL AMENDMENTS

- A. Soils Test: As determined by Engineer and Owner's Representative to meet requirements shown on drawings.

2.4 FERTILIZER AND MYCORRHIZAL FUNGI

- A. Fertilizer: Provide the following:
1. Basis-of-Design Product: Reforestation Technologies International, Salinas CA (800-784-4769); Bio-Paks 16-6-8 "Time of Planting Fertilization".
 2. Application Rates: 1 Bio-Pak per one gal. container plant; 2 Bio-Paks per foot of plant height for balled and burlapped plantings.
- B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.
1. Basis-of-Design Product: Reforestation Technologies International, Salinas CA (800-784-4769); AM-120 VA Mycorrhizal Inoculum (Myco Pak).
 2. Application: 1 Myco Pak per container plant; 3 Myco Paks per balled and burlapped plant.

2.5 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded leaf compost.
 - 2. Color: Natural.

2.6 WATER

- A. The Contractor shall be responsible for watering all planted areas during the maintenance period. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost. Water provided by Contractor shall be free from impurities injurious to vegetation.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Temporary Watering Bags for Woody Trees and Shrubs: Treegato, 20-gallon UV-treated polyethylene that is reinforced with nylon webbing, available at www.treegator.com. Treegators may be owned by the Contractor and removed from the site when no longer required.
- D. Temporary Watering Equipment: Hoses and sprinklers. Equipment may be owned by the Contractor and removed from the site when no longer required.

2.7 PESTICIDES/HERBICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.8 MISCELLANEOUS PRODUCTS

- A. Burlap: Non-synthetic, biodegradable.
- B. Root Gel: Product of organic-based ingredients formulated to enhance root growth and increase stress tolerance for bare root planting; containing 18 species of mycorrhizal spores to increase nutrient uptake, and water-holding gel.

1. Basis-of-Design Product: Novozymes Biologicals, Inc., Salem VA (800-342-6173, www.novozymes.com/roots); ROOTS Root Dip Gel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation of aeration piping systems, and avoid disruption and damage of services.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches, unless otherwise indicated. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Loosen subgrade of tree planting areas to a minimum depth of 36 inches.
 - 2. Apply superphosphate fertilizer directly to subgrade before loosening.
 - 3. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 4. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate indicated on Drawings.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped, balled and potted, container-grown, and fabric bag-grown stock.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected overnight, after working hours, or when unattended by Installer's personnel.

- B. Subsoil and topsoil removed from excavations may be used as planting soil, subject to compliance with requirements specified for planting soil.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare bearing same relationship to adjacent finish grades as it had to grade in nursery.
 1. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set balled and potted and container-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
 1. Carefully remove root ball from container without damaging root ball or plant.
 2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Set fabric bag-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- C. Cut exposed roots cleanly during transplanting operations.
- D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.
- E. Plant trees as shown on Drawings, following procedures in "Tree and Shrub Planting" Article.
- F. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees and shrubs as directed by Architect.
- C. Prune, thin, and shape trees and shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.8 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and plugs as indicated.
- B. Dig holes large enough to allow spreading of roots.

- C. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average settled thickness, with 36-inch radius around trunks or stems, unless otherwise indicated. Do not place mulch within 6 inches of trunks or stems.
 - a. Mulch groupings as continuous beds.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch average settled thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 PESTICIDE/HERBICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.12 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.13 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 02941

PLANTING SOILS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

1.2 SUMMARY

A. Scope of Work:

The work of this Section consists of all site preparation work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to the following:

1. Evaluation of rough subgrade water infiltration.
2. Planting soil material acquisition.
3. Testing and analysis for specification conformance.
4. Inspection and testing of subgrade for preparation of subgrade.
5. Preparation of mixes and testing for conformance.
6. Installation and placement of soils.
7. Installation and placement of landscape underdrainage piping
8. Decompaction of soils.
9. Mock-up of planting soil profiles.
10. Final in-place testing of soils.
11. Coordination with other trades.
12. Clean-up.

B. Related Work Under Other Sections:

Carefully examine all of the Contract Documents for the requirements that affect the work of this Section. Other specification Sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 02720 – Drainage Utilities
2. Section 02725 – Subsurface Infiltration Bed
3. Section 02216 – Modular Tree Cells
4. Section 02911 – Planting Soil for Modular Tree Cells
5. Section 02930 – Exterior Plants
6. Section 02920 – Lawns and Grasses

C. Definitions:

1. *Compaction*: Compaction of the soil fabric is any force applied to the soil that reduces porosity and where 90 percent of all compaction can be accomplished with only three applications of force under optimum soil moisture conditions.
2. *Dry Soil*: The condition of the soil at or below the wilting point of plant available water in which the soil is powdery and subject to blowing.

3. *Frozen Soil*: The point at which the soil water has frozen and the soil has become very hard and cloddy. Ice crystals can be seen in the pore spaces of the soil.
4. *Field Capacity*: The percentage of water remaining in a soil two or three days after having been saturated and after free gravimetric drainage has ceased.
5. *Moist Soil*: The condition of the soil in where it can be formed into a ball and maintain its shape. Deformation of the soil is difficult with hand pressure. Free water is not visible and is usually considered the point between the wilting point and field capacity of the soil.
6. *Saturated*: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile.
7. *Scarification*: The loosening of the surface of a soil lift by mechanical or manual means to alleviate compaction of the soil surface. Depth of scarification is dependent on material and extent of compaction. Depths are noted within the specifications.
8. *Subsoil*: The soil horizon directly below topsoil that provides water holding and structural support to plants. Source of the majority of micro-nutrients.
9. *Subgrade*: The in-situ soil material that the planting soil will be installed upon.
10. *Topsoil*: The mineral surface layer of soil that exhibit obliteration of all or much of the original rock structure and must show the following: (1) an accumulation of humified organic matter closely mixed with the mineral fraction and not dominated by properties characteristic of subsurface horizons; (2) has reasonable tilth (biological, chemical and physical properties) to support plant growth; and have two or more of the following:
 - a. a bulk density of less than 1.5g/cc installed
 - b. less than 15 percent by weight coarse fragments greater than 2mm
 - c. identifiable structure between clods called peds, no massive structure
 - d. no contamination (ie. Toxic weeds, chemicals, heavy metals, construction debris)
11. *Wet Soils*: Soils that are considered wet will easily be deformed by hand pressure, maintain their shape, and free water will be visible within the pore spaces. The water content at this soil condition is considered at field capacity or wetter.

D. Qualifications and Quality Assurance:

1. *Analysis and Testing of Materials Qualifications*: For each type of packaged material required for the work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards and procedures of the following:

American Society of Testing Materials (ASTM)
 American Society of Agronomy
 Soil Science Society of America
 Association of Official Agricultural Chemists
 U.S Composting Council

2. *Quality Assurance Qualifications*: Work and materials shall meet the standards of the following references:

International Society of Arboriculture (ISA)
 American Society for Testing Materials (ASTM)
 Environmental Protection Agency (EPA)
 New York Department of Conservation (NYDEC)

3. *Installer Qualifications*: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

- a. *Installer's Field Supervision:* Require Installer to maintain an experienced full-time supervisor on Project site who has at least 5 years experience with projects of similar scale and complexity.
- b. The Landscape Contractor shall have experience in the proper and safe transportation and installation of soil material.
- c. The Landscape Contractor shall have adequate supervision, staff, equipment and experience needed to complete a project of this magnitude.
- d. The Landscape Contractor shall prepare and present to the Engineer required soil submittals, and their associated specified test results at an absolute minimum of four weeks prior to the scheduled soil and plant installation.
- e. The Landscape Contractor shall have at between 3 to 5 years experience in installing designed soil mixes.

4. *Soil Mixing Contractor Qualifications:*

- a. Shall be able to provide soil mixes that meet the specifications within tolerances assigned.
- b. Shall be able to produce enough consistently uniform soil material for the project to meet the scheduled demands.
- c. The soil mixing contractor shall be engaged at least six weeks prior to scheduled soil installation to allow for sufficient time for material searches and initial planting mix approval.

5. *Testing Laboratory Qualifications:* An independent laboratory, recognized as an agricultural based testing agency, with experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- a. Employ a qualified independent testing and inspection laboratory acceptable to the Engineer and Owner to perform tests and certifications indicated.
- b. It is the responsibility of Landscape Contractor in conjunction with the Soil Supplier to submit material for the soil and compost tests.
- c. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from ASTM, EPA, and/or Methods of Soil Analysis, Soil Science Society of America.
- d. *Testing Laboratories:* These are some examples of testing facilities that can accomplish part of or complete testing of all soil mixes:

Atlantic Testing Laboratories	6085 Court St., Syracuse, NY	315-699-5281
Norm Hummel (Hummel & Co.)	35 King Street, PO Box 606 Trumansburg, NY	607-387-5694
CME Associates, Inc.	PO Box 1824, 8560 Brewerton Rd., Cicero, NY	315-698-9315
PW Laboratories, Inc.	6544 Fremont Road, East Syracuse, NY	315-437-1420

1.3 SUBMITTALS AND TESTING

- A. *Certificates:* Provide certificates required by authorities having jurisdiction, including any composted materials containing sewage sludge and material sources as defined by the Sites

documentation. Approval as EPA Type 1 “exceptional quality” is required as well standards for application of composted organic material by state or local regulations.

B. *Testing Intervals for Organic Amendments, Planting Soil Mixes:* Testing is required at the following intervals:

1. Submit complete test results and samples of the S3 and organic soil amendment (compost) materials for approval as described within Part 1 following criteria of Part 2 of this section.
2. After test results for the composted organic material have been accepted the Contractor shall create sample soil mixes for the S1 layer for the planting soil mix and perform the complete tests described in Section 02941, Part 1.
3. In-place planting soil testing shall follow methods specified in Part 1 of this section for the layers and intervals noted following the specific ranges and limits noted within Part 2 of this section. Incomplete test results shall not be reviewed, delaying the approval process.

C. *Test Procedures and Reporting:* Submit certified report for each test required. Each test report shall have its associated soil layer clearly marked along with the name of the soil supplier and soil material product name or designation. Only complete submittals with all corresponding test results and samples as list within Part 1 will be reviewed. Submit test results for compost and S3, then after approval, mix and submit the S1 layer test results.

1. *Compost:* Analyses of composted organic materials, including composted biosolids, are required prior to initial soil mix acceptance. Analyses shall include all tests specified below and meet the criteria listed in Part 2 of this section. Incomplete test results will not be reviewed, delaying submittal approval.
 - a. Maturity index either by Solvita, Dewar Self Heating or CO₂ evolution sometimes called respirometry.
 - b. Reaction in 1:1 water
 - c. Carbon/Nitrogen ratio
 - d. Foreign Material on a dry weight basis
 - e. Organic Matter percent on a dry weight basis
 - f. Ammonium-N using an extract method
 - g. Salinity using a 1:1 water paste method
 - h. Basic Nutrient content of macro nutrients (P, K, Ca, Mg)
 - i. If the compost material contains any biosolids, heavy metals must be tested to meet EPA Chapter 503 and/or the New York State levels for human use.
2. *Soil Mixes and Topsoil:* Testing shall be performed and reported for particle size requiring percent of gravel (>2.0 mm), very coarse sand (2.0 – 1.0 mm), coarse sand (1.0 – 0.5 mm), medium sand (0.5 – 0.25 mm), fine sand (0.25 – 0.10 mm), very fine sand (0.10 – 0.05 mm), silt (0.05 – 0.002 mm) and clay (< 0.002 mm). Ammonium-N content, conductivity, soil reaction (pH), basic macro nutrients, CEC and organic matter percentage on a dry weight basis shall also be tested as specifically noted below.
 - a. Particle size distribution by ASTM F1632-03 for all soil layers and topsoil. Fines passing the #270 sieve are to be measured using the hydrometer method as outlined in ASTM F1632. If any alternate method is used such as ASTM D422, the results still must be reported at the specified particle size breaks listed above or by plotting as a particle size distribution curve on a five cycle semi-log graph.
 - b. Organic matter content by ASTM F 1647, commonly known as loss on ignition.
 - c. Salts and Ammonium test using Woods End Research Laboratory # 104 Soluble Ion Test or 1:2 soil/water extract test as specified in *Methods of Soil Analysis, Part 3* and must be

tested and made available to the Engineer or Soil Scientist within two weeks of planned soil installation.

- d. Plant available Phosphorous, Potassium, Magnesium, Calcium and Cation Exchange Capacity (CEC) tested for the S1 Planting Soil Mix. Quality Assurance samples shall complete only particle size distribution, conductivity (EC), organic matter content, pH, ammonium-N for the S1 material.
 - e. Quality Assurance testing for S3 shall consist of particle size distribution by ASTM F1632, organic matter content, pH and conductivity (EC).
- D. *Sources for Soil Components and Planting Soil Mixes:* Submit information identifying sources for all soil components and the contractor responsible for mixing of planting soil mixes.
1. Owner or Engineer shall have the right to reject any soil supplier that cannot meet the testing requirements in a timely fashion, cannot provide timely deliveries, or cannot provide required quantities and/or uniform materials.
 2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
 3. Submit supplier name, address, telephone and fax numbers, and contact name.
 4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project. Indicate quantity and type of material from each supplier.

1.4 QUALITY ASSURANCE / ACCEPTANCE

- A. *Planting Soil QA:* During the placement of planting soils, test every 200 cubic yards (or one test for every planting area) of planting soil mix delivered to the job site. Tests shall be for soil mix quality assurance. Required tests for all layers include particle size distribution, pH, and organic matter. Report organic matter content on a percent by weight basis. Additional tests for salts (EC) and Ammonium-N shall be completed for S1 soil layer only. Testing procedures are described in Part 1 of this section.
- B. *Samples:* Planting soils require a long lead time. Prior to ordering the listed materials, submit representative samples of the same organic batches and soil mixes that will be used to the Engineer for selection and approval. Do not order materials until the Owner's approval has been obtained. Schedule at least 4 weeks for soil ingredient search and initial submittal approval. Delivered materials shall closely match the approved samples.
1. *Organic amendment:* submit duplicate samples of 1 quart.
 2. *Planting Soils:* submit duplicate samples of 1 quart for each soil layer after mixing organic material and soil. The Soil Mix shall match the material being placed as closely as possible.
 3. A duplicate 1 quart sample of the soil layers and compost shall be sent to the soil consultant for review.
- C. *In-place Designed Soil Testing:*
1. General planting soil installation for planting beds and bio-retention areas shall be tested using a cone penetrometer or equivalent for approximately one point every 100 ft² at an interval after S3 layer installation and again after complete soil profile installation. The planting soil penetration resistance shall be uniformly increasing in density with depth, not exceeding 200 lbs/in². There shall not be any compacted dense layers within the soil profile greater than 50 lbs/in² than the background resistance. Specific penetration resistance rates are given in Part 2 of this section for each soil layer. Infiltration rates of the soil surface (not in mulch) of the Bio-retention areas shall be tested at one test per basin at the lowest point

using ASTM 3385 to determine saturated hydraulic conductivity at installation. Records of initial testing will be used to monitor long term performance of the basins with other conductivity testing over time. The soil scientist will also conduct additional investigations on compaction and conductivity based on observed installed soil geomorphological parameters for all Bioretention Basins.

2. In-place Density Tests for any designed soils prescribed under sidewalks and pervious paving surfaces shall be conducted for at least three tests of surface soil density per segment as noted on the drawings. The surface that is to support pavement construction is to be tested. Density testing shall conform to ASTM standards using either ASTM D1556-07 or ASTM D6938-10 and shall be between 88 to 92% of Standard Proctor measured at below optimum moisture content (do not compact planting soils at moisture contents above the "Optimum" line)

- D. *Planting Soil and Compost Submittal Acceptance:* Submittals for planting soil approval must have complete test results attached as specified for each soil, results shall be clearly marked for their corresponding soil layer, clearly labeled with the soil supplier's name, and receipt of soil samples by the Soil Scientist before review of the submittal can take place. Incomplete test results will not be reviewed delaying the approval process.
- E. *Soil Installation Acceptance:* Notify the soil scientist at least 10 days in advance of date of soil placement. Inspection of the soil installation shall take place during placement of the S3 layer while some of the subgrade is visible and another inspection during the placement of the S3 layer before placement of the S1 layer. Final inspection shall take place during S1 installation.
- F. *Partial Acceptance:* Acceptance of partial areas or portions of the total work may be granted at the option of the Engineer or Landscape Architect only if the area to be inspected for acceptance is large, well defined and easily described. The Engineer or Landscape Architect is not obligated to provide partial acceptance of the work.
- G. *Final Acceptance:* Final acceptance shall be defined as the date after which the Engineer and Soil Scientist determine that all work, including Punch List items has been satisfactorily completed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- B. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Owner. Deliver soil materials only after preparations for placement of planting soil have been completed.
- C. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- D. Install planting soil layers directly before planting is to commence. Do not install planting soils so that they over-winter without vegetation. Failure to vegetate the planting soil or allowing partial planting soil installation allows for extensive erosion, compaction, and overall degradation of the planting soil system requiring extensive refurbishment before spring planting.
- E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high. If soil stockpiles greater than six feet high are to be stored for more than two weeks, the contractor shall break down and disperse soil so that mounds do not exceed the six-foot height restriction or thoroughly mix the stockpile once a month.

- F. Vehicular access to the site is restricted. Prior to construction the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access which shall include, but not limited to equipment movements and staging locations
- G. Soil materials shall be covered at least two weeks prior to installation to prevent excess moisture from saturating the soil stockpile. Test for the moisture content of the soil mix using the gravimetric oven dry method as described in Soil Science Society of America, *Methods of Soil Analysis*, Part 1, 1986 at least two days prior to soil installation if planting soil moisture content is questionable or at the request of the engineer or soil scientist.
- H. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after precipitation, nor when frozen. Soil shall be handled only when the moisture content is less than 8 percent by volume.
- I. The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.

PART 2 – PRODUCTS

2.1 SOIL LAYERS (HORIZONS):

A. General

1. All plant mix material shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. Samples of individual components of plant mixes in addition to blended plant mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub soils through the QA testing. Comply with specific materials requirements specified.
 - a. No base component material or soil components for plant soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Engineer and Soil Scientist.
 - b. If necessary, testing of the soil material components may be requested by the Soil Scientist to facilitate approval of the plant soil mix.
 - c. As necessary, make any and all plant soil mix amendments and resubmit test reports indicating amendments until approved.
3. The Engineer and Soil Scientist may request additional testing by the Contractor for confirmation of mix quality and/or plant soil mix amendments at any time until completion if quality control samples deviate from the specifications and initially approved submittals.

B. *Mulch*: Mulch shall consist of aged, shredded hardwood bark and wood fiber free of foreign materials, ranging in size from ½” to 3”.

C. *Planting Soil Supply*:

1. In the event that any of the soil materials are not available from the supplier or are not in compliance with specifications herein, the Contractor shall obtain material from other

suppliers and conduct tests specified herein to provide materials in compliance with these specifications.

2. The Engineer and Soil Scientist shall be notified of all soil mix substitutions or problems with the planting soil supply in order to assist with a smooth delivery and installation.

D. Planting Soils:

1. *Soil layer (S3):* Planting Soil Drainage Layer consisting of a material with a USDA Texture of coarse sand.
 - a. Soil reaction with a pH between 4.5 – 7.0.
 - b. An estimated saturated conductivity of 10 - 25 cm/hour.
 - c. The S3 layer within the bio-retention swale/stormwater trench shall have, uniformly increasing with depth, a penetration resistance of < 200 lbs/in² after installation. No dense layers (+ 50 lbs/in² from background rate) are allowed.
 - d. There shall be no visible organic material present in this layer.
 - e. Material can be a natural sand or finely ground recycled glass meeting the following particle size distribution:

S3 Soil Layer Particle Size Distribution

Particle Size Class	Passing Sieve No	Range in Percent Passing ASTM F 1632-03
fine gravel	10	95 – 100
very coarse sand	18	80 – 95
coarse sand	35	60 - 80
medium sand	60	10 – 40
fine sand	140	8 – 15
very fine sand	270	1 – 10
silt*		1 – 6
clay*		0 – 4
Chemical		
Organic Matter %	ASTM F 1647-02a	<0.25
pH	1:1 Water	4.5 – 7.0

*determined by hydrometer method in ASTM F1632-03.

2. *Soil layer (S1):* Planting Soil Surface layer. A 6- to 8-inch layer consisting of material with a USDA Texture of sand to loamy sand amended with organic matter (must be tested to meet specified requirements after compost is approved and added).
 - a. The soil specifications shall be that the minimum infiltration rate for planting soil areas stays above 5 cm/hour (2 in/hr) after installation.
 - b. The soil shall have soil moisture content less than 8% by weight for installation.
 - c. The S1 layer shall have a uniformly increasing with depth, penetration resistance of < 120 lbs/in² after installation. No dense layers (+ 25 lbs/in² from background rate) are allowed.
 - d. The particle size distribution shall be:

S1 Soil Layer Particle Size Distribution

Particle Size Class	Passing Sieve No	Range in Percent Passing ASTM F 1632-03
---------------------	------------------	--

fine gravel	10	95 – 100
very coarse sand	18	90 – 100
coarse sand	35	65 – 85
medium sand	60	30 – 40
fine sand	140	15 – 25
very fine sand	270	9 – 18
silt*		6 – 12
clay*		3 – 6
Chemical		
Organic Matter %	ASTM F 1647-02a	2 – 4%
pH	1:1 water	5.5 – 6.5
EC	1:1 paste	1.5 dS/m
Phosphorous (P)	extract	20 – 100 ppm
Potassium (K)	extract	200 – 600 ppm
Cation Exchange (CEC)	Extract	>8 Meq/100g

*determined by hydrometer method in ASTM F1632-03

E. *Organic Amendment:*

1. Composted Biosolid and municipal yard waste compost producers shall provide the heavy metal certificate of the material delivered as per EPA and state or local standards. Composted organic matter shall have the following criteria:

Criteria	Test Method	Acceptable Range
Type		brewer's waste, or leaf mulches are also acceptable. Composted municipal waste (chipped, shredded and screened wood, leaves, bark, etc.) alone is not acceptable unless it meets all of the criteria noted
Carbon/Nitrogen Ratio		11:1 – 22:1
Degree of Maturity	Dewer Self Heating Test, <u>or</u>	VI – V
	Solvita Maturity Index, <u>or</u>	6 – 8
	CO ₂ Evolution	1.2 % C/day
Foreign Material	Dry wt.	< 1" dia. And < 2% (of total)
Organic Matter %	Dry wt.	25 – 75%
Reaction	1:1 water	5.5 – 8.0
Ammonium	extract	< 200 ppm
Nutrient Content	extract	Contains some nitrogen, phosphorus, potassium, calcium, magnesium, sodium and micronutrients including iron, copper, boron, and manganese. Nutrients shall be present in appropriate agricultural and horticultural proportions to prevent ion antagonism.
Heavy Metals	extract	Concentrations of zinc, mercury, cadmium, lead, nickel, chromium, and copper must be below EPA and the state standards for biosolid applications to soils with human activity.

F. *Planting Soil Mix Equivalency Table:*

The mix ratios are rough estimates based on usual components found in the area and their physical properties. Slight adjustments to the mix may be needed to achieve the required planting soil properties.

Layer Designation	Base Material or Equivalent	Second Soil Mix Component	Third Soil Mix Component	Mix Ratio (Volume)
S3 Layer	ASTM C33 Fine Aggregate, non-calcareous Masonry Sand, or fine ground recycled glass	None	None	None
S1 Layer	Approved S3 material	sandy loam*	Approved Compost	3:1:1
		sandy clay loam*	Approved Compost	5:1:1
		loam*	Approved Compost	4:1:1

*USDA soil textures

G. *Landscape Underdrainage Pipe Filtration Aggregate:*

1. The perforated underdrainage pipes shall require a minimum 4 inch gravel filtration encasement to protect the pipe from siltation from the overlying soil material.
2. In order to best match the sand particle size and allow for laminar inflow of water, clean, washed NYSDOT #1 stone, free of dust, fines, or soil particles, is required.
3. No geotextile fabric is to be used separating the gravel layer from the overlying sand layer. Non-woven geotextile shall be used to line the drainage trench (bottom and sides) and used to temporarily cover the crushed stone to prevent siltation from other construction until the planting soil is in place.

H. *Landscape Underdrainage Perforated Pipe:*

1. *Landscape Underdrainage Piping:* Landscape underdrainage piping will be placed in a 12”W x 12”D trench pitched >0.5% to the outlet. Piping will be placed as noted on the Plans.

STANDARD	MEETS ASTM F810 OR F405
SIZE	4” or as shown.
PERFORATION	¼” inflow holes @ 6” on center, located at the 4- and 8-o’clock position of the installed pipe

I. *Landscape Drainage and Structural Soil Filter Fabric:*

1. A drainage-type non-woven geotextile fabric shall be used as a separation layer to prevent the surrounding in-situ subgrade soil from migrating into the underdrainage system. The geotextile is used to line the entire trench excavation prior to placement of any crushed stone and underdrainage piping. The permeability of the drainage fabric shall be a minimum of 110 gal/min/sq.ft.
2. Drainage geotextiles fabric shall meet the following Minimum Average Roll Value (MARV) specifications:

PROPERTY	TEST METHOD	REQUIREMENT	PROPERTY	TEST METHOD	REQUIREMENT
Grab Tensile Strength	ASTM D-4632	150 lb. min.	Puncture Strength	ASTM D-4833	90 lb. min.
Grab Tensile Elongation	ASTM D-4632	50% max.	UV Resistance	ASTM D-4335	70% at 500 hrs min.
Trapezoidal Tear Strength	ASTM D-4533	35 lb. min.	Apparent opening	ASTM-D-4751	40-80 US Sieve
Mullen Burst Strength	ASTM D-3786	300 psi. min.	Permeability	ASTM D-4491	110 gal/min/ft.2 min.

2.2 SOIL PROFILES

- A. *PROFILE SP-1 – Structural Planting Soil Profile:* This planting soil profile consists of one soil horizon. This soil profile shall be areas noted on the drawings that shall receive tree plantings where tree roots are encouraged to grow under pavement. The pavement layers are separated by geotextile above a compacted S3 layer with a maximum of 30 inches over a scarified and correctly pitched subgrade or underdrainage gravel where noted on the drawings. The S3 layer is variable and shall be thinned based on underground utilities or obstructions to achieve final grade. The basis for the S3 layer is the sand specified in Part 2.
- B. *PROFILE SP-2 – Bio-Retention Basins/Tree Pits:* This planting soil profile consists of two soil horizons and a landscape underdrainage filtration gravel bed. This soil profile shall be for areas noted on the drawings that are designated as Bio-retention Basins or open tree pits. The A horizon (S1 layer) of 6 - 8 inches covered with 2-3 inches of specified approved mulch over a 24-inch layer of S3 material placed on landscape filtration gravel within a excavation correctly pitched to the underdrainage piping. The basis for the S1 is the soil mix specified in Part 2. The S3 layer is coarse sand specified in Part 2 of this section. The piping, pea stone and fabric is also specified within Part 2 of this section.

PART 3 – EXECUTION

3.1 COORDINATION

- A. *Pre-Installation Examination Required:* The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify the Owner in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Owner.
- B. *Planting Soil Preparation:* Examine soil and remove foreign materials, stones over 1”, and organic debris over 2” in length. Mix-in amendments as required by tests and as approved by the Owner. All preparation and mixing shall be accomplished when the soil moisture content is less than 8 percent by volume.

- C. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

3.2 EXCAVATION AND SCARIFICATION

- A. Excavation of the soils shall be accomplished to a depths noted for each soil profile area. All construction debris shall be removed from the planting areas prior to placement of the soil layers. Care shall be taken to avoid working the soil when it has 8 percent moisture content or above.
 - 1. *Excavation Depths:* (of the subgrade below final grade where applicable)
 - a. All Areas shall be excavated a minimum of 36 inches below final grade or as noted on the drawings for specific locations.
 - 2. *Subgrade pitch:* The subgrade shall be pitched toward the underdrainage with an average around 1 percent or about 1.25 inches fall per 10 feet or as noted on the drawings.
- B. Scarification of the Subgrade: Scarification must loosen the surface of the subgrade following final rough grade to a depth of 4 to 6 inches prior to the designed soil placement.

3.3 UNDERDRAINAGE PIPING INSTALLATION

- A. Landscaping Underdrainage:
 - 1. Underdrainage shall be installed within a minimum 12” x 12” trench lined with standard filtration fabric. Locations of the underdrainage shall be placed as per the drawings.
 - a. For areas of planting soils that will use foundation drains as the landscape underdrainage, follow the Drawing Details.
 - 2. The perforated pipe with perforations at 4 and 8 o’clock (down) with a minimum gradient of 0.5 percent is applied on a bed of 4 inches of approved washed crushed pea stone.
 - 3. Cleanouts shall be placed at the upslope portion of the pipe to allow future flushing of the underdrainage system. If elbows are installed they shall be two 45 degree fittings to equal the 90 degree turn. Then gravel shall encase the pipe at least for 4 inches.
 - 4. Excess filter fabric shall be placed over the underdrainage construction prior to S3 placement to protect the gravel from siltation from other construction activities. The filter fabric shall be removed just prior to S3 placement

3.4 MIXING OF PLANTING SOIL

- A. The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.
- B. Mixing of the compost for the S1 layer (topsoil) shall be accomplished in the same manner as the other mixing procedures. The compost shall be moist, but not overly wet. Compost shall not be so wet as to have water squeezed out by hand or so dry as to be easily blown by wind.

3.5 PLACEMENT OF SOIL LAYERS (HORIZONS)

A. *Examination of Subgrade:* The subgrade shall be examined by the Contractor prior to the start of soil placement and planting. Any issues shall be noted and related to the Owner in writing prior to acceptance of the subgrade by the Landscape Contractor:

B. Planting Soil Placement:

1. *General Soil Placement Procedures:*

- a. Scarify the subgrade to a depth of 4 to 6 inches.
- b. Installation of planting soils shall be accomplished with small tracked equipment. Back-blading is strictly forbidden as it will overly compact the delicate planting soil. If planting soil has been kept dry and the subgrade is not saturated, installation of the designed planting soil can continue the day after a rain event, unless the subgrade is considerably saturated or has standing water.
- c. Where applicable, place the first layer of S3 in one 6 inch lift. Compaction of this lift shall consist of light tamping by the installers foot traffic. No mechanical compaction shall be allowed except where otherwise noted.
- d. Large tree (rootballs around 36 inches tall that would sit on about 4 inches of compacted S3) (for smaller trees see 'e' below) planting shall follow these procedures for handling the planting soils in and around the rootballs.
 - i. Adjust the subgrade overall depth to allow 4 inches of S3 material and so that the root flair of the tree will be 1 to 2 inches above final grade
 - ii. There shall be a pedestal of compacted subgrade under each of the tree planting areas. Compact this area to 95 percent of standard Proctor at below optimum moisture content then lightly scarify the pedestal surface. The tree pedestal shall be slightly higher in elevation than the surrounding subgrade to allow drainage away from beneath the rootball.
 - iii. Place at least 4 inches of S3 material on the pedestal area to allow support for the rootball and assist with tree leveling.
 - iv. Install the 6 to 8 inches of the S1 layer after all plantings have been completed.
- e. Trees with rootballs less than 36 inches tall shall follow these procedures for soil installation and planting. These trees and large shrubs shall be planted after the S3 layer is installed, but prior to the S1 layer installation.
 - i. Compact a pedestal of S3 material to about 90 percent of Standard Proctor at below optimum moisture then lightly scarify the pedestal surface.
 - ii. The soil depth shall be so that the root flair of the tree will be 1 to 2 inches above final grade.
 - iii. Install the 6 to 8 inches of the S1 layer after all plantings have been completed.
- f. Care shall be taken to maintain the separation between the designed soil layers. Do not mix the S1 or S3 with adjacent layers.
- g. Reducing the amount of compaction to the soils can be accomplished by beginning the work in corners, against walls, or at the center of isolated beds, and progressing outwards. This limits the amount of traffic needed for installation on the placed soil.
- h. Planting soils shall never be moved or worked when wet or frozen.
- i. Penetration resistance shall not exceed 200 lbs/in² within the S3 and the resistance for the S1 layer shall be less than 120 lbs/in² except where otherwise noted. The planting soil shall be uniformly increasing in density with depth. There shall not be any compacted layers within the soil profile.

- j. The Contractor shall place barricades as required to prevent any unnecessary compaction of planting soil layers from vehicles, equipment, or pedestrian traffic during construction and vegetation establishment. Any additional compaction of the planting soils must be loosened satisfactorily to meet penetration resistance specifications.
2. *Under Pavement Soil Profile Placement:* For areas designated PROFILE SP-1
- a. Scarify the subgrade to a depth of 4 to 6 inches.
 - b. Place a variable thickness of S3 drainage layer in 6 inch lifts over the scarified subgrade that is correctly pitched to the underdrainage piping. Compaction of this lift shall consist of light tamping by the installers foot traffic. Compact each remaining lift to between 88 to 92 percent of Standard Proctor below optimum moisture. **DO NOT** compact soils above optimum moisture content.
 - c. Scarify each lift surface before applying additional lifts to a depth of 2-3 inches. The final lift below the Geotextile and pavement subbase shall not be scarified.
3. *Bioretention Basin/Tree Pit Soil Profile Placement:* For areas designated PROFILE SP-2
- a. The planting soil media shall be mechanically mixed until a homogenous mixture is obtained.
 - b. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.
 - c. Install approved Bioretention washed crushed stone in the bottom of the retention basins, install perforated piping as per the drawings.
 - d. The planting soil media (S3 layer) shall be placed in lifts of 12 to 18 inches, and spread out by means of an excavator bucket or other means to minimize compaction. Placement of the soil media should only occur when it is at the correct moisture content (not wet or dry), and only when there is no precipitation present.
 - e. The Bio-Retention Basin profile follows the Profile SP-2 thickness unless otherwise noted on the Drawings.
 - f. There shall be no abrupt changes in textural class between layers, as this will inhibit infiltration. **NO soil interlayer filter fabric or compacted soil zones.**
 - g. The planting soil media should be left to settle for at least one storm event before the final lift so that it can be adjusted in the field to correspond to the plan elevations.
 - h. A 3-inch topdressing of approved mulch shall be placed prior to the establishment of vegetation to protect the swale from construction sedimentation. The mulch can be removed after plantings are established.
 - i. If blowing of material is a concern, biodegradable netting can be spread over the surface until the facility has gone through several wetting cycles.
 - j. The gravel and sand layers shall extend across the entire length and width of the Bioretention Basin or as shown on the drawings.

CONSTRUCTION NOTE: For all utility boxes and structures that will be placed completely within the designed soil shall require compacted pedestals to support the structures.

3.6 PROTECTION AND REPAIRS

A. General:

1. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials. Landscape contractor shall be the only personnel allowed on areas where planting soil has been installed.
2. Within the installation warranty period repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compacted due to subsequent construction operations or weather conditions.
3. Scarify or remove and replace material to a depth as directed by the Owner; reshape and re-compact by only hand tamping at the prescribed moisture content.
4. Where settling occurs, before pavement installation and final soil installation acceptance, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

B. *Bio-Retention Basin / Stormwater Trench Area Protections:* To ensure proper long-term functionality of the Bio-Retention Basins, several procedures and scheduling will need to be followed while handling planting soil installation around these areas.

1. Install protective filter socks and erosion controls after excavation and installation of the underdrainage, gravel and filter fabric to restrict sedimentation of the Bio-filtration areas.
2. Do not install the S3 filter sand prior to planting soil installation. Failure to comply will allow excessive sediment to contaminate the filter sand causing decreased functionality.
3. Install the S3 filter sand in conjunction the application of the S3 layer. Install 3 inches of coarse wood chip mulch to the final surface of the Bio-retention swale to help trap sediment and prevent infiltration of sediment into the filter sand until vegetation establishment. It is highly recommended to install the complete Bio-retention swales in the summer or during several weeks of dry weather to ensure that erosion is kept to minimum.
4. Maintain effective erosion and sediment controls throughout the vegetation establishment period.
5. Vegetate the surrounding catchment areas as quickly as possible.

3.7 POST INSTALLATION MAINTENANCE

A. Where settling occurs, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

1. Any post installation changes or amendments to previously approved soils without the Engineer or Soil Scientist's consent are the responsibility of the owner.

B. Fertilization of planting areas shall be handled after establishment after soil tests have been taken to determine the optimum fertilizer rates.

C. The following items are the responsibility of the Owner after the guarantee period to ensure the sustainability of the designed soil and plants for the life of site.

1. After one year, collect soil samples in each of the various soil areas and submit them for laboratory testing for fertilizer and liming recommendations.
2. Each "type" of soil and planting area shall be sampled separately, but similar areas can be grouped. For example, areas of designed soil in turf areas, planting beds (flower and shrub), and turf areas of pre-existing plantings shall to be sampled and tested separately. Fertilization

- and liming needs to be tailored to each area for maximum effect and to reduce over fertilizing and liming and possible contamination of ground water and runoff.
3. Repeat soil sampling for these areas every two years after first sampling and fertilize and lime to test recommendations.
 4. Clean and remove sediment build up within all Bio-Filtration Basins on a minimum of a bi-annual basis or less as needed. Removal of sediment on a yearly basis is recommended during the dry summer months so as not to damage/compact the filtration basins.
 5. Inspect and clean out all drainage trenches and subsurface infiltration and underdrainage piping annually.

END OF SECTION