

SECTION 260010 - GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

Site Lighting:

Furnish and install equipment and materials required to provide a complete electrical system for site lighting. Provide all trenching, pipe bedding, backfill, compaction, conduit, conductors, pull boxes, and miscellaneous components including the following:

- A. Disconnect and remove existing light poles, (return to Owner).
- B. Provide and install direct burial light pole bases.
- C. Provide and install new light poles and fixtures.
- D. Connect new lighting to existing lighting circuit.
- E. Replace pavements, roadways, lawns and walks disturbed by excavating operations with materials equal to adjacent material.
- F. Notify and coordinate all work with Colgate University Facilities personnel. Verify panel board location, size (space available), routing, and circuit loads.
- G. Verify if existing pathways at Merrill House main panel can accommodate proposed telcom / lighting circuits.

Site Electrical Improvements:

- A. Install pre-cast concrete transformer pad and containment curb. (Provided by others).
- B. Complete all trenching, pipe bedding, conduit, backfill, compaction, and site restoration.
- C. Electric Primary: (from utility pole to new transformer – approximately 120 LF)
 - 1. Provide and install 4” primary conduit, schedule 80 PVC straight sections with 10-foot length rigid steel required at all bends.
 - 2. Provide and install 45-degree sweep of 10-foot length rigid steel conduit into concrete transformer pad and all grounding/ bushings at transformer location.
 - 3. Install precast concrete transformer pad and containment curb, (provided by Village).
- D. Secondary Service: (from new transformer to site)
 - 1. Provide and install 2” schedule 80 PVC conduit and all wiring for secondary services, including Merrill House building power, EV charging stations, with stub-out for future EV stations, and stub-out for future event space.
 - 2. Provide and install PT wood frame meter pedestal with space for three (3) meters, (Merrill House, EV and future event space) and two (2) 200-amp disconnects. Painted finish, (color approved by Owner).

- E. Site Lighting:
1. Provide and install (one) 1-inch or 2-inch site lighting/ power conduit as noted on plans and pull wire for fully functional site lighting and power to all new light poles.
 - A. One site lighting circuit on dusk-to-dawn building controls.
 - B. One power circuit for GFCI outlets to be installed on all new light pole bases for future security cameras and wireless access (WAPs).
 2. Provide and install one empty 1" or 2" Telcom conduit spare as note on plans for future cameras/ WAPs by ITS.
 3. Provide and install pull boxes for proposed junctions and future stub-outs per plans.

1.2 REGULATIONS AND CODE COMPLIANCE

- A. All work and materials shall conform to and be installed, inspected and tested in accordance with the 2008 National Electric Code and with the governing rules and regulations of federal, state, and local government agencies.
- B. System shall conform with the applicable portions of American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), Insulated Power Cable Engineers Association (IPECA), National Electrical Manufacturer's Association (NEMA), International Electrical Testing Association (INETA) and the associated utility company standards.
- C. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70).
- D. Components and/or systems tested by Underwriters Laboratories, or other suitable nationally recognized independent testing laboratories, shall bear the associated label, seal or stamp or conformance.
- E. All penetrations through fire rated assemblies shall be fire-stopped in accordance with applicable UL and local building code standards.
- F. Obtain all necessary permits and fees and charges for same.
- G. Final location of all light poles to be approved by the Landscape Architect in the field.
- H. The following is a list of codes and standards that will apply to this project:
 1. New York State Building Code.
 2. New York State Energy Conservation Construction Code.
 3. New York State Department of Labor Rules and Regulations.
 4. New York State Department of Health.
 5. Federal Occupational Safety and Health Act - OSHA.
 6. Life Safety Codes, NFPA 101.

7. National Electrical Code, NFPA 70.
8. Electrical Safety Requirements, NFPA-70E.
9. Local Codes, Ordinances or Campus Standards
10. NEMA Standards
11. Factory Mutual or other Insurance Carrier.
12. National Grid – Supplement to Specifications for Electrical Installations ESB.
13. Village of Hamilton DPW Standard Specifications

1.3 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

- A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) for approval. Verify field conditions and compatibility with proposed work.
- B. Material lists:
 1. Conductors and cables (Thhn-Xhhw)
 2. Overcurrent protection devices
 3. Connectors and splices
 4. Grounding systems components
 5. Underground duct and raceways (conduit: PVC or rigid)
 6. Exterior electrical box
 7. Ground boxes, (pull box/ hand holds)
- C. Light pole
- D. Light Fixture

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Schedule 80, polyvinyl chloride (PVC) with molded PVC fittings, with pull string for below grade installation.
- B. Rigid galvanized steel conduits and fittings for above grade installation.
- C. Acceptable Manufactures: Carlon, Cantex, National Pipe and Plastics, Allied.

2.2 CONDUCTORS

- A. Copper - No. 10 AWG and smaller shall be solid.
- B. Copper - No. 8 AWG and larger shall be stranded.

- C. No splice shall be permitted in the circuit other than in a junction box fixture.

2.3 INSULATION (600 VOLTS OR LESS)

- A. No. 10 AWG and smaller - THWN/THHN
- B. No. 8 AWG and larger - THWN/THHN, THW
- C. Identification clearly marked at regular intervals for size, type, voltage and UL listing.

2.4 CONNECTORS

- A. General: Factory fabricated for appropriate class, type, material, size, capacity, and temperature rating.
- B. No. 10 AWG and Smaller: Insulated wire unit with locking spring type insert.
- C. No. 8 AWG and Larger: Split bolt type.

2.5 NEUTRALS

- A. Equal to phase conductors.

2.6 ACCEPTABLE MANUFACTURES

- A. Coleman Cable
- B. Berk-Tek Alcatel
- C. Southwire Company
- D. General Cable
- E. American Wire
- F. Encore Wire Corp.

2.7 EQUIPMENT

- A. Polymer concrete pull box, meeting ASTM D-2444 impact resistance, locking cover, Quazite/ Hubbell box or equal. Provide heavy duty cover for pull boxes located in pavement areas.
- B. Ornamental Light Fixture: MS805_LED Main Street Series / Sternberg Lighting (Campus Standard)
Model # PT-MS805B LED-3-16L35-MDL016- Black
 - (4) Type 3 distribution
 - (5) Type 4 distribution
 - (4) Type 5 distribution

Distributed by LightSpec/ Syracuse
2806 Court Street, Syracuse, NY 13208 (315) 451-8884.

- C. Ornamental Light Pole: 6200 Oxford Series / Sternberg Lighting

(Campus Standard)
Model # CSA-NF/ 6212TFP63-C/ Black

Distributed by LightSpec/ Syracuse
2806 Court Street, Syracuse, NY 13208 (315) 451-8884.

- D. Concrete Light Pole Base:
1. Precast concrete universal light pole foundation - minimum 4,000 psi.
 2. Adjustable bolt circle and bolt diameter.
 3. 18" diameters x 5'-0" length.
 4. Binghamton Precast and Supply Corp. (607) 722-0334,
www.binghamtonprecast.com.
Or
Holbrooks Precast, Inc (607-849-3787
sales@holbrooksprecastinc.com
- D. GFCI outlet: Exterior duplex receptacle, 20A, 125V AC, NEMA 5-20R, Hubbell or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Work shall be expeditiously executed in a well-planned, organized, neat, workmanship like manner. Coordinate work schedule with other Contractors.
- B. Unless otherwise noted or herein specified, materials and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. Electrical work herein specified and/or noted shall be executed in strict conformance with the National Electrical Code.
- D. Install light poles and fixtures as detailed and in accordance with manufacturer's recommendations.
- E. Provide sleeves, conduit and other items required for built-in features of the construction. Coordinate electrical work with sign manufacturer's requirements and point of connection with electric service.
- F. All components of each designated conduit system shall be complete prior to pulling conductors.
- G. Apply water soluble, Underwriters Laboratories listed pulling lubricant only as required and then as sparingly as possible; thereafter, thoroughly remove residual lubricant from accessible conductors within panelboards, junction boxes, pull boxes, wire ways, etc.

- H. Insulate connections with Underwriter's laboratories listed molded composition covers and/or plastic tape.
- I. Neatly train, lace and arrange conductors within junction boxes, pull boxes, wire ways, terminal cabinets, etc. to complement access and facilitates modifications.
- J. Testing: Demonstrate working system to College Facilities Manager.
- K. Underground conduit shall be a minimum of 30" below finished grade.
- L. Connections: Tighten electrical connectors and terminals per manufacturer's published torque-tightening values. If manufacture's torque values are not indicated, use those specified in UL 486A-486B.
- M. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation rating than un-spliced conductors. Use oxide inhibitor for aluminum conductors.
- N. Grounding: Comply with UL 467 for grounding and bonding materials and equipment.
- O. Paint items noted on the plans or provide specified factory applied finish as noted.

3.2 FIELD QUALITY CONTROL

- A. Identify system components, wiring, cabling and terminals.
- B. Operational test: After installing luminaires, switches, equipment, and accessories, and after electrical circuitry has been energized, test units to confirm operation with campus facilities personal.
- C. Luminaires will be considered defective and replaced if not passing operation tests and inspection.
- D. Adjust the aim of luminaires as necessary, and in the presence of the Architect.

3.3 CLEAN UP

- A. During the contract and at intervals as directed by the Landscape Architect clear the site of all extraneous materials or debris. Leave the site in a clean, safe, well-draining, neat condition.
- B. Clean all equipment, light poles, and fixtures.

END OF SECTION 260010

SECTION 311201 - SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in Division 26, 31, 32 and 33.

1.2 DESCRIPTION OF WORK

- A. The extent of site preparation is shown on the drawings.
- B. Site preparation work includes, but is not limited to, the following:
 - 1. Site investigation and underground utility identification
 - 2. Protection of existing trees, shrubs, ground covers and lawns to remain
 - 3. Topsoil stripping and stockpiling on site (See Section 329201)
 - 4. Site clearing and removals
 - 5. Saw cutting pavement
 - 6. Relocations/salvaged materials noted
 - 7. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 329201 – Seeded or Sodded Lawns
- C. Section 334001 - Storm Drainage

1.4 SITE INVESTIGATION

- A. The Contractor shall visit the site before bidding, inform and familiarize themselves of all site conditions, including but not limited to, site topsoil, sub-soil, rock, subsurface and groundwater conditions affecting proposed work. No allowance or additional cost will be made in the work of this contract for failing to determine overall project site conditions.
- B. Verify locations and protect utilities and structures, whether or not shown on the drawings. Existing utilities and structures shown on the drawings are for the Contractor's convenience and locations are not guaranteed.
- C. Verify survey information given on drawings. Walk the site with the University Facilities Management Personnel to discuss approximate locations of reputed utilities not shown on the survey, prior to performing work. Notify the Architect of any and all discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey information.

- D. Locate and protect from disturbance existing survey monuments, pins, markers and benchmarks whether or not shown on drawings. When any disturbance or damage occurs, notify Architect in writing within 24 hours. Describe nature of disturbance or damage and date first occurred. Provide copies to applicable government and municipal agencies. Pay costs for restoring monument to satisfaction of said agencies, at no additional expense to the Owner.

1.5 JOB CONDITIONS

- A. The terms "Architect" and "Landscape Architect" for Divisions 31, 32 and 33 work shall mean Appel Osborne Landscape Architecture, 102 West Division St., Suite 100, Syracuse, NY 13204, Tel. (315) 476-1022. Facsimile (315) 479-7573 or other representative(s) that Colgate University may determine.
- B. Examine drawings and specifications for the entire project. Become familiar with the scope and sequencing of work required. Coordinate and cooperate with other Contractors and trades working in and adjacent to the project.
- C. Examine work prepared prior to this contract. Commencement of work will be construed as complete acceptance of all preparatory work by others.
- D. Obtain and pay for permits, (if required) by governing authorities. Perform the work in compliance with applicable standards, codes and requirements of governing authorities having jurisdiction.
- E. Safety is the sole responsibility of the Contractor.
- F. Burning on site and use of explosives are not permitted.
- G. Responsibility for existing utilities:
 - 1. Contact Dig Safely New York at least two (2) full working days, and not more than ten (10) working days, before digging begins or as required by latest state law. Locate by hand excavation and provide protection from damage to existing utilities to remain in the area. (Tel. 811)
 - 2. Existing utilities encountered within excavated areas shall be supported, blocked and/or braced in a manner approved by the owner of the utility. Leave supports in place to the extent required by the owner of the utility.
 - 3. Should uncharted or incorrectly charted utilities be encountered, notify the Landscape Architect immediately for directions as to procedure.
 - 4. Do not break utility connections without providing temporary services as acceptable to the Landscape Architect and the owner of the utility.
 - 5. Repair and pay for damages to existing utilities as directed by utility Owner at no additional cost to the Owner.

6. Cap ends of utilities to be abandoned or removed in accordance with regulatory agencies and as directed by the Landscape Architect.
- H. Provide protections and conduct operations to prevent injury and damage to persons, work of other Contractors, existing items to remain, structures, pavements, lawns, and adjacent properties.
- I. Restore work damaged by this Contractor inside and outside the contract limits to the condition existing prior to the start of work, unless otherwise directed, to the satisfaction of the Landscape Architect, and at no additional cost to the Owner.
- J. Vehicular and pedestrian traffic control:
 1. Maintain vehicular and pedestrian traffic during construction activities. (Merrill House and Campus Safety Building will be occupied throughout construction).
 2. Provide alternate routes and traffic control around closed and obstructed traffic ways as required by governing regulations or the Owner.
 3. Provide temporary fencing, flag-persons, barricades, warning signs, wayfinding signage and warning lights or other measures to protect the public and cause the least interruption of work.
- K. Field Measurements: Take necessary field horizontal and vertical measurements required in order to perform the work and design intent shown on the drawings and outlined in the specifications. Assume complete responsibility for accuracy of such measurements and dimensions.
- L. Removal of spoils, dust control, debris, and clean up:
 1. Control air pollution caused by dust and dirt; comply with governing regulations. Water to control dust when necessary and as directed by the Architect or Certified Erosion Control Specialist. Provide water sprinkling materials, equipment and labor to prevent the nuisance of dust to the surrounding areas.
 2. Legally dispose of removed and demolished items, including trash, debris, construction waste, spoils, or excess material off the Owner's property, at a licensed disposal facility having adequate capacity to accept the project's waste.
 3. Burning of combustible materials on the site is not permitted.
 4. During the contract and at intervals as directed by the Architect, clear the site of extraneous materials, rubbish, construction waste, and debris. Leave the site in a clean, safe, neat, well-draining condition.
 5. Soil: Sweep roads, access ways, paved areas, and parking areas where soil, mud and debris have dropped or tracked from construction and delivery vehicles on a daily basis and as directed by the Landscape Architect or Certified Erosion Control Specialist.

6. Spoils: Remove from site and legally dispose when not required for fill or determined to be unsatisfactory soil material per Section 312201 - Site Earthwork.
- M. Construction Review - General: Site visits will be made by the Landscape Architect to observe construction conformance to drawings and specifications. The occasional site visits by the Landscape Architect shall not be construed as supervision of construction or make them responsible for the safety programs and precautions, including but not limited to: the safe access, visit, use, work travel, or occupancy of any person. Site visits shall not make the Landscape Architect responsible for means, methods, techniques, sequences or procedures of construction selected by the Construction Manager, Contractor or his Sub-contractors.
- N. Site Complexity: The existing site will be intensively developed. Because of the construction and resulting graphic complexity, it is impractical to show every detail. However, the general design intent is clearly shown and shall be applied to individual conditions not specifically shown as directed by the Landscape Architect and at no additional cost to the Owner.
- O. Asbestos, Toxic and Hazardous Materials: The Division 31, 32 and 33 site work contract does not include testing for, handling or removal of hazardous materials such as, but not limited to: asbestos, fuel, oil, PCB's, or other toxic or hazardous waste materials as identified by the EPA and/or NYSDEC. If any such materials are encountered during any part of the site work, the Contractor is responsible for identifying potential hazardous material and immediately notify all governing agencies having jurisdiction as required by law. Also, within one (1) hour of discovery notify the Landscape Architect, Consultants, and Owner. The Owner shall provide testing and removal by others, under separate contract. The Contractor shall recommence work under this contract when the Owner provides written certification that remediation is complete per governing agency. The Contractor shall not be penalized for any delays caused by the hazardous testing and removal, unless such hazardous material incident was a result of Contractor's operations. The Contractor shall indemnify and hold harmless the Landscape Architect, Consultants and Owner, agents, and employees from and against all claims, damages, losses and expenses, direct and indirect or consequential damages, including but not limited to fees and charges of attorneys and court and arbitration costs, arising out of or resulting from the performance of the work by the Landscape Architect, Consultants and Owner, or claims against the Landscape Architect, Consultants and Owner arising from the work of others, related to hazardous waste.

The above indemnification provision extends to claims against the Landscape Architect, Consultants and Owner which arise out of, are related to, or are based upon, the dispersal, discharge, escape, release or saturation of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, or pollutant in or into the atmosphere, or on, onto, upon, in or into the surface or subsurface soil, water or water courses, objects, or any tangible or intangible matter, whether sudden or not.

Should the hazardous material incident be the result of the Contractor's operations, the Contractor shall be responsible for all costs associated with the discovery and remediation of such hazardous material such as, but not limited to; testing, consultant

fees, damage, loss, fees and charges of attorneys, court and arbitration costs, claims by other contractors, direct and indirect or consequential damages.

- P. Salvageable Items: Remove at any time after work starts. Storage or sale on site of salvageable and removed items is not permitted. Do not remove topsoil from site without written permission from the Owner. Salvaged items include traffic signs, and granite curbing for re-use in the new work.
- Q. Relocated Items: Relocate site items as noted. Disassemble if necessary, (fully or partially) and move to new location and re-assemble.
- R. SUBMITTALS/PROCEDURES: Submit Tests, Shop Drawings, Material Certificates (showing content/mechanical analysis) and Manufacturer's Product Data (MPD) to Landscape Architect for review a minimum of two (2) weeks prior to installation.
 - 1. Provide a minimum of five (5) copies from material producer or laboratory, stamped as checked and approved by the Contractor before submittal to the Architect or as otherwise indicated in Division 1. **(Note: Electronic submittal process may be acceptable when approved by the Owner.)**
 - 2. Refer to individual specification sections for a list of required submittals.
 - 3. For each material certificate required, provide certification by a Landscape Architect approved independent testing laboratory which gives analysis results and states that the material complies with or is superior to the specified requirements.

1.6 SUBMITTALS: (See 1.5, above)

- A. Provide photographic documentation. Photographically document existing features which, may be affected by the construction, inside and outside the contract limit line. Existing features include, but are not limited to: structures, pavements, curbs, utilities, lawns and vegetation, especially individual trees which are over six (6") inches in diameter and noted to remain on the drawings. Also, particular attention shall be paid to the construction access, stockpile and haul road areas. Distribute a copy of the photographic documentation (color prints or digital format) to the Owner and Landscape Architect prior to the start of construction.

PART 2 - PRODUCTS

2.1 PLASTIC FENCE (for work zone security and pedestrian traffic management)

- A. Shall be new or good quality used 4'-0" high heavy duty orange plastic fence NC450.
- B. Posts shall be new or good quality U-channel posts to hold plastic fence.

2.2 OTHER PROTECTIVE DEVICES

- A. Shall include, but not be limited to; wood planks, rubber mats, barrels, lights, barricades, traffic controls, cones, steel plates, and other temporary protections.
- B. Contractor to provide all necessary protections required by Occupational Safety and Health Administration (OSHA).
- C. Temporary/ Movable Fence: Shall be new or good quality used 6-foot-high x 8-foot length rigid panel sections with stanchions.
- D. Traffic Barrels: 48" height.

PART 3 - EXECUTION

3.1 PROTECT EXISTING VEGETATION TO REMAIN

- A. Prior to commencing site preparation work, notify the Landscape Architect, and/or Owner representative, and meet on site to locate existing trees, lawns and vegetation which are to remain
- B. Protect and keep existing vegetation to remain free from physical damage. Keep in a healthy, vigorous growing condition for the entire construction period as follows:
 - 1. Keep site disturbance and staging limits to a minimum. Obtain approval from Owner for material and equipment storage areas. Limit access points and routes to the project site. Coordinate site access with other trades and contractors on the work site.
 - 2. Groups of Trees and Vegetation: Place orange plastic construction fencing around drip line(s) of trees and plant beds as detailed or directed by the Landscape Architect. Do not store materials, run equipment, park vehicles, or otherwise disturb area within the drip line (full canopy of tree) or in plant beds.
 - 3. Specimen and Individual Trees: Protect each as noted and detailed. Do not store materials, run equipment, park vehicles or otherwise disturb area within the drip line (full canopy of tree).
- C. Rejuvenate damaged vegetation by pruning watering, fertilizing, staking and other methods as directed by the Landscape Architect. Replace trees and other vegetation that cannot be restored to full growth with comparable size, quantity, quality and species as determined by the Architect.
- D. Repair lawns disturbed due to construction operations outside the grading limits, as specified and directed by the Landscape Architect. Provide screened topsoil, seed, and mulch over damaged lawn areas, access ways or where tire rutting occurred.

3.2 TOPSOIL STRIPPING AND STOCKPILING ON SITE

- A. Strip full depth of existing topsoil from areas to be regraded, paved, or otherwise built upon. When amount of available topsoil exceeds what is required for new lawn work,

report, or Contractor assumed depth, continue to remove all topsoil and lower the paved or built element subgrade. Place additional satisfactory earth fill in uniform depths as indicated in the Site Earthwork Section 312201. Maintain finished grades as shown on the drawings. This work shall be done at no additional cost to the Owner.

- B. Minimum quantity of topsoil shall be as needed to provide four (4") inches settled depth on lawn areas. Verify quality and quantity. Supply imported topsoil when amount of available topsoil meeting above requirements is less than what is required for the proposed lawn areas. See Section 329201 for imported topsoil requirements.
- C. When amount of available topsoil meeting above requirements exceeds what is required for the proposed lawn areas, remove excess from the site as directed by the Landscape Architect. Maintain finish grades as shown on the drawings. Provide borrow topsoil if necessary when existing quantities as insufficient to meet requirements.
- D. Topsoil shall be well drained, homogeneous texture soil of uniform grade, without the admixture of subsoil material. Topsoil shall be free of dense material, hardpan, and stone over three-quarters (3/4") inch in diameter, and other objectionable foreign material including, but not limited to, debris, toxins, hazardous wastes and chemicals (such as, but not limited to, atrazine and muriatic acid) that may be injurious to humans, animals and plant materials.
- E. Stockpile on site where shown on the drawings or as directed by the Owner. Provide all hauling as necessary. Do not mix topsoil stockpiles with other materials. Do not remove topsoil from site without written permission by the Owner. Stabilize and maintain all stockpiles as specified.

3.3 SITE CLEARING AND REMOVALS

- A. Items and materials noted to be removed shall become the property of the Contractor, unless otherwise noted. Obtain Owner's approval prior to removal off site or for relocation of salvaged material on site. Remove material off site and legally dispose of it. Backfill voids with imported granular backfill, placed in eight (8") inch layers compacted to 95% maximum density.
- B. Remove physical elements above and below grade as shown and which interfere with proposed construction. Physical elements include but are not limited to: trees, roots, vegetation, pavements, curbs, foundations, previous construction materials, unused utilities or abandoned pipes, walls, rocks, and other debris.
- C. Trees, shrubs and roots shall be completely removed and disposed of legally off site.
- D. Maintain existing utilities shown to remain and protect from damage during demolition and construction operations. Do not interrupt existing utilities; provide temporary services when required, as acceptable to the Architect.
- E. Research with Owner possible locations of existing subsurface utilities prior to excavating.

- F. Repair/ restore pavement surfaces that may have been damaged due to construction operations or removals. Power-wash, sweep, seal or replace in kind as directed by the Architect.

3.4 SAW CUTTING

- A. The Work consists of vertical saw cutting of the existing asphalt or concrete pavement structure to facilitate the removal of the asphalt or concrete bound material.
- B. The equipment shall be capable of producing a smooth vertical saw cut without causing damage to the adjacent pavements or related site features.
- C. The Contractor shall saw cut the asphalt/concrete pavement to a depth which will allow removal of the material without causing damage to the adjacent pavement. Rough, jagged or cracked edges will not be acceptable. Concrete pavement shall be removed at the nearest contraction joint.

3.5 RELOCATIONS

- A. Any item noted to be relocated shall be removed by the Contractor from its existing position without damaging it, stored, protected from theft, fire, vandalism and damage for the project duration. Reset in the location(s) and in the manner detailed, noted on the drawings or specified.
- B. Clean salvaged items as noted prior to re-installation.
- C. Backfill voids with imported granular fill material, placed in eight (8") inch layers compacted to 95% maximum density when located in proposed pavement areas or 90% maximum density when located in proposed non-paved areas.
- C. Salvaged items not scheduled for re-installation shall be returned to the Owner. Move items to Owner designated areas.
- D. Reinstall traffic signs displaced by construction operations. Replace sign posts that are damaged as directed by the Owner.

3.6 CLEAN UP

During the contract and at intervals as directed by the Landscape Architect and as site preparation is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well-draining, neat condition.

END OF SECTION 311201

SECTION 312201 - SITE EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of site earthwork and site grading is shown on the drawings.
- B. Site earthwork includes, but is not limited to, the following:
 - 1. Horizontal and Vertical Layout
 - 2. Shoring, Bracing and Supporting
 - 3. Grading and Excavation
 - 4. Fill Materials
 - 5. Compacted Backfill and Fill
 - 6. Field Quality Control Testing and Inspection Services
 - 7. Guarantee
 - 8. Clean Up
- C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312501 - Erosion, Sediment and Pollution Control
- C. Section 334001 - Storm Drainage

1.3 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop, American Association of State Highway and Transportation Officials.
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
- D. ASTM D 1556 - Standard Test Methods for Density and Unit Weight of Soil in Place by the Sand Cone Method.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
- F. ASTM D 2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

- G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- K. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
- L. Deep Ripping and Decompaction shall be per NYSDEC recommendations, April 2008, or latest edition.
- M. Occupational Health and Safety Act.

1.4 SUBMITTALS (See Section 311201, 1.5)

- A. Furnish name of New York State licensed Land Surveyor to be employed and perform project layout. Obtain Architect's approval prior to performing work.
- B. Submit written report on NYS licensed Land Surveyor's letterhead verifying that professional's involvement with the project layout. The report shall briefly state the scope of services performed for the project, the dates work was accomplished, and an explanation of any adjustments required, specifically listing as built and FIELD VERIFY requirements as noted in 3.2 of this specification section.
- C. Provide Earthwork Contractor's experience requirements as indicated in 1.5, "Quality Assurance". Obtain Architect's approval prior to performing work.
- D. Samples: 10 lb. samples of each type of fill; submit in airtight containers to testing laboratory.
- E. Materials Sources: Submit name of imported materials source for each type of fill material.
- F. Fill Composition Test Reports (Imported and Onsite): Provide results of laboratory tests (mechanical analysis, material content and soil classification) on proposed and actual materials used to determine acceptability. This shall include one optimum moisture-maximum density curve (Modified Proctor) for each soil/imported fill type as determined by ASTM D1557, Method A, latest issue.
- G. Compaction Density Test Report(s) required in Field Quality Control of this specification.

1.5 QUALITY ASSURANCE

- A. Perform all site earthwork, site grading and excavation in compliance with requirements of governing authorities having jurisdiction.
- B. The **Owner** will employ a licensed soil testing and inspection service for Field Quality Control Testing of materials. This Contractor will coordinate day to day scheduling with the Owner's testing agency.
- C. Earthwork Contractor Experience Requirements: Submit business name, business Owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Earthwork for this Project. Provide a list of at least four (4) Earthwork projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past two (2) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.
- D. Layout Foreman Experience: The Earthwork Contractor must provide a competent layout foreman skilled in this specific type of layout/earthwork project. The layout/earthwork foreman shall have a minimum of three (3) similar projects completed within the last three (3) years. Provide a list of projects layout/earthwork foremen has completed including project name, address, Owner contact information and project scope of work.

1.6 JOB CONDITIONS

- A. Job conditions in Section 311201 apply.
- B. Provide enough fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- C. When fill materials need to be stored on site, locate stockpiles were directed by Owner.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination of material types.
 - 3. Protect stockpiles from erosion and deterioration of materials by covering as directed by the Landscape Architect and as specified.

1.7 SUB-SURFACE SOIL INFORMATION

- A. No subsurface testing / geo-technical information or data provide herein.
- B. Exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are acceptable to the Landscape Architect and Owner. Coordinate test locations with Owner prior to starting work. Backfill immediately when completed and repair to satisfactory conditions as determined by the Landscape Architect. It is expressly understood that the Owner, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn therefrom by the Contractor.

- C. Walk the site with Colgate facilities personnel to verify underground utilities and known subsurface conditions.

1.8 UNUSUAL SUBSURFACE CONDITIONS

Notify the Landscape Architect immediately in writing via email when unusual conditions are encountered during excavation, including, but not limited to excessive flooding, miscellaneous structures, uncharted or unlocated utilities, foundations, bed rock, toxic and hazardous materials, and chemicals, suspected archaeological artifacts, and unsatisfactory soil materials. Request clarification before proceeding. Refer to paragraph 3.4 of this specification Section.

PART 2 -PRODUCTS

2.1 FILL MATERIALS

A. **Satisfactory General Earth Fill:**

1. To be used **outside** of structural elements, storm structures, utility pipe bedding, pole bases and curbs.
2. Satisfactory earth fill shall be satisfactory on-site subsoil or hauled in off-site subsoil free of toxics, hazardous wastes, and chemicals (such as, but not limited to, atrazine and muriatic acid) that may be injurious to humans, animals, and plant materials. Satisfactory earth fill shall also be free of rubbish, debris, wood, masonry, metal, frost, vegetation, or other deleterious material, which cannot be properly compacted. Use general earth backfill that is dry and free of clay. Rocks, gravel, or earth shall not be larger than 3" in any dimension/direction.
3. Satisfactory earth fill materials are also defined as those complying with the American Association of State Highway Transportation Officials (AASHTO), M-145 soil classification Groups A-1, A-2-4, A-2-5, A-3 and Unified Soil Classification System GW, GP, GM, GC, SW, SP, SM, and SC as determined by ASTM D2487.

B. **Imported Granular Backfill:**

1. Imported granular backfill to be used for asphalt pavement subbase, concrete subbase, storm structures, storm pipes, water pipes, utility pipes and other site structures.
2. Backfill shall be **run of crusher limestone** meeting the following gradation as determined by ASTM-C136:

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
3/4" or 19 mm	75 - 90%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

3. Backfill shall be free of debris and deleterious materials. In no case shall the plasticity index exceed 5.0 or the percentage passing the 200-mesh sieve exceed 8%. The quality of the imported granular backfill shall be determined by the magnesium sulfate soundness test, if considered suspect by the Architect. The maximum percent loss at four cycles by weight shall be 20.
4. Refer to Building Earthwork for backfill requirements for the building foundation and slab.

C. Imported Structural Fill:

1. Imported structural fill to be used for top eight (8") inches of design subgrade elevation for pavement areas requiring fill below the base stone profile.
2. Shall be *run-of-bank gravel* free from organic matter or other deleterious materials, meeting the material gradation requirements of Item 304.05 Sub-base Course, Type 4, of the NYSDOT's Standard Specifications for Construction Materials, as determined by ASTM C136.

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
1/4" or 6.3 mm	30 - 65%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

2.2 UNSATISFACTORY SOIL MATERIALS

- A. Shall be defined as soil with high percentage of decomposed rock, sand, organic matter, or moisture laden clay to prevent adequate compaction. Also, soil with toxics, hazardous wastes, and chemicals (such as atrazine and muriatic acid) that may be injurious to humans, animals, and plant materials. Also, soil with significant quantities of rubbish, debris, wood, masonry, metal, frost, or other deleterious material which cannot be properly compacted shall be classified as unsatisfactory.
- B. Unsatisfactory soil materials are defined as those described in AASHTO M-145, soil classification, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 with CBR value less than 7.0. Also Unified Soil Classification System ML, CL, OL, MH, CH, OH as determined by ASTM D2487 with CBR value less than 7.0 in addition to peat and other highly organic soils; and soil materials of any classifications that have a moisture content at the time of compaction beyond the range of 1% below and 3% above the optimum moisture content of the soil material/backfill material, as determined by the Moisture Density Relationship test.
- C. When unsatisfactory soil materials are encountered at proposed subgrades and other design elevations, proceed as described in Part 3 (Execution) of this Section.
- D. The use of slag (a byproduct of metal processing) is unacceptable for any use on this project site.

2.3 SOURCE QUALITY CONTROL

- A. See "Quality Assurance" of this specification section for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, Contractor is responsible to test and analyze all samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.

2.4 SHORING, BRACING AND SUPPORTING

- A. Shoring and bracing shall conform to the requirements of the Occupational Health and Safety Act.
- B. Shoring and bracing shall be provided, placed, and maintained at the locations and elevation that are necessary or required to: support and protect the sides and bottom of the excavation; prevent undue disturbance or weakening of the supporting materials below or beside the works; prevent movement of ground which may disturb or damage the work, adjacent pavements, property, structures, or other works.
- C. Provide materials for shoring, bracing, and supporting, such as sheet piling, uprights, sheathing, stringers, and cross-braces, in good serviceable condition. Use timbers that are sound and free of large or loose knots.
- D. Provide design by Contractor's NYS Licensed Engineer, when shoring is required to perform work as shown on the drawings. Submit to Architect for approval.
- E. Installation: Shoring and bracing shall be driven and placed so that it can be removed as backfilling takes place without damage to the pipeline or its appurtenances, structures, and without settlement of or damage to adjacent pavements and structures.
- F. Removal: The Contractor shall remove all shoring and bracing as the excavation is backfilled, unless directed by the Landscape Architect to be left in place. The procedure for extracting shoring and bracing and placing backfill shall ensure the backfill load is applied gradually, and disturbance of the works or foundation material is avoided.
- G. Support all utilities as required by the municipality/utility owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field conditions such as benchmarks, monuments, topography, inverts, locations of utilities and property lines before proceeding. Notify the Landscape Architect immediately, in writing, of discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey and layout information. Additional costs resulting from failure to verify field conditions prior to commencing work shall be borne by this Contractor and at no additional cost to the Owner.

3.2 LAYOUT

- A. Stake layout up to and including those elevations and dimensions specifically noted on drawings as "FIELD VERIFY" (FV). Ensure that the field elevation and dimension agree with the elevation and dimension on the drawings before continuing. Notify the Architect immediately, in writing, of any discrepancies prior to commencing work. Additional costs resulting from failure to verify dimensions as noted on drawings shall be borne by this Contractor and at no additional cost to the Owner.
 - 1. Assume sole responsibility for the accuracy of the layout work.
 - 2. Run from point(s) of beginning (POB), base lines, property monuments, benchmarks, iron survey pins, or other points given on the drawings.
 - 3. Roads, Parking Areas, and Walks: Accurately locate and stake curb lines, center line, swales, point of curve and tangency as necessary to accurately build.
 - 4. Buildings and Site Features: Accurately locate and stake corners, offset corners, slopes, and center lines as necessary to accurately build.
 - 5. Pipe Work: Accurately locate with laser.

3.3 GRADING

- A. Cut and Fill: Presume the earthwork does **NOT** balance on site. Meet the grades shown on the drawings. Haul in or haul away as may be necessary. Provide earthwork calculations and provide for imported or exported material as part of bid. No additional costs will be allowed.
- B. Grade areas as indicated, including transition areas, with uniform levels and slopes between finish elevations.
- C. Cut to grades and profiles indicated.
- D. Set grade stakes at fifty-foot (50') intervals, at corners, and breaks in grade.
- E. Conduct operations to avoid ponding of water. Provide all pumping equipment, sump pits, and temporary diversion swales where and when necessary to continue work performance on schedule and as specified.
- F. Shape subgrade surface of site elements to within 0.10' above or below required subgrade elevation, compacted as required and sloped to provide drainage as shown on the drawings. Notify the Landscape Architect for subgrade review prior to continuing work.
- G. Refer to Section 311201 for topsoil requirements.

3.4 EXCAVATION

- A. Remove and legally dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed.

- B. Sloping and Benching: Follow OSHA recommendations based on soil type to determine slope configurations. Slope the sides of excavations five (5') feet deep and over to the angle of repose of the material excavated; otherwise, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.
- C. Bracing and Shoring:
1. Provide bracing and shoring as required in excavations, to maintain sides and to protect structures from settlement.
 2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
 3. Remove shoring and bracing before completion of backfilling except where required for structural support or slope stability.
 4. The design, installation, and maintenance of such shoring and bracing required to accomplish the above purpose are the sole responsibility of the Contractor.
 5. Follow OSHA recommendations for bracing and shoring.
 6. Indemnify the Owner, the Landscape Architect, against any action arising from damage to existing structures, utilities or injury to persons resulting from the Contractor's actions or failure to act, in carrying out the intent of this section.
- D. Protections: Protect structures, vegetation, utilities, sidewalks, pavements, and other facilities in areas of work. Barricade and secure open excavations and provide warning lights/signage from dusk to dawn each day.
- E. Extent of Excavations: Excavate for structures to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of other work and for review. Trim bottom to required lines and grades to provide solid base to receive concrete or imported granular backfill material.
- F. Unsatisfactory Soil Materials: When unsatisfactory soil materials, as defined in this section, are encountered at design elevations, immediately notify the Architect in writing by email or other equally expeditious means. Continue as directed by the Architect and Geo-Technical Engineer. When conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price or negotiated price basis in accordance with Contract Documents. This additional excavation shall be measured each day and verified by the Owner's representative and the Contractor's Superintendent. A daily written accounting, attested by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. **Assume twenty-five (25) cy of undercutting and removals, placement of soil stabilization fabric (SSF) and providing and compacting to 95% density imported granular backfill material in Base Bid.** Unit price provided shall be utilized to add to or delete from this assumed quantity to account for actual quantity encountered.

- G. Unauthorized and Over Excavations: Fill the voids created by the removal of materials beyond indicated subgrade elevations with lean concrete (2000 psi). Or correct by:
1. Extending the indicated bottom elevation of the concrete footing to the lower elevation, at no additional cost to the Owner.
 2. Adding imported granular backfill material compacted to 95% density to proper design elevation and layout as directed by the Architect, at no additional cost to the Owner. Testing agency to perform compaction testing prior to proceeding.
- H. Dewatering:
1. Contractor shall anticipate seasonal variations of soil moisture content and groundwater in the Base Bid as verified by site investigation indicated in Section 311201.
 2. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
 - a. Surface and ground water shall be intercepted and removed before entering excavations. All necessary measures shall be taken. Earth dikes, ditches, or other devices, if required, shall be constructed to prevent such flows.
 3. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - a. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - b. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
 - c. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 4. The Contractor shall at all times provide and maintain proper and satisfactory means and devices (i.e. ditches, temporary pipes, pumps, and/or other temporary construction) for the removal of all water entering the excavations. Water shall be removed as fast as it may collect, in such manner that shall not interfere with the execution of the work or in the proper placing of pipe, structures or other work.
 5. Provide and operate sufficient pumping machinery to keep excavated parts free of water. Dig sump pits when necessary into which the excavation shall be drained. Take care and proper precautions in the use of pumps so that in no case will foundations, footings and utilities already in place or existing foundations,

- footings of adjacent structures or utilities be undermined or disturbed, and erosion occur due to pumping.
6. Do not discharge pumped materials into any body of water, wetland, adjacent property, roadside swales, subsurface storm systems, or any infiltration practices as determined by the Architect. Provide temporary sediment basins, traps, and filter bags for pumped water.
 7. Adjust, repair, replace, or clean all work, surfaces resulting from dewatering operations.
- I. Prepare subgrade in excavated areas to minimum density of 95% in structure, pavement, utility areas and 90% under lawn non-paved areas.
- J. Rock and Rock Excavation:
1. **Rock Definition:** Shall be defined as solid hard material located in ledges, bedded aggregate deposits and unstratified masses, and all-natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which must be removed by pneumatic hammers. Rock does not include shale, slate, soft sandstone, hardpan, masonry or concrete rubble, boulders less than three (3) cubic yards, such other rock material which is decomposed, stratified, weathered or shattered, or any material capable of being removed by a well maintained Caterpillar 225 power shovel, D8 Dozer with Ripper, or Architect approved equivalent.
 2. **Rock Excavation Administrative Procedures:** When encountered, shall be stockpiled for measurement before removal and paid for on a unit price basis in accordance with Contract Documents. Notify Architect immediately of rock discovery prior to performing any rock removal or continued excavation. Rock excavations as defined shall be measured each day and verified by the Owner's designated representative and the Contractor's on-site Superintendent. A daily written accounting, attested to by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. ***Contractor to assume ten (10) c.y. of rock excavation and removal in Base Bid.*** Unit price provided shall be utilized to add to or deduct from this assumed quantity to account for actual quantity encountered.
 3. **Rock Excavation Removal Procedures:** Includes removal and disposal of rock. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions.
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock

without forms or exterior waterproofing treatments.

- e. 8 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- 4. Any over excavation due to rock excavation and removal shall be handled as directed under "Over Excavation" in this Section.
 - 5. Contractor has the option to remove existing rock and dispose off-site or crush existing rock and use as satisfactory general earth fill when it meets gradation noted in 312201 for imported granular backfill material.

3.5 BACKFILL AND FILL

- A. Preparation of Ground Surface to Receive Fill: Remove vegetation, organic materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Break up and remove existing foundations, concrete slabs, abandoned utilities, and site features. Plow, strip, roughen, or break up slope's steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.
- B. Execute these steps when the existing ground surface, after removal of the above unsatisfactory materials, has a density less than that specified under "Compaction" for the particular area classification: Break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to the required depth and percentage of maximum density.
- C. In no case shall fill be placed on a subgrade that is wet, muddy, rutted, spongy, frozen or that contains frost.
- D. Areas to receive any fill or backfill should be properly prepared and reviewed by the Landscape Architect prior to the placement of fill.
- E. Place imported granular backfill, imported structural fill and satisfactory general earth fill material in layers not more than eight (8") inches in loose depth in a manner to minimize segregation. The fill shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift.
- F. Moisture Content: Contractor shall anticipate seasonal variations of all soil and fills moisture content in the Base Bid. The moisture content of the materials shall be adjusted prior to application of compaction such that it is no more than 1% below or 3% above the optimum moisture content of the material. Apply water to surface, subgrade or layers of soil material when required to achieve compaction densities stated below. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
- G. Compaction:
 - 1. Compact each eight (8") inch layer of fill and backfill materials.

2. Compact fill material below subgrade for structures, slabs, pavements, and utilities to minimum 95% of optimum in place density as determined by ASTM D1557, Modified Proctor.
 3. Compact fill material below subgrade for lawns or unpaved areas to minimum 90% of optimum in place density as determined by ASTM D1557, Modified Proctor.
- H. Equipment:
1. Use sheepsfoot rollers, pneumatic tired rollers, drum rollers, vibrating tampers, and other compaction equipment capable of obtaining the required density throughout the entire layer being compacted.
 2. Use power-driven hand tampers for compacting materials adjacent to site structures.
 3. For utility trenches or other confined areas, small compaction equipment may be necessary such as a vibratory plate, jumping jack or walk-behind vibratory roller. In these cases, lift heights no greater than six (6") inches should be maintained.
- I. Reconditioning Compacted Areas: Where previously completed compacted areas are disturbed by subsequent construction operations, traffic, or adverse weather, scarify, and dry out the surface, regrade, and recompact to the required density prior to further construction at no additional cost to the Owner. Use hand tamping for re-compaction over underground utilities.

3.6 FIELD QUALITY CONTROL

- A. Soil Testing Service must inspect and approve density tests, retesting, and proof rolling of subgrades, as described in this section, before further construction work is performed thereon.
- B. Perform compaction density testing on compacted fill and granular base course in accordance with ASTM D1556, ASTM D1557, ASTM D2922, and D3017.
- C. In place density testing should be performed at a frequency of one (1) test per 500 square feet per lift in open areas, and one (1) test per 25 feet per lift in confined areas and utility trenches.
- D. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content in the soil, to provide additional compaction and testing or otherwise to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace with new material at no additional cost to the Owner.
- E. Materials contaminated by mud, debris, organics and/or other deleterious materials shall be removed and replaced with uncontaminated specified material.

- F. No fill shall be placed over an area or lift of fill that has not be tested and achieved satisfactory results.
- G. Proof Rolling: On pavement subgrades, in cut areas only, unless otherwise directed by the Architect, the only testing required will be the proof rolling as described below:
 - 1. Provide Soil Testing Service with 48-hour advance notification when subgrades are ready to proof roll.
 - 2. Proof Roll the prepared pavement subgrade surface with fully loaded ten (10-c.y.) cubic yard earth moving truck. Check for unstable areas. Subgrades that rut, pump or deflect under the truck's tires may be judged unstable by the Landscape Architect. These areas may require further compaction or undercutting as directed by the Soil Testing Service or at the discretion of the Landscape Architect.

3.7 GUARANTEE

- A. Guarantee concrete slabs, pavements, curbs, walls, trenches, utilities, structures, lawns, and plant materials free from settlement for a period of one (1) year from the date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Landscape Architect, whichever is later.
- B. Repair to proper grade and alignment any and all settlement of concrete slabs, pavements, curbs, walls, trenches, utilities, structures, lawns, and plant materials adversely affected by settlement within one (1) year after date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Landscape Architect, whichever is later, at no additional expense to the Owner. In damaged compacted areas, scarify the surface, re-shape, and compact to required density prior to further construction.
- C. All repairs/corrections shall be completed to the satisfaction of the Owner within seven (7) days of written notice by the Owner.

3.8 CLEAN UP

During the contract and at intervals as directed by the Landscape Architect and as earthwork is completed, clear the site of surplus earth, large surface stones, debris, tools, and equipment. Leave the site in a clean, safe, well-draining, and neat condition.

END OF SECTION 312201

SECTION 312501 - EROSION, SEDIMENT AND POLLUTION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide erosion, sediment and pollution controls as shown on the drawings and as directed by the Landscape Architect to significantly reduce runoff on downstream and neighboring properties. This includes temporary control measures to mitigate land disruption by other Contractors during construction of this project.
- B. Erosion, sediment and pollution control includes, but is not limited to, the following:
 - 1. Storm structure protection
 - 2. Silt fence
 - 3. Temporary concrete washout facility
 - 4. Lawn Restoration
 - 5. Spill prevention, reporting and documentation
 - 6. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312201 - Site Earthwork
- C. Section 329201 – Seeded & Sodded Lawns
- D. Section 334001 - Storm Drainage

1.3 REFERENCES

- A. Spill Guidelines Manual (SGM) New York State Dept. of Environmental Conservation.
- B. New York State Standards and Specifications for Erosion and Sediment Control, dated July 2016 or latest edition.

1.4 SUBMITTALS: (See Section 311201, 1.5)

- A. Manufacturer's Data (MPD) are required for:
 - 1. Filter Fabric for Storm Structure Protection
 - 2. Silt Fence with Net Backing
 - 3. Fiber Roll
 - 4. Spill Response Equipment
- B. Material Certificates (MC) showing content/mechanical analysis and Samples are required for:

1. Seeding & Sodding: (See Section 329201)

C. Listing of emergency contract numbers. This list shall include the name of an Emergency Response Contractor that may be used in certain situations.

1.5 QUALITY ASSURANCE

A. Perform erosion, sediment and pollution control in compliance with applicable requirements of the New York Standards and Specifications Erosion and Sediment Control Manual, dated July 2016 (or latest edition) or other governing authorities having jurisdiction.

B. It is the Site Contractor's responsibility to prevent stormwater pollution from running offsite. All pollution control work related to the site contract shall be included in the Base Bid. All pollution control work related to other contracts shall be on a time and material basis and backcharged to the responsible party.

C. In the event of a chemical or hazardous spill or release, the individual(s) who caused the spill is responsible for prompt and proper clean-up. If the spill requires cleanup procedures beyond the means of the Contractor, an emergency spill cleanup Subcontractor shall be hired by the Contractor. They shall be utilized when the Contractor does not have the appropriate training, equipment or materials to cleanup the area safely and effectively. This shall be done at no additional cost to the Owner. Any testing and cleanup required post cleanup shall be provided by the Contractor at no additional cost to the Owner.

1.6 JOB CONDITIONS

A. Job conditions in Sections 311201, 312201, 329201 and 334001 apply.

B. Contractor will take all necessary precautions to avoid allowing dust generation that violates NYSDEC regulations and compromises compliance with governing authorities air monitoring plan.

1.7 INSPECTIONS AND MAINTENANCE

A. The Landscape Architect or qualified personnel of the Operator shall inspect disturbed areas of the construction site at least once per week. Special attention will be focused on areas not finally stabilized, structural control measures, point discharge (outlets) and locations where vehicles enter or exit the site. Disturbed areas will be inspected for pollutants entering the drainage system. Structural control measures will be reviewed for effectiveness in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site will be inspected for evidence of off-site sediment tracking.

B. The Contractor shall provide timely maintenance of vegetation erosion and sediment control measures, and other protective measures, during construction. Corrective measures must be performed within one (1) calendar day of the Landscape Architect's or Operator's (Owner's) report. Failure by the Contractor to perform corrective work within

this schedule automatically authorizes the Operator to hire others and back-charge this Contractor. The Landscape Architect or Operator will send a letter or email correspondence one (1) calendar day before hiring others and backcharging this Contractor.

- C. The Contractor shall conduct daily inspections of the equipment staging and maintenance, fueling, hazardous waste staging and waste storage areas to ensure that spill control measures are in place. Stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored on site.
- D. The Operator (Owner) shall provide long term maintenance of the storm water facilities after the site is finally stabilized.

1.8 SPILL PREVENTION, REPORTING AND DOCUMENTATION

- A. To minimize the potential for discharge to the environment of oils, petroleum, or other hazardous substances, the following requirements shall apply:
 - 1. All oil, petroleum, or hazardous materials stored or temporarily relocated on site during the construction process shall be stored in a way to provide protection from vehicular damage and to provide containment of leaks or spills. Temporary berms, dikes, storage basins, or similar methods shall be employed as appropriate on site.
 - 2. Maintain file of Material Safety Data Sheets (MSDSs) or other references for recommended spill clean-up methods and materials.
 - 3. Keep spill response equipment readily accessible.
- B. In the event of a spill contact the Construction Manager, Owner (Operator), and Landscape Architect. The Contractor shall also notify all other Contractors working around the area of the spill.
- C. If spilled material has entered any sanitary/storm sewer system then contact the municipality or agency with jurisdiction over the system, in addition to those listed in this section.
- D. The contractor shall be responsible for the initiation of spill reporting and documentation procedures. All petroleum spills must be reported to NYSDEC Spill Hotline at 1-800-457-7362, less than two (2) hours following discovery. All petroleum spills must be reported to NYSDEC unless all of the following apply:

Criteria	Description
Quantity	Must be known to be less than 5 gallons.
Containment	Must be contained on an impervious surface or within an impervious structure. No access to the environment.
Control	Must be under control and not reach a drain or leave the impervious surface.
Cleanup	Must be cleaned-up within two (2) hours of occurrence.
Environment	Must not have already entered into soil or groundwater or onto surface water.

- E. A release of a “reportable quantity”¹ or unknown amount of a hazardous substance must also be immediately reported to the NYSDEC Spill Hotline. Spills of reportable quantities of chemicals or “harmful quantities”² of oil to navigable waters must be reported to the federal National Response Center, 1-800-424-8802 or 1-202-426-2675.

¹ *Reportable Quantity*: Refers to the quantity of a hazardous substance or oil that triggers reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) (USEPA, September 1992).

² *Harmful Quantity*: Includes discharges that violate applicable water quality standards, cause a film, sheen, or discoloration on a water surface or adjoining shoreline; or cause a sludge or emulsion to be deposited beneath the water surface or shoreline (40 CFR 110.3).

PART 2 - PRODUCTS

2.1 STORM STRUCTURE PROTECTION

- A. Shall be commercially manufactured, needle-punched, non-woven geotextile, comprised of polypropylene fibers. Standard of quality shall be Mirafi 140N as manufactured by Tencate/Mirafi Group, www.tencate.com, or Architect approved equal.

- B. Stakes: Shall be square, non pressure treated hardwood. Size as detailed.

OR

- C. Fiber Roll/ Straw Wattle, (refer to 2.5)

2.2 SILT FENCE

- A. Shall be a woven polypropylene geotextile comprised of UV stabilized polypropylene slit film and 1.25" square, non pressure treated, pointed, hardwood posts and net mesh backing for additional support. Standard of quality for silt fence shall be IVI-3611MW as manufactured by Indian Valley Industries, Inc., www.iviindustries.com, (607) 729-5111, or Architect approved equal.

2.3 TEMPORARY CONCRETE WASHOUT FACILITY

- A. Concrete washout facility to fully contain all concrete washout needs of the entire project and all contracts.
- B. Concrete washout facility shall be temporary straw bales that are lined with a single sheet of a minimum of 10 mil polyethylene sheeting that extends over the entire basin to prevent escape of discharge. Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to inclement weather to prevent accumulation and overflow of precipitation.
- C. Provide concrete washout to prevent discharge from concrete trucks or equipment cleaning to inlets, surface or groundwater.
- D. Concrete washout facility shall be no closer than 50 feet from environmentally sensitive areas such as waterbodies, wetlands, and open drainage facilities and watercourses. Signs shall designate concrete washout facilities.

- E. Ensure that the concrete washout facility complies with all Federal, State and local laws, rules, and regulations. Ensure that the concrete washout facility is in place before delivery of concrete to site.
- F. Provide a sign identifying area as "Concrete Washout" acceptable to the Architect. Maintain throughout the project duration.

2.4 SEEDING AND SODDING

Seeding and Sodding shall be as specified in Section 329201.

2.5 FIBER ROLL

- A. Shall be a pre-manufactured cylindrical log of coconut fibers, straw, wheat or rice encased in a netting of biodegradable jute, nylon or burlap. Rolls shall be between 8"-10" in diameter, 25' in length and shall weigh at least 1.8 pounds per linear foot. The netting shall be secured tightly at each end of the rolls.
- B. Standard of quality shall be Photodegradable Fiber Rolls as manufactured by American Fiber Rolls (866) 446-2594 or equal.

2.6 SPILL RESPONSE EQUIPMENT

- A. The following is a list of recommended spill control material. The contractor is responsible to have spill control and personnel protective equipment readily available for the materials being used. Acquire sufficient quantities and types of appropriate spill control materials needed to contain any spills that can be reasonably anticipated. The need for equipment to disperse, collect and contain spill control materials should be on site at all times.
 - 1. Personal Protective Equipment
 - a. Chemical Splash Goggles
 - b. Gloves
 - c. Boot Covers
 - d. Tyvek Aprons or Suits
 - 2. Absorption Materials
 - a. Spill Pillows and Socks
 - b. Absorbent Booms and Pads
 - c. Dikes for use on rough surfaces
 - d. Storm Structure Covers
 - e. "Loose" Absorbents
 - 3. Tools
 - a. Shovel, Broom, Brush
 - b. Disposal Bags
 - c. Sealing Tape
 - d. Hazardous Waste Stickers
 - e. "Danger" and "Keep Away" Signs
 - f. Five-gallon pails or 20-gallon drums with polyethylene liners

- B. Basis of Design shall be provided by 3M, 888-364-3577; New Pig Corporation, 800-468-4647; SpillKits911, 800-474-5911; Dawg, Inc., 800-935-3294; or Architect approved equal.
- C. Place spill response equipment in a readily assessable location within or immediately adjacent to the project site.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. Between the Pre-Construction Meeting and starting site work, the Contractor shall:
 - 1. Review inspection and maintenance procedures.
 - 2. Designate specific Owner and Contractor personnel responsible for daily inspection and maintenance.

3.2 GENERAL EROSION CONTROL

- A. Install initial construction erosion control features, as indicated on drawings and specifications or as directed by the Landscape Architect, prior to topsoil stripping, earthwork, and removal of existing vegetation. Keep the disturbance to a minimum and shall not exceed five (5) acres, unless directed by the Architect. Install other features as described in the sequence of erosion, sediment and pollution control on the drawings.
- B. Start permanent seeding within seven (7) calendar days of rough grading. When this is not possible, provide temporary seeding of 100% perennial rye grass at the rate of six pounds (6#) seed per one thousand (1,000 sf) square feet. Provide temporary seeding within seven (7) days on non-roof, non-paved areas. When adverse weather conditions prevent good germination, repeat seeding as directed by the Landscape Architect until the area is stabilized. Till under temporary grass and fine grade when preparing for final permanent lawn stabilization.
- C. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a nonerosive velocity.
- D. Do not store fill materials within one hundred (100) feet of the banks of any streams or waterbodies, intermittent or perennial.
- E. Inspect erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.
- F. Remove sediment deposits when they reach approximately one-half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.
- G. Provide prompt (weekly) removal and disposal of rubbish and debris in accordance with the governing authorities, Owner policies, and good housekeeping measures.

3.3 MUNICIPAL SEWER, SWALES AND WETLAND EROSION CONTROL

Control erosion, siltation and pollution to municipal sewers, swales and wetlands by taking appropriate measures such as, but not limited to, the following:

- A. Do not disturb the bed and banks of waterbodies unless specifically shown on drawings. When bed and bank work is shown, obtain permits and proceed with work creating the minimum disturbance necessary to complete the project.
- B. Prevent petroleum products and excessive amounts of silt, clay, and muck from entering municipal sewers, waters, swales or wetlands of New York State during construction.
- C. Prevent fresh concrete, concrete leachate, and washings from equipment and trucks, from entering municipal sewers, waters, swales or wetlands of New York State during construction.
- D. Place silt fence to control erosion at the downslope edge of disturbed areas. This barrier to sediments is to be put in place before disturbance of the ground occurs and is to be maintained in good condition until disturbed land is heavily vegetated or otherwise permanently stabilized.
- E. Seed areas of soil disturbance resulting from this project with appropriate perennial grass seed and mulched with straw within seven (7) calendar days as described in general erosion control. Mulch shall be maintained until a suitable vegetative ground cover is established and as directed by the Architect.

3.4 CONSTRUCTION SITE DUST CONTROL

- A. The Contractor shall prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety issues.
- B. Dust control applies to construction roads, access points, other disturbed areas and stockpiles subject to surface dust movement and dust blowing.
- C. Contractor may use any number and combination of dust control methods, as approved by the Architect. They include:
 - 1. Applying water to haul roads
 - 2. Restricting vehicle speeds to 10 mph
 - 3. Hauling materials in properly tarped or watertight containers.
 - 4. Covering stockpiles and materials
 - 5. Wetting equipment and work area
 - 6. Mulching
 - 7. Spray adhesives and polymer additives (MSDS sheets required)
 - 8. Barriers and wind breaks
- D. Contractor is responsible for any cleanup and site restoration associated with dust control measures, dust pollution on or off the project site property at no additional cost to the Owner.

3.5 STORM STRUCTURE PROTECTION (IN LAWN AREAS)

- A. Cut fabric from a continuous roll to eliminate joints. If joints are needed, they will be overlapped to the next stake.
- B. Space stakes evenly around inlet 3 feet apart and drive a minimum 18 inches deep. Spans greater than 3 feet may be bridged with the use of wire mesh behind the filter fabric for support.
- C. Fabric shall be embedded 1-foot minimum below ground and backfilled. It shall be securely fastened to the stakes and frame.
- D. A 2" x 4" wood frame shall be completed around the crest of the fabric for overflow stability.
- E. Wrapping the storm structure grate with fabric is NOT acceptable, however straw bale dikes may be used in lieu of filter fabric.

3.6 STORM STRUCTURE PROTECTION (IN DISTURBED PAVED AREAS)

- A. Install fiber rolls/ wattles around storm inlets structures. Secure roll to grate.

3.7 SILT FENCE

- A. Locate as shown on drawings and as directed by the Architect. Excavate trench along the lower perimeter(s) of site, along the contract limit line, and as indicated on the drawings. Place excavated material on uphill side of trench for backfilling.
- B. Drive stakes securely into the downhill side of the trench. When prefabricated silt fence with fabric attached to stakes is used, drive stakes so that fabric is buried in the ground as detailed.
- C. Backfill trench with excavated material, so that fabric is securely buried in the ground to prevent undermining. Tamp soil.
- D. Join sections by overlapping fabric between two (2) stakes. Set stakes simultaneously. Overlap by minimum six (6") inches, fold, and staple to prevent sediment bypass.
- E. Attach silt fence securely to stakes spaced no more than eight (8' o.c.) feet on center. Secure fence fabric to stake with minimum three one (1") inch staple.
- F. Toward the end of the project, when site is stabilized and as directed by the Architect, remove silt fence and correct lawn area around removal to a smooth, neat, well-draining condition.

3.8 TEMPORARY CONCRETE WASHOUT FACILITY

- A. Install per detail in a location as approved by the Owner. Provide a stable surface, easily accessible by concrete trucks.
- B. A sign shall be installed adjacent to each washout facility to inform concrete equipment operations to utilize the proper facilities. The sign shall be installed as detailed and maintained throughout the project.

- C. Temporary concrete washout facility shall be constructed and maintained in sufficient quantity and size to contain all liquids and concrete waste generated by washout operations for the entire project and by all Contracts.
- D. Perform washout of concrete mixers, delivery trucks, and other delivery systems in designated areas only.
- E. Wash concrete only from mixer chutes into approved concrete washout facility.
- F. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material. Liner seams shall be installed in accordance with manufacturers' recommendations.
- G. Contents of the concrete washout facility shall not exceed 50% capacity of the facility. At or before 50% capacity is reached, discontinue pouring concrete until the facility is cleaned out. Remove hardened concrete and properly dispose off site. Allow slurry to evaporate or remove from site and dispose off site. Immediately replace the liner if it gets damaged.
- H. Remove concrete washout facility when it is no longer needed as directed by the Architect.

3.9 PERMANENT SEEDING AND SODDING

- A. Install as described in Section 329201.

3.10 SPILL RESPONSE EQUIPMENT

Use per manufacturer's recommendations and as directed by the NYSDEC, or other governing agencies.

3.11 CLEAN UP

- A. During the contract and at intervals as directed by the Landscape Architect and as erosion, sediment and pollution control procedures are completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 312501

SECTION 321201 - ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of asphalt paving is shown on the drawings.
- B. Asphalt Paving work includes, but is not limited to, the following:
 - 1. Soil Stabilization Fabric
 - 2. Granular Base Course
 - 3. Asphaltic Concrete Paving and Patching
 - 4. Hot Pour Crack Sealing and Filling
 - 5. Painted Lines and Pavement Markings
 - 6. Field Quality Control
 - 7. Clean up
- C. Provide all materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.
- D. Work in Public Right-of-Way: Meet all codes, standards and procedural requirements of the municipality or agency having jurisdiction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312201 - Site Earthwork

1.3 REFERENCES

- A. The latest editions of the following Standards, as referenced herein, shall be applicable:
 - 1. New York State Department of Transportation Standard Specifications, Section 402 - "Hot Mix Asphalt (HMA) Pavements" and 407 - "Bituminous Tack Coat"
 - 2. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
 - 3. American Sports Builders Association (ASBA) Asphalt Guidelines, latest edition
- B. The following reference standards shall apply for Testing and Inspection:
 - 1. ASTM D1074: Standard Test Method for Compressive Strength of Bituminous Mixtures
 - 2. ASTM D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Mixtures Using Paraffin-Coated Specimens.
 - 3. ASTM D2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

4. ASTM D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-absorptive
 5. Compacted Bituminous Mixtures
 6. ASTM D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
 7. ASTM D3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
 8. ASTM D3549: Standard Test Methods for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
 9. NYSDOT Materials Method 28 Friction Aggregate Control and Test Procedures
- C. The following reference standards shall apply for pavement markings:
1. ASTM D93: D562, D711, D821, D1475, D1640, D2248, D2369, D3723, D3960, E70, G53.
 2. DOT Code of Federal Regulations, Hazardous Materials and Regulations Board, Reference 49CFR, ICC Regulations
 3. Federal Specification TT-P-115E, Type III (Type I if V.O.C. compliance)
- D. Additional testing required only if directed in writing by Architect due to asphalt installation and material issues:
1. ASTM D1560: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
 2. ASTM D4125: Standard Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method
 3. ASTM D5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
 4. ASTM D6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
 5. ASTM D7312: Standard Test Method for Determining the Pavement Shear Strain and Complex Shear Modulus of Asphalt Mixtures Using the Superpave Shear Tester

1.4 SUBMITTALS

- A. Provide Paving Contractor experience requirements, as outlined in "Quality Assurance" of this specification section, for the following:
1. General Paving
- B. Provide Asphalt Producer Vendor Certificate and proof of quality control monitoring as outlined in "Quality Assurance" of this specification section.
- C. Provide material certificates showing content/mechanical analysis for the following:
1. Asphaltic Concrete Mix Design:
 - a. Type/name of mix (less than 24 months old)

- b. Gradation analysis for all aggregates
 - c. Plot (0.45 power graph) of the final aggregate blend
 - d. Bulk specific gravity of all aggregates and final aggregate blend including worksheets for natural (virgin) as well as reclaimed asphalt pavement (RAP)
 - e. Grade of asphalt binder (PG) being used
 - f. Optimum percent asphalt binder (AC)
 - g. Mix air voids at optimum
 - h. Bulk specific gravity of mix at optimum
 - i. Theoretical maximum specific gravity of mix at optimum
 - j. Voids in the Mineral Aggregate (VMA) and Void Filled with Asphalt (VFA)
 - k. Dust to total asphalt binder (AC) ratio
 - l. All design data and associated design curves
2. Asphalt Tack Coat
- D. Provide Manufacturer's Product Data (MPD) for the following:
1. Soil Stabilization Fabric
 2. Hot Pour Crack Sealing and Filling
- E. Field Quality Control test reports as indicated in this specification section.
- F. Provide necessary work permit(s), insurance coverage or bond as required for work in the Public Right-of-Way.

1.5 QUALITY ASSURANCE

- A. Paving Contractor Experience Requirements:
1. General Paving/ Pavement Stripping: Contractor shall have the experience of at least five (5) years in business. Paving superintendent has a minimum of three (3) years' experience as a paving crew operating foreman.
- B. Asphalt Testing and Inspection Services:
1. The **Owner** will employ and pay for the services of an Independent Testing Agency to provide testing and inspections of asphalt pavements.
 2. The services and the information provided by the Testing Agency are provided for the sole benefit of the Owner. The information is provided to the Contractor for the sole purpose of being aware of what is being reported.
 3. The Contractor is solely responsible for assuring the work complies with the Contract Documents in all respects and may not rely on the testing agency for this or any other assurances. The Testing Agency and their representatives are not authorized to revoke, alter, relax, enlarge, or release any of the requirements of the Contract Documents, approve or accept any portion of the work, perform

or excuse any duties of the Contractor, or be involved in the scheduling of any work.

4. Asphalt paving materials and operations shall be tested and inspected as the work progresses. Failure by the Testing Agency to detect any defective work or material shall not in any way prevent later rejection (when such defect is discovered) nor shall it obligate the Owner for final acceptance.
- C. Asphalt producer shall monitor production according to the procedures of NYSDOT Material Method 28 Friction Aggregate Control and Test Procedures. Asphalt producer shall be a New York State approved/certified HMA (Hot Mix Asphalt) manufacturing facility.

1.6 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Atmospheric conditions for applying courses:
1. Hot mix asphalt shall generally arrive on the project site between 270°-300° F. (per asphalt producer recommendations).
 2. Place asphalt concrete wearing course or bituminous surface treatment only when atmospheric temperature is above 50 degrees F. and rising, and when asphalt binder course is thoroughly dry.
 3. Place binder course only when air temperature is above 45 degrees F. and rising and when asphalt base course or granular stone base course is thoroughly dry.
- C. Grade Control: Establish and maintain required lines and elevations.
- D. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. Obtain and pay for permits required by local authorities.
- E. Construction Review and Testing: Notify and coordinate with the Independent Testing Agency and Architect when the subgrade is shaped and ready for proof rolling. Also, when the granular base course is fully installed, compacted and ready for density testing. Protect subgrade and subbase at all times.
- F. When staging or scheduling delays occur and wearing course cannot be installed directly after binder course installation, or longer than 72 hours, the Contractor shall power wash surface and apply asphalt tack coat, as specified, prior to wearing course installation, at no additional cost to the Owner.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver all materials to the job site with all labels intact and legible at time of installation.

- B. Store materials off ground under cover. Protect from damage or deterioration.
- C. Handle materials to prevent damage to surface, edges, ends and factory applied finishes of items. Damaged material shall be rejected and replaced.

PART 2 - PRODUCTS

2.1 SOIL STABILIZATION FABRIC

- A. Shall be a heavy duty, commercially manufactured woven polypropylene geotextile. Standard of quality shall be Mirafi 500X, manufactured by TenCate or Architect approved equal.

2.2 GRANULAR BASE COURSE

- A. Shall be as specified in Section 312201.
- B. The graded and designed granular base below all new Asphaltic Concrete Pavements shall be constructed, tested, and prepared in accordance with Section 312201 - Site Earthwork of the Contract Documents.

2.3 ASPHALTIC CONCRETE

- A. Paving shall consist of :
 1. Medium Duty (auto driveways, parking spaces or street patching) pavement shall be as indicated on the plans.
 2. Light Duty (sidewalks) pavement shall be as indicated on the plans.
 3. Municipal Road Work (asphalt patching within the Right-of-Way), meet code requires of municipality having jurisdiction.
- B. Hot Mix Asphalt Top Course: Pavement shall meet the minimum requirements for 9.5 mm (Type 7) Hot Mix Asphalt Top Course (75 gyrations), with a PG 64-22 Binder as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 15% of the total mix.
- C. Hot Mix Asphalt Binder Course: Pavement shall meet the minimum requirements of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.
- D. The coarse aggregate used in HMA shall be sound, angular crushed stone or crushed gravel. The fine aggregate shall be well graded, moderately sharp to sharp (angular) sands. No aggregates known to cause rust spots or pop-outs (steel slag, iron pyrite, and / or dust balls) are allowed in the asphalt.

- E. No pyrite or steel slag aggregates are to be within the Reclaimed Asphalt Pavement (RAP) being utilized for any of the courses above.
- F. No recycled concrete is allowed in any of the asphalt mixtures.

2.4 BITUMINOUS TACK COAT

- A. Material shall consist of an asphalt emulsion, Grade RS-1h, and shall meet the minimum requirements of Section 407, of the current NYSDOT Standard Specifications. Bituminous Tack Coat shall be installed over all new and existing concrete and asphalt pavements and structures prior to the installation of new Hot Mix Asphalt materials. The following application rates shall apply:
 - 1. New Hot Mix Asphalt 0.05-0.07 gal/sy
 - 2. Milled Surfaces of Existing Asphalt 0.10-0.15 gal/sy
 - 3. Abutting Vertical Edges (drainage structures, appurtenances) 0.05-0.07 gal/sy
 - 4. All Styles of Curbs and Gutters 0.05-0.07 gal/sy
 - 5. Delayed asphalt installation of HMA Courses 0.10-0.15 gal/sy

2.5 HOT POUR CRACK SEALING AND FILLING

- A. Single component, hot applied asphalt crack and joint sealant capable of withstanding temperatures of up to 450° without experiencing polymer degradation.
- B. Shall be supplied in solid blocks comprised of heat stabilized polymers and asphalt.
- C. Meeting the following material requirements when tested in accordance with ASTM D5329. (see chart below)

Chemical & Physical Analysis

Recommended Application Temperature	350-400°F
Maximum Heating Temperature	450°F
Cone Penetration at 25°C	50 max.
Flow at 60°C, mm	0.
Softening point	200°F Min.
Flexibility 0°F	(1" Mandrel)-Pass
Specific Gravity	1.17
Asphalt Compatibility	Passes

- C. Standard or quality shall be Crack Master Supreme as manufactured by Thorworks Industries, Inc., 800-395-7325, www.thorworks.com or approved equal.

2.6 PAINTED LINES AND PAVEMENT MARKINGS

- A. The extent of the pavement markings shall match the extent, location and composition of pavement markings existing at the site prior to start of work where applicable.

- B. The work includes, but is not limited to the following: parking stall divider lines, wheelchair legends, “STOP” legends, “NO PARKING” legends, EV Legends, striping, and other pavement markings as may be shown on the plans.
- C. Provide ready-mixed, one component waterborne traffic line paint. Standard of quality shall be: Pro-Park® Waterborne Traffic Marking Paint B-97 Series as distributed through Sherwin-Williams, 800-474-3794; or Architect approved equal.
 - 1. Colors (as approved by the Owner in writing):
 - a. Yellow: 1 Gallon & 5 Gallon, Product Number B97YD2467
 - b. White: 1 Gallon & 5 Gallon, Product Number B97WD2434
 - c. Blue: 1 Gallon & 5 Gallon, Product Number B97LD2022
 - d. Black: 1 Gallon & 5 Gallon, Product Number B97BD2021
 - 2. Paints shall contain all necessary co-solvents, dispersants, wetting agents, preservatives and all other additives, so that paint shall retain viscosity. Halogenated solvents and glass beads shall not be permitted.
 - 3. Volatile Organic Compound (VOC) content shall not exceed 250 grams maximum per liter of paint as determined in accordance with ASTM D 3960 test, excluding water and exempt solvents.

PART 3 - EXECUTION

3.1 PREPARE SURFACE

- A. Prior to commencement of asphalt paving, all excavations, drainage, utilities, backfilling, fencing, bollards, storm structures, curbing installations, adjustments, proof-rolling and density test procedures shall be complete to the satisfaction of the Landscape Architect.
- B. Prior to commencement of tack coat and asphalt paving within pavement milled areas, as shown on the plans, all cracks and joints in the milled pavement surface shall be prepared and filled in accordance with the project specifications. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat.
- C. Saw cut, using straight and true lines, all existing asphalt pavements to remain in place with straight, neat edge for abutting against proposed asphalt pavement.
- D. Provide and confirm field quality control as described in Section 312201 for pavement subgrade and granular base course stone.

3.2 CONSTRUCT PAVEMENT GRANULAR BASE COURSE

- A. General: Consists of placing granular base course material, in layers of specified thickness, over prepared subgrade and fabric to support a pavement course.

- B. Grade Control: Provide engineering layout per Section 312201 and grade stakes. During construction, protect grade stakes; maintain lines and grades including crown and cross-slope of each course.
- C. Install soil stabilization fabric after subgrade has been acceptably compacted and proof rolled. Install soil stabilization fabric as recommended by the manufacturer AND;
 - 1. Lay fabric in direction of construction traffic.
 - 2. Overlap fabric side to side and end to end a minimum of two (2') feet.
 - 3. Establish reasonable compaction and rut stability before using heavy or vibratory compaction equipment.
- D. Placing:
 - 1. Place granular base material over soil stabilization fabric, on prepared subgrade in layers of uniform thickness, conforming to the asphalt pavement details on the drawings.
 - 2. Place granular base material in a maximum of six (6) inch layers and compact with a vibratory or 10-ton smooth wheeled roller.
- E. Provide density testing as described in Section 312201.
- F. Surface Smoothness: Test finished surface for smoothness. Surface will not be acceptable when it deviates more than 3/8" measured by a 10-foot straightedge, in any direction.
- G. The finished grade of the granular base course shall be verified to ensure that the final finished product of the bituminous concrete pavement surface will be installed to the lines and grades of the existing pavements and proposed elevations surveyed by the Contractor prior to the start of the paving work.

3.3 PLACE ASPHALT MIX

- A. General:
 - 1. The Contractor shall submit a paving plan, indicating intended direction of paving, number of pulls, etc. for approval prior to the start of paving operations.
 - 2. Joints: Saw cut vertical straight, neat edges for joints required. Joints shall be sharp and clean, conforming to shapes drawn on drawings. Ragged joints will not be accepted.
 - 3. Mill two (2') feet into surface of adjacent asphalt so joints do not line up.
 - 4. Place bituminous tack coat to all surfaces as indicated in this specification. When pavement surface temperature is above or below the 75-130 degrees F. range, the

grade of asphalt emulsion must be modified according to NYSDOT standards. Tack coat shall not be applied to a wet surface or when the pavement surface temperature is below 45 degrees F.

5. Place asphalt on approved prepared surface, spread and strike-off.
 6. Spread mixture at minimum temperature of 225-240 degrees F. Place inaccessible and small areas by hand. Hand work shall be minimized to ensure the best possible finished surface. Place each course to required grade, cross-section, and compacted thickness.
 7. Paving operations shall not be scheduled when ample time does not exist to place, compact, and finish roll the hot mix asphalt during daylight hours and prior to rainfall.
- B. Pavement Placing: Shall be installed in accordance with Section 402-“Hot Mix Asphalt (HMA) Pavements”, of the current NYSDOT Standard Specifications.
- C. Paving Equipment:
1. Must be capable of placing, spreading and finishing courses of HMA to the specified thickness.
 2. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging.
 3. Auger extensions are required while pavers are extended beyond the basic screed width.
 4. Paving equipment shall be self-propelled and capable of maintaining the line and grade shown on the plans with suitable electronic equipment. The screed shall be straight and true with no bow and utilizing a vibratory screed. Paving equipment should have fully functional screed heaters and joint preheaters.
- D. Asphaltic Concrete shall be installed as follows:
1. Medium Duty Asphalt Pavement: Installed in two (2) lifts consisting of 50.8mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by 38mm SUPERPAVE Hot Mix Asphalt Top Course.
 2. Light Duty Asphalt Pavement: Install one lift consisting of 76mm SUPERPAVE Hot Mix Asphalt Top Course.
- E. Place in strips not less than ten (10') feet wide, unless otherwise acceptable. In placing each succeeding pass after the placement of the initial pass, the screed of the paver shall be set such that it overlaps the preceding pass by 6" and be sufficiently high such that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material shall be removed.

- F. After first lift has been placed and rolled, place succeeding lifts and extend rolling to overlap previous lifts. Where possible, top course shall be placed at right angles to binder course and in the direction that the drainage flows. Where this is impractical, offset joints of the two courses by a minimum of two (2') feet so upper and lower joints do not align.

3.4 ROLL ASPHALT MIX

A. General:

1. Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project, with two rollers required as a minimum. (Three rollers shall be required when tonnage is greater than 300 tons/day.)
2. Rollers shall be of a good condition and capable of compacting the HMA to the minimum in-place density required by this specification. Compact asphalt with a nominal 10 ton steel wheel roller or pneumatic rubber tired roller. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
3. Begin rolling when mixture will bear roller weight without obvious or excessive displacement.

- B. Finish Rolling: Each lift of the Asphaltic Concrete Pavement shall be mechanically rolled and compacted to the finished thicknesses specified in the Contract Documents. The pavements shall be compacted to a minimum of 94%-97% of the materials theoretical density as determined by AASHTO Method T 209 and an air void percentage of 5%-6% maximum.

- C. Patching: Remove and replace paving areas mixed with foreign materials, dirt, and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

D. Joints:

1. The Contractor shall sequence the installation and orientation of all Asphaltic Concrete Pavements such that the minimum numbers of longitudinal and transverse joints are produced and in accordance with the approved Asphalt Placement Work Plan.
2. Neat, straight butt joints between successive passes.
3. When repairs or staging of work occurs, make neat vertical saw cut between old and new work to create butt joint. Heat joint prior to pouring. Cold joints are not acceptable.

4. Apply bituminous tack coat to all surfaces and rates indicated under "Bituminous Tack Coat" of this specification section. Tack coat shall not be required on abutting vertical edges for pavements placed in the same day.
 5. Minimize construction, longitudinal, and transverse joints left open for an extended period of time.
 6. Construct longitudinal joints by paving in a hot fashion with a temperature of not less than 220°F to ensure maximum performance and adhesion.
 7. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements of this specification.
 8. Cut straight and true (vertical construction or transverse joints if the material has cooled to less than 220°F prior to the placement of the next pass to ensure the best performing joint possible.
- F. Edges at lawn: Roll at 45 degrees as detailed, creating clean edge conforming to shapes indicated on the drawings. Ragged edges will not be accepted. Return and saw cut ragged edges at no additional cost to the Owner as directed by the Architect.
- G. The final finished grades of the new Bituminous Concrete Pavements must be smooth and true to the contours and shall be installed to the lines and grades of the site prior to start of construction. The final finished grades shall match adjacent pavement surfaces and concrete slabs, aprons, and doorways.
- H. Construction Delays (over 72 hours): When placement of the wearing course over the binder course is delayed over 72 hours, thoroughly clean existing surface of dirt, oil and other debris by pressure washing and sweeping. Place bituminous tack coat as specified in this section.

3.5 ASPHALT TOLERANCES

- A. Thickness and Density: Compact each asphalt course to produce the thickness indicated on the drawings within the following tolerances:

Binder Course: Plus or minus 1/4-inch
Wearing Course: Plus or minus 1/8-inch

- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined using a 10-foot straightedge applied transversely or longitudinally to paved areas:

Binder Course Surface: 1/4"
Wearing Course Surface: 1/8"

3.6 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency shall provide the following in the daily report at a minimum:
1. Verify the following for the asphalt mix design prior to asphalt placement:
 - a. The asphalt mix design has been approved.
 - b. The asphalt mix design specifies the minimum relative compaction and the methods required to determine maximum density.
 2. Verify the asphalt subgrade has been acceptably proof-rolled. (See Section 312201.)
 3. Inspect /test aggregate base course material for in-place density (95%) and thickness. Test materials for gradation classification, and physical properties. (See Section 312201.)
 4. Inspect/test asphalt wearing course material for compaction during placement and conduct thickness measurements during lay-down. Take temperature of the asphalt mixture and compare actual temperature with the approved asphalt mixture design range. As a minimum, perform the following inspection/tests:
 - a. Collect trip tickets from trucks delivered to the site and verify correct mix design being used for the project.
 - b. Temperature tests: one per truck.
 - c. Lay down thickness (uncompacted): one per strip or 500 square feet minimum
 - d. Verify equipment rolling pattern and passes to ensure proper compaction: one per day
 - e. Density test (daily lab density): one test per 5000 square feet minimum
 - f. Hot mix samples (laboratory testing for density per ASTM D1188): one per day
 - g. Thickness per ASTM D3549 and density samples per ASTM D2950 by a properly calibrated nuclear asphalt testing device. If there is a disagreement between tests done by ASTM D2950 and ASTM D1188, the values done by ASTM D1188 will govern: one test per 20,000 square feet (surface lift), one test per 10,000 square feet (base lift)
 - h. Air voids per ASTM D3203 or D2726: one test per 5000 square feet minimum
 - i. Verify compaction at the joints and seams. The completed paved surface to be true to grade and cross section. Verify smoothness by using an unlevelled 10-foot straightedge and ensuring no gap at any point between straightedge and pavement exceeds surface smoothness requirements above except at interception or at changes of grade.
 - j. The screed/lay down thickness tolerance shall be between 1/8 to 3/16 inches greater than the required asphalt minimum layer requirement. When screed depth is set for the exact thickness as specified, immediately notify the Owner's Representative and Contractor that the installed asphalt thickness may be deficient to achieve the specified

- minimum thickness. Identify areas of non-complying thickness and attach a drawing identifying the areas to the daily field report.
- k. Immediately notify the Owner's Representative and Contractor when paving is being conducted in cold weather and asphalt temperatures are below or above the design mix range.
 - l. Check the surface grades and drainage patterns. Identify on a drawing all paved areas that are holding water after asphalt placement and notify the Owner's Representative and Contractor. Small ponding areas (bird baths) larger than two (2') feet in any dimension are not acceptable. When this test proves that surface conditions are not acceptable, the Contractor will be responsible for correcting the problem areas. Install a one (1") inch shim coat of wearing course material, or other means acceptable to the Architect.
 - m. Verify tack coat and edge coat have been applied at the proper rate.
- B. Unacceptable Paving: Remove and replace unacceptable paving as directed by the Landscape Architect, immediately and without argument or delay. Correction of deficient areas in the wearing course shall be done by sawcutting and removal of defective area of work. Tack coat shall be applied to all edges and the pavement shall be replaced. Shimming or skin patching of the wearing course shall not be permitted. Correction of deficient areas within the binder course shall be corrected by sawcutting and milling high spots, and truing and leveling low spots or as directed by the Landscape Architect.

3.7 SURFACE PROTECTION

- A. Protection: After final rolling and sealing, do not permit any type of vehicular or construction traffic on pavement until it has cooled and hardened as recommended by the producer/manufacturer, minimum of 48 hours.
- B. Provide protection including, but not limited to, fencing, traffic cones, barrels, lights, reflective signs, flag persons and barricades until mixture has cooled and attained its maximum degree of hardness.

3.8 HOT POUR CRACK SEALING AND FILLING

- A. The crack must be free from moisture, dust, and loose aggregate. Routing or wire brushing are preferred methods followed by a compressed air heat lance immediately prior to sealing. The substrate and air temperature must be above 45°F.
- B. Shall be melted in direct fired or oil jacketed melters. Material should reach recommended pouring temperature of 350-400°F. Fresh material may be added as sealant is used.
- C. Apply heated crack filler using either a pump and wand system or a pour pot. For best results the sealant depth to width ratio should not exceed 2 to 1 (i.e. 2-inches deep to 1-inch wide). The cooled sealant height should not exceed 1/8" above surrounding

pavement. Using a sealing shoe or squeegee, band the material 2 to 3 inches wide over the crack.

3.9 PAINTED LINES AND PAVEMENT MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust. Remove dirt, oils and other foreign matter. All surfaces to receive pavement markings shall be clean and in good condition to accept pavement markings.
- B. Coordinate provisions for installation with work of other trades.
- C. Locate to alignment and dimensions as shown on drawings and/or approved by Owner.
- D. Painted markings shall meet regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by NYSDOT, Division of Traffic and Safety, Section 262.25 and figure PM-42; and they shall comply with the most recent version of the Americans with Disabilities Act Standards for Accessible Design.
- E. Protect: Adjacent surfaces and other items to remain with tape, drop cloths, or other Architect approved means.
- F. Application: Two coats according to manufacturer's recommendations resulting in a dense, opaque application without any ghosting of former pavement markings showing through. Over spraying along edges will not be accepted. Edges shall be sharp and crisp, to the shapes required by the drawings.
 - 1. First coat shall be installed at the recommended DFT (dry film thickness) after paving is in place. The second coat shall be applied at the recommended DFT no later than thirty (30) days after the completion of work.
 - 2. Apply paint materials using clean brushes, rollers or spraying equipment.
 - 3. Apply paint materials as a rate not exceeding those recommended by the paint manufacturer for surfaces being painted, less 10% of losses
 - 4. Comply with manufacturer's recommendations for drying time between coats. The minimum DFT must be met. Apply additional coats as needed to achieve minimum total specified DFT of the paint system.
 - 5. The minimum required total Dry Film Thickness (DFT): The DFT shall be the minimum required thickness as measured in mils.
 - 6. System coverage requirements minimum total thickness (unless otherwise noted):
 - a. 1st Coat – 3.0 mils
 - b. 2nd Coat – 6.0 mils
 - 7. Exterior Paint Systems: Provide the following paint systems as indicated: (Colors to be approved by Owner.)

- a. Parking stall, division and limit lines shall be 4" in width, true and straight. Color: White – DFT 6.0 mils
 - b. Pavement lettering "NO PARKING" shall be 2'-0" in height. Color: Yellow – DFT 6.0 mils
 - c. Stop legends shall be as detailed on drawings. Color: White – DFT 6.0 mils
 - d. Wheelchair legends shall be as detailed on the drawings. Color: Blue background with white symbols. Parking stall striping shall be Blue at handicap stalls only – DFT 6.0mils
 - e. Diagonal striping Handicapped. Color: Blue – DFT 6.0 mils
 - f. Directional signage shall be as detailed on the drawings. Color: White – DFT 6.0 mils
 - g. Electric vehicle charger legends shall be as detailed on the drawings. Color: Green background with white symbols and border – DFT 6.0mils
- G. Allow 48 hours minimum curing time for paint before allowing traffic on surfaces. Clean up thoroughly including all protective tape, spilled paint, and debris. All parking area marking and painting to be protected by appropriate traffic barriers, lighted if necessary, so located as to prohibit parking and traffic until traffic lines are completed and properly dry.

3.10 CLEAN UP

During the contract, and at intervals as directed by the Landscape Architect, and as asphalt paving is completed, clear the site of extraneous fabric, gravel, asphalt waste and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 321201

SECTION 321301 - SITE CONCRETE WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of site concrete work is shown on the drawings and includes concrete flatwork, reinforcement, placement, finishing, curing, testing and acceptance requirements for concrete.
- B. Site Concrete work includes, but is not limited to, the following:
 - 1. Concrete walks and curb ramps
 - 2. Concrete footings, bases, foundations, granite curb backing
 - 3. Concrete cradles, saddles, collars and thrust blocks (*if required*)
 - 4. Light pole bases (*precast pole base or cast-in-place option*)
 - 5. Concrete scheduling
 - 6. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 260010 - General Electrical Provisions

1.3 REFERENCES

- A. ACI 301-96 - Specifications of Structural Concrete for Buildings
- B. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
- C. ASTM C31 - Standard Practice for Making and Curing Test Specimens in the Field
- D. ASTM C33 - Concrete Aggregate
- E. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- F. ASTM C94 - Ready-Mixed Concrete
- G. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars
- H. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete
- I. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)

- J. ASTM C150 - Portland Cement
- K. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
- L. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method
- M. ASTM C260 - Air Entraining Admixtures for Concrete
- N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
- O. ACI 315 - Details and Detailing Concrete Reinforcement

1.4 SUBMITTALS: (See Section 311201, 1.5)

- A. Shop Drawings
 - 1. Light pole bases (cast-in-place type)
- B. Manufacturers Product Data (MPD) and Samples where indicated are required for the following:
 - 1. Water Based Curing Compound
 - 2. Cold Weather Admixture
 - 3. Hot Weather Admixture
 - 4. Air Entrainment
 - 5. Form Release
 - 6. Detectable waring system (cast iron)
- C. Submit proposed 4,000 psi concrete mix design and test data in accordance with ACI 301 to the Architect for review prior to commencement of the work.
 - 1. Indicate the locations and elements for which the mix will be used.
 - 2. Include in the concrete mix design all required or proposed admixtures necessary to facilitate the installation of the concrete by the means and methods selected by Contractor for this project.
- D. Mill test certificates and/or test reports for cement indicating compliance with these specifications.

1.5 QUALITY ASSURANCE

- A. Concrete Testing Services: The **Owner** shall employ an acceptable independent testing laboratory to perform materials evaluation, testing of concrete mixes, and quality control testing. Coordinate day to day scheduling with the testing agency. Field technician shall be ACI Certified Grade 1 Field Technician.
- B. Construct and erect concrete formwork in accordance with ACI 301 and 347.
- C. Perform concrete reinforcing work in accordance with ACI 301.

- D. Perform cast-in-place concrete work in accordance with ACI 301.
- E. Conform to New York State Building Code.
- F. Field quality control tests are specified in Part 3 - Execution.

1.6 JOB CONDITIONS

- A. Job conditions in Section 312201 apply. Provide ample and skilled manpower for concrete installation which is a recognized time sensitive procedure.
- B. All concrete work shall conform to American Concrete Institute (ACI) 304R-00 "Guide for Measuring, Mixing, Transporting and Placing Concrete".
- C. Do not install concrete work when the temperature of the outside air is below 50 degrees F. and falling unless suitable means acceptable to the Landscape Architect are provided to protect work from cold and frost and ensure that mortar and concrete will cure without freezing as indicated in "Cold Weather Concreting" below.
- D. Cold Weather Concreting: Provide non-chloride accelerating water reducing admixture in site concrete work placed at ambient air temperatures below 50 degrees F. (10 degrees C.). Comply with International Masonry Industry All-Weather Council cold weather construction and protecting recommendations and American Concrete Institute 306R-10 "Guide to Cold Weather Concreting."
- E. Hot Weather: Provide water reducing retarding admixture in site concrete work placed at ambient air temperatures above 80° F. Comply with American Concrete Institute 305R-10 "Guide to Hot Weather Concreting."
- F. Construction Review: Notify the Landscape Architect when stairs, foundations, walks, and pads are formed and ready to receive concrete. Radius form layout shall be inspected and approved by the Architect.
- G. Schedule: Unless otherwise directed in writing by the Architect, construct site concrete work from April 1 to October 15. This permits a minimum 30-day dry curing period prior to possible application of deicing chemicals by the Owner. Obtain written approval from Landscape Architect to conduct cold weather concrete work scheduled after October 15.
- H. Site concrete work performed between October 16 and March 30 will require cold weather concrete practices and protections at no additional cost to the Owner, (including concrete admixtures and/or thermal blankets).

1.7 ADA REQUIREMENTS

- A. GENERAL: Concrete work shall comply with the Americans with Disabilities Act as described in the 2010 ADA Standards issued by the Department of Justice (DOJ) and the Department of Transportation (DOT) or latest edition, shall be used.

- B. Concrete walk surfaces shall be flush and free of abrupt changes.
- C. Walkways shall have a maximum 2% cross-pitch.
- D. Curb ramps shall not exceed 1:12 transition slopes.

PART 2 - PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Forms: Either steel or wood, exterior type softwood, PS1, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects, extending the full depth of concrete. Concrete walks which require radius form work shall be set with flexible forms, conforming to the shapes and dimensions as indicated.
- B. Lumber: PS 20.
- C. Form Release Agent: Shall be non-staining and non-residual. Approved manufacturers: Increte Wall Form Release, Sakete Form Release Oil, Kleen Kote Release Agent or Landscape Architect approved equal.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish, free of rust and/or oxidation. Reinforcing bars shall be bundled and tagged with grades and suitable identification markings, shall be waterproof, and shall not be removed until steel is placed.
- B. Steel Welded Wire Reinforcement ASTM A185, plain type:
 - 1. Flat Sheets
 - 2. Mesh size: 6 x 6 (standard W1.4 x W1.4, heavy duty W2.1 x W2.1)
 - 3. Free of rust and/or oxidation
- C. Reinforcement Accessories:
 - 1. Tie Wire: FS QQ- W-461 G, annealed steel, back, 16-gage minimum.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. They shall provide sufficient supports at close enough spacing so that the steel will carry the weight of the workmen and the fresh concrete without deformation from its specified location.
- D. Fabricate concrete reinforcing in accordance with ACI 315.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type 1 or Type II, Portland type.

- B. Aggregates (ASTM C33):
 - 1. Fine aggregates: clean, sharp, natural sand.
 - 2. Coarse Aggregates: 3/4" maximum size stone meeting the requirements of New York State Department of Transportation Specification 703.02.
- C. Water: Clean and not detrimental to concrete.

2.4 ADMIXTURES

- A. Calcium Chloride in concrete is prohibited.
- B. Air Entrainment Admixture: ASTM C260, Darex AEA ED or Architect approved equal.
- C. Water Reducing Admixture: ASTM C494, Type A; not containing more chloride ions than are present in municipal drinking water.
- D. High Range Water Reducing Admixture: ASTM C494, Type F or G; not containing more chloride ions than are present in municipal drinking water.
- E. Cold Weather Accelerating Admixture: (Ambient temperature below 50°F.) Non-chloride water reducing accelerating admixture, ASTM C494, Type C, PolarSet as manufactured by WR Grace & Co. or Architect approved equal. Mix at rates recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.
- F. Hot Weather Water Reducing and Retarding Admixture: (Ambient temperature above 80° F.) Shall be Daratard series admixture, ASTM C494, Type D, as manufactured by WR Grace & Co. or Architect approved equal. Mix at a rate recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

2.5 COMPOUNDS, HARDENERS, AND SEALERS

- A. Water Based Curing Compound: ASTM C309, Type 1, clear or translucent. Standard of quality shall be Kure-N-Seal as manufactured by Sonneborn or Architect approved equal. (two applications).

2.6 CONCRETE MIX

- A. Mix and deliver ready-mix concrete in accordance with ASTM C94.
- B. Concrete:
 - 1. Compressive Strength (Minimum at 28 days): 4,000 psi
 - 2. Slump (Maximum): 2 to 4 inches
 - 3. Air Entrainment: 5-8.5%

4. Flexural Strength (ASTM C78): 650 psi at 28 days.
- C. Use water-reducing admixture in all concrete.
- D. Water/Cement Ratio: Maximum 0.42 for 4,000 psi concrete.
- E. Cement Factor Per Cubic yard: Minimum 560 lbs. for 4,000 psi concrete.
 1. Substitution of fly ash for cement is prohibited.
- F. Maximum Size of Coarse Aggregate: Per ACI 301, 3/4" maximum.
- G. Select admixture proportions for normal weight concrete in accordance with ACI 301.
- H. Add air-entraining agent to concrete mix for all concrete work exposed to exterior.

2.7 MIXING WATER CONTROL

- A. The quantity of mixing water used in the concrete mix shall be determined by the Contractor, except that the Architect/Geotechnical Engineer may direct that such quantity of water be reduced if the slump of the concrete exceeds the specified slump. The Contractor's determination of the quantity of mixing water shall conform to the various limits on water/cement ration and slump specified. Concrete consistency shall be uniform from batch to batch.
- B. During the course of the work, the batch plant will make quantitative measured moisture determinations of the aggregates utilized in each batch. Aggregate weights and batch water requirements shall be adjusted accordingly for measured aggregate moisture content.
- C. When concrete is transported in units approved for mixing, the addition of not more than 10% of the total design water will be permitted at the job site to obtain initial slump.
 1. Any addition of water shall be followed by mixing of at least 30 revolutions in the mixing speed range.
 2. No more than two additions of water at the point of deposition before discharge shall be allowed.

2.8 DETECTABLE WARNING SYSTEM

- A. Cast in place iron detectable warning plates (**cast iron**), with raised detectable/tactile domes. Units shall be interlocking or concealed bolted to provide varying lengths, ADA compliant. Standard of quality shall be East Jordan Iron Works, Inc., Cast Iron Detectable Warning Plates, (800) 626-4653, www.ejiw.com or Architect approved equal.
- B. Finish: Natural Patina providing visual contrast.

- C. Guarantee period shall be five (5) years from substantial completion including defective work, breakage, deformation, heave, and loosening plates.

PART 3 - EXECUTION

3.1 CONCRETE WALKS, SLABS, or PADS

- A. Surface Preparation: Remove loose material from the compacted subgrade surface immediately before placing concrete. Remove any standing water, mud, debris, frost, snow, ice from surfaces upon or against which concrete is to be placed.
- B. Proof-roll prepared subgrade surface to check for unstable areas and the need for additional compaction. Do not begin concrete pour until such conditions have been corrected, subgrade is compacted to 95% and ready to receive concrete.
- C. Form Construction: Construct to required size and shape. Brace and secure to maintain alignment, elevation and position. Check completed formwork for grade and alignment, prior to installing concrete. Clean forms as needed to remove foreign matter.
- D. Install welded wire mesh on concrete brick or mesh chairs to proper level in maximum lengths possible. Offset end laps in both directions. Splice laps with tie wire. Lifting mesh after concrete pouring is not acceptable.
- E. Prepare concrete mixture including the following:
 - 1. Add hot weather or cold weather admixture to accommodate field weather conditions.
- F. Concrete Testing: Will be performed as described in Part 3, "Field Quality Control" of this specification section.
- G. Conveying:
 - 1. Convey concrete by means that will prevent segregation and loss of mortar from the mix.
 - 2. Provide adequate manpower and equipment in the form of buckets, buggies, chutes, conveyors or other approved means to assure continuous operation.
 - 3. Convey concrete so that no equipment with aluminum parts comes in contact with fresh concrete.
- H. Concrete Placement: Do not place concrete until subgrade and forms have been checked for line and grade. Moisten granular base course as required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they have been brought to the required finish grade, alignment, and expansion joints have been installed.
- I. Spread concrete as soon as it is deposited on the granular base course, using methods which prevent segregation of the mix, and with as little rehandling as possible.

Consolidate concrete along the face of forms. Consolidate with care to prevent dislocation of mesh, reinforcing and joint materials.

K. Concrete Finishing:

1. Perform concrete finishing using machine or hand methods as required.
2. After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
3. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous, smooth finish.
4. Work edges of slabs and joints with a 1/8" radius edging tool, two (2") wide, unless otherwise shown.
5. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows.
6. Broom finish, by drawing a medium hair broom across the concrete surface as detailed. Repeat operation when required to provide a medium texture acceptable to the Architect.
7. Curing: Refer to schedule noted in 1.6, above.
 - a. Immediately after placement, protect concrete from premature drying.
 - b. Remove all dirt, dust, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry.
 - c. Stir curing compound thoroughly before using.
 - d. Apply a continuous, uniform film by solvent-resistant low-pressure spray only, short-nap roller or lamb's wool applicator. For best results, use a canister curing compound sprayer. Use spray tip number 8004 or equivalent for water-based or waterborne products.
 - e. For curing, apply first coat evenly and uniformly as soon as possible after final finishing. Apply second coat when all construction is completed, and structure is ready for occupancy.
 - f. When soil contamination occurs, notify the Architect immediately in writing. Remove contaminated soils and legally dispose of, provide soil test(s), replace soil, plantings and lawns at no additional cost to the Owner.

3.2 FOOTINGS, BASES, FOUNDATIONS, SADDLES, CRADLES or COLLARS (as required)

- A. Footings, Bases, Foundations: Locate and provide where shown on drawings and as detailed.
- B. Saddles: Locate and provide where shown on drawings or where vertical distance between crossing pipes is eighteen (18") inches or less. Construct saddles spring line (centerline) to spring line and full width of trenches.
- C. Cradles: Locate and provide where shown on drawings. Construct cradles the full width of the trench, six (6") inches below the pipe and on both sides of the pipe up to the spring line.
- D. Collars: Locate and provide where shown on drawings or where pipe slopes exceed ten (10%) percent. Construct collars one (1') foot thick, full width of trench plus one (1') foot extension each side, above and below pipe.

3.3 INTERRUPTION OF CONCRETING

- A. Should placing concrete be suspended or unavoidably interrupted, provide keyways and/or bulkheads to prevent feather-edging when work is resumed. Roughen horizontal surface for bond.

3.4 REPAIR AND PROTECTION FOR CONCRETE WORK

- A. Cut out and replace defective concrete work which has blisters, cracking, crazing, curling, discoloration, dusting, efflorescence, low spots, pop outs, scaling or mortar flaking, spalling, settling, or heaving as defined by Portland Cement Association 2001, "Concrete Slab Surface Defects" and as directed by the Landscape Architect.
- B. Modify or replace concrete not conforming to the required lines, details, elevations and specifications as directed by the Architect.
- C. Protect the work from damage until acceptance of the work. Exclude traffic from concrete work for at least fourteen (14) days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

3.5 LIGHT POLE BASES (cast-in-place option)

- A. Solo-tube form. Provide and install as detailed.
- B. Coordinate anchor bolt pattern with light pole manufacturer.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed by ACI certified technicians; Grade 1. Certificates shall be submitted to the Architect for persons performing inspection and testing prior to the start of work.

- B. Field Inspection and testing shall be paid for as directed under 1.5 "Quality Assurance". Where retesting, additional inspection, lab tests or other professional services are required due to rejected work, any cost associated therewith will be solely at the Contractor's expense.
- C. The Contractor shall plan his operations to allow adequate time for all required testing and inspection.
- D. The Contractor shall provide facilities and equipment necessary to obtain and handle representative sample of materials to be tested.
- E. The testing laboratory shall be responsible to the Owner for the field control of all concrete and may reject batches because of high slump, uncontrolled air entrainment, delays or other conditions of non-compliance with these specifications.
- F. Sampling and Field testing will be performed during concrete placement per ASTM C31, C39, C143, C172 and C173.
- G. Five (5) Concrete Test Cylinders: Taken for every 30 or less cubic yards of concrete placed are required or a fraction thereof.
 - 1. Two (2) Cylinders will be tested at 7 days, two (2) cylinders will be tested at 28 days and one (1) cylinder will be held for possible testing at a later time.
- H. One (1) Additional Test Cylinder: Taken during cold weather concreting, to be cured on the job site under the same conditions as placed concrete it represents, is required.
- I. Air Content Test: Taken for each set of test cylinders taken, is required.
- J. One (1) Slump Test: Taken for each set of test cylinders taken is required.
- K. Test results will be reported by telephone to the General Contractor and Architect on same day tests are made. Written report with copies will follow to the Owner, Architect, and Landscape Architect. Email copies of laboratory test, evaluation reports for concrete materials and mix designs will be submitted.

3.7 CLEAN UP

During the contract and at intervals as directed by the Architect and as concrete work is completed, clear the site of gravel, concrete, appurtenances and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 321301

SECTION 321601 - GRANITE CURB

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of granite curb is shown on the drawings.
- B. Salvage, clean and reinstall existing granite curb.
- C. Provide new granite curb.
- D. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 321201 - Asphalt Paving
- B. Section 321301 - Site Concrete Work

1.3 SUBMITTALS: (See Section 311201, 1.5)

- A. Provide material certificates showing granite curb source and that material meets product specification in Section 2.1 below.

1.4 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Salvage existing granite curb and stockpile for reuse and/or provide new. Clean salvage granite curb for reuse. Remove concrete backing and other debris. Minimum curb length of 5-feet.
- C. Construction Review: Verify profile and curb-ramp locations with Owner and Architect prior to setting curb. Used curb to be approved by Architect prior to setting.
- D. Restore asphalt pavement meeting municipal DPW standards when curb work is within the ROW.

PART 2 - PRODUCTS

2.1 GRANITE CURB

- A. Shall be hard, durable, light grey in color and free from seams which would impair its strength. The curb shall be sawed top and split face. No drill marks shall appear on the exposed face. Minimum length shall be 2 ft.; maximum 8 ft. Curbs set to a radius of less than 100 ft. shall be cut to the curve required. Maximum length on curves shall be four feet.
- B. Provide project specific granite types:
 - 1. Vertical Curbs/ split face: 5" x 16"

2. Transition Curb
 3. Vertical Curb Corners (for radius 3'-0" or less if required)
- C. Standard of quality: As manufactured by H.E. Fletcher Granite Company, 275 Groton Road, North Chelmsford, MA 01863, PH# 978-251-4031, Fax# 978-251-8773 or Architect approved equal.
- D. The Contractor has the option to salvage and reuse existing granite curb that is in good condition, free of large chips, cracks, discoloration, and a minimum length of 5-feet.
- 2.2 WET CONCRETE BACKING
- Shall be 4000 psi as specified in Section 321301, 2.3, 2.4.
- 2.3 GRANULAR BASE COURSE
- As specified in Section 312201, 2.1, B.
- 2.4 DRY MIX CONCRETE SETTING BED
- Shall be Portland cement dry, mixed in the proportions of, one-part Portland cement to three parts of concrete sand and six parts of coarse aggregate (passing 1-1/2" screen).
- 2.5 ASPHALT PATCHING: Refer to Section 321201 – Asphalt Paving

PART 3 - EXECUTION

- 3.1 SETTING CURB
- A. Curbing shall be set leveled on a 3-inch dry mix concrete setting bed foundation.
 - B. Set granite to line and grade as shown on the plan. Provide continuous wet concrete backing both sides of curb. Joints shall be a minimum of 1/4" and shall be fully mortared from face to back of curb. Bevel corners to 45 degrees with a mitered joint.
 - C. Set curbs to the line and grade given in a smooth curve or straight line. When curbing ends, it shall transition from a six (6") inch reveal to no reveal meeting finished grade.
 - D. Curbing shall be set, backfilled and compacted to 1/2 the height on the sidewalk face to prevent movement when backfilling is placed. Once the paving has been rolled, the remaining fill shall be placed and compacted to avoid future settlement of the walk.
 - E. Alignment: The joints between curb stones shall be butt tight with a maximum 1/8" gap.
 - F. Backfill curbing with wet concrete each side of the curb stone and all spaces under the curb shall be filled with concrete so that the entire unit is completely supported.

3.2 CLEAN UP

- A. During the contract and at intervals as directed by the Architect and as granite curb installation is completed, clear the site of extraneous granite curb and debris. Leave the site in a clean, safe, well draining, neat condition.
- B. Salvaged curb not used in the new work shall be returned to the Owner.

END OF SECTION 321601

SECTION 323001 - METAL BOLLARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of metal bollards is shown on the drawings and as specified in the contract documents.
- B. Metal bollards work includes, but is not limited to, the following:
 - 1. Providing and installing metal bollards as noted in the specifications and as detailed.
 - 2. Provide bollard slip covers.
- C. Provide all labor, materials, tools, equipment, and services required to install metal bollards and furnishings as indicated on the plans and as specified.
- D. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instruction and in accordance with all approved shop drawings and submittals.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 321301 - Site Concrete Work

1.3 REFERENCES

- A. Manufacturers Data and Recommended Installation Requirements

1.4 SUBMITTALS: (See Section 3 1201, 1.05)

- A. Provide Manufacturer's Product Data (MPD), Material Certificate and samples as noted:
 - 1. Bollard Cover (¼" nominal wall thickness polyethylene thermoplastic): MPD
 - 2. Bollard Cover color chart (color approved by Owner).
 - 3. Schedule 40 Steel Pipe.
 - 4. Reflective Tape: MPD and Sample

1.5 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Construction Review: Notify the Architect when footing location(s) for metal bollards are coordinated to avoid underground utilities and marked in the field.

1.6 QUALITY ASSURANCE

- A. Manufacturer's warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.
- B. Ten (10) year warranty against fading.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to project site in wrapped, neat, secure condition. Provide means to unload products from delivery trucks.
- B. Protect all products and installation area from vandalism, theft, other construction, premature use, etc. until Owner acceptance and Architect sign off.
- C. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately reordered, to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors to provide proper protection.

PART 2 - PRODUCTS

2.1 METAL BOLLARD

- A. Pipe: Shall be galvanized schedule 40 steel pipe, 6-inch OD x ½" wall thickness.
- B. Concrete: Shall be 4000 psi as specified in Section 321301.

2.2 REFLECTIVE TAPE

Shall be exterior grade, reflective. Standard of quality shall be Scotchgard, as manufactured by 3M or Architect approved equal. Color as noted on detail.

2.3 BOLLARD COVER

Shall be made of ¼" nominal wall thickness polyethylene thermoplastic (LDPE). Top shall be domed. Standard of quality shall be as manufactured by Ideal Shield or Architect approved equal. Color shall be selected by Owner and approved by Architect from standard manufacturer's color options.

PART 3 - EXECUTION

3.1 INSTALL METAL BOLLARD

- A. Shop cut bollard.
- B. Locate per plan and install as detailed. Verify location of underground utilities. Neatly saw cut pavement or install bollards before paving.

- C. Auger hole for concrete footing. Set metal bollard in center of hole and brace plumb and vertical, (bollard spacing at electrical transformer shall be 48-inches on-center).
- D. Fill annular spaces around and inside metal bollard with concrete. Dome top of concrete footing and concrete inside metal bollard to shed water. Check for alignment and set plumb.
- E. When concrete has set, remove braces.
- F. Install bollard cover and reflective tape per manufacturer's recommendations. Anchor cover to bollard with a single set screw at bottom of post.
- G. Protect bollards until accepted.

3.2 CLEAN UP

During the contract and at intervals as required by the contract documents and as directed by the Architect and as metal bollards are installed, clear the site of all extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well-draining, neat condition.

END OF SECTION 323001

SECTION 323002 - TRAFFIC SIGNS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of new traffic signage is shown on the drawings.
- B. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.
- C. Salvage and stockpile existing traffic signs that interfere with work operations. Clean and reinstall at completion of work.
- D. Replace signposts that are damaged when reinstalling existing signs.

1.2 SUBMITTALS: (Provide Section 311201, 1.5)

- A. Provide shop drawings for each different type and size of sign listed in the Traffic Sign Schedule.
- B. Provide MPD for sign posts and plates.

1.3 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. No work shall be fabricated until shop drawings for the work have been favorably reviewed by the Architect.
- C. Construction Review: Notify the Architect when locations for signs are coordinated to avoid underground utilities and marked in the field for review.
- D. Provide sleeves, anchors, footings and other items and build in coordination with work of other trades.

1.4 RELATED WORK ELSEWHERE

- A. Section 321301 – Site Concrete

PART 2 - PRODUCTS

2.1 SIGNS

- A. Sign Plate:
 - 1. Sign Plate shall be aluminum sheets .090" (approximately 3/32") thick, with two coats of Dupont Imron spray semigloss paint.

2. Letters, numbers, symbols, and arrows shall be engineering grade, (EG) reflective. Sign plates, letters and numbers shall meet the colors and regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by the State of New York Department of Transportation, Division of Traffic and Safety.
 3. Refer to Traffic Sign Schedule and/or sign details on drawings for sign wording, quantities, and other information.
 4. Hardware shall be galvanized.
 5. Standard of quality shall be as manufactured by Eastern Metal/USA-Sign, www.usa-sign.com or Architect approved equal.
- B. Sign Posts: Shall be painted steel, 2-inch O.D. square x 1/8" wall thickness. Two coats of metal primer and one coat flat black finish. Provide decorative post cap as detailed.
- 2.2 CONCRETE FOR FOOTINGS: As specified in Section 321301, 2.1.

PART 3 - EXECUTION

3.1 INSTALL SIGNS

- A. Erect signs plumb. Drive posts into firm ground or bolt to sleeve in pavement areas or concrete footings as detailed. Use driving caps to avoid deforming posts.
- B. Refer to sign schedule for mounting heights. Attach metal sign plates to steel posts securely with 1/4" dia. galvanized nuts/ washers and bolts. Mount sign plates to the building façade or wall were noted on the drawings
- C. Re-install salvaged signs that are in good condition in locations as shown on the plans or as directed by the Architect. Replace damaged signposts with new as directed by the Architect.
- D. Traffic Signs that are temporarily removed or relocated within the Right-of-Way shall be re-installed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

3.2 CLEAN UP

During the contract and at intervals as directed by the Architect and as traffic sign installation(s) are completed, clear the site of extraneous paint, fasteners, concrete, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 323002

SECTION 329001 - PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of planting is shown on the drawings.
- B. Planting work includes, but is not limited to, the following:
 - 1. Soil preparation
 - 2. Installing commercially grown trees, (*Owner shall purchase plantings*)
 - 3. Planting accessories
 - 4. Maintenance: See watering, and other specific requirements
 - 5. Guarantee
 - 6. Clean up
- C. The Contractor shall provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.
- D. The OWNER shall tag and purchase plant materials including delivery to site.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 329201 - Lawns

1.3 SUBMITTALS (See Section 311201, 1.5)

- A. Furnish name of Landscape Contractor and/or Nurseryman to perform planting work and obtain Architect's approval.
- B. Provide Material Certificates, MPD, Test Reports or Samples as noted for:
 - 1. Planting Mulch: Twelve (12 oz.) ounce sample
 - 2. Stone Mulch: Twelve (12 oz.) ounce sample
 - 3. Planting Soil Mixture: Material Certificate and Test Report. See 1.4 F.
 - 4. Plant Materials: Certificates of Inspection by regulatory agencies. Leave tags with botanical names and nursery source(s) on plants until reviewed by Landscape Architect.

1.4 QUALITY ASSURANCE

- A. Perform planting in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Planting Contractor: Planting work by established Landscape Contractor and/or Nurseryman having sufficiently experienced crews, supervisor(s), specialized equipment

and an excellent record of performance on completed planting projects of comparable size, scope, and quality. Provide expert plantsman to direct the work in the field on a regular, daily basis.

- C. Nomenclature: Plant names shall conform to the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature. Plants shall be true to botanical name, tagged with a waterproof, legible tag showing botanical name, size, and nursery source of origin.
- D. Size and Grading: Plant sizes and grading shall conform to the latest edition of "American Standard for Nursery Stock" as sponsored by the American Association of Nurserymen, Incorporated (AAN), latest issue unless otherwise specified.
- E. Nursery Source: Obtain freshly dug, healthy, vigorous, plants nursery grown under climatic conditions similar to those in the locality of the project for a minimum of two (2) years. Plants shall have been lined out in rows, annually cultivated, sprayed, pruned, and fertilized in accordance with good horticultural practice. Plants shall have been transplanted or root pruned at least once in the past three years. Balled and bur lapped plants must come from soil which will hold a firm root ball. Heeled in plants and plants from cold storage not accepted.
- F. Testing:
 - 1. Engage an independent, qualified State of New York soil testing service. Pay for soil testing and inspection services.
 - 2. Test representative material samples proposed for use as follows:
 - a. Planting Soil Mixture
 - (1) pH factor
 - (2) Mechanical analysis
 - (3) Percentage of organic content
 - (4) Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.
 - b. Peat Moss
 - (1) Loss of weight by ignition
 - (2) Moisture absorption capacity
 - c. Bone Meal

1.5 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Planting seasons and timing conditions:

1. Unless otherwise directed in writing by the Landscape Architect, the planting of trees, shall be from in the Spring, March 15 to June 1, and in the Fall, from October 15 to December 15. Refer to 1.5 Fall Planting Hazard restrictions below.
 2. Proceed with and complete planting work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
 3. Do not conduct planting operations until fine grading in the work areas has been completed satisfactorily.
 4. Cooperate with other Contractors and trades working in and adjacent to planting locations. Examine drawings and specifications for the entire site and become familiar with the scope of other work required, especially underground utilities.
- C. Construction Review: Plants will be purchased by the Owner and delivered to the project site. The Owner will review and approve materials prior to being turned over to the Contractor. Coordinate scheduling for installation. The Contractor will be responsible for care and maintenance of the plant materials upon being turned over from the Owner.
- D. Owner shall furnish water at the building face(s). Contractor shall provide labor, hoses, sprinklers and watering equipment.

PART 2 - PRODUCTS

2.1 PLANTS

- A. Plants shall be well formed without voids and open spaces, typical of their species or variety, with normal habit of growth. Plants shall be first quality, sound, healthy, vigorous, well branched and densely foliated. Plants shall have healthy, well developed fibrous root systems. They shall be free of defects, disfiguring knots, sun-scald injuries, frost cracks, abrasions, disease, insect pests, eggs, and larvae.
- B. Plants shall conform to the measurements specified in the Plant List. Measurements specified shall be minimum size acceptable for each variety. For each plant of minimum size, provide a plant of maximum size. Plants that meet the requirements specified in the Plant List, but do not possess a normal balance between height and spread will not be accepted. Plants for use when symmetry is required, or in rows, shall be matched as nearly as possible. Plants shall not be pruned prior to delivery.
- C. Plants and tree trunks shall be measured when the branches are in their normal position. Dimensions for height and spread as contained herein refer to the main body of the plant and not from branch-tip to branch-tip. Shade trees shall be free of branches up to seven feet, with a single leader, well branched and reasonably straight stems. No trees which have had their leaders cut or damaged will be accepted. Trees must have straight trunks with single leader intact. There shall be no abrasion of the bark and no fresh cuts of limbs over one (1") inch which has not been completely calloused over.

- D. Balled and burlap plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock." Cracked or mushroomed balls are not acceptable.

2.2 PLANTING ACCESSORIES

- A. Planting soil mixture for trees shall be premixed in bulk, and contain the following by volume:
 - 20 parts clean on site soil
 - 10 parts topsoil
 - 1 part bone meal
- B. Topsoil: 10-20% organic, 20-65% passing 200 mesh sieve. Fertile, friable, natural topsoil of leafy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sand, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.5 and 7.5, free of substances harmful to plants which will be grown in the soil.
- C. Starter Fertilizer: Water soluble fertilizer and plant food 10-52-17 containing no sulfate or chloride salts. Standard of quality shall be as manufactured by Fairlawn Chemical Co., Inc., 485 Holt Road, Webster, NY (585) 671-2400, and distributed by Organix, 569 Klem Road, Webster, NY (585) 787-2711 or Architect approved equal.
- D. Peat Moss: Brown to black in color, weed and seed free, dried sphagnum peat moss, containing not more than 9% mineral on a dry basis and conforming to NYSDOT 713-20.
- E. Bone Meal: Finely ground, raw, minimum 4% nitrogen and 20% phosphoric acid. It shall be delivered in sealed bags showing the manufacturer's guaranteed analysis.
- F. Stakes: Minimum eight (8') foot long, five (5") inch round cedar wood posts, (Campus Standard).
- G. Hose: New, two (2) ply garden hose not less than one-half (1/2") inch in diameter.
- H. Guy Wire: 10-gauge galvanized steel wire for guying plantings where specified.
- I. Tree Wrap: Standard of quality shall be four (4") inch wide waterproof 30-30-30 Krinklecraft, or Landscape Architect approved equal.
- J. Wood Mulch: Ground or shredded bark, medium size, from softwood trees. No pieces over two (2") inches in greatest dimension. Free from sawdust, stones, debris, and deleterious materials.
- K. Anti-desiccant: Standard of quality shall be "Wiltpruf" or Architect approved equal.

PART 3 - EXECUTION

3.1 LAYOUT: Locate and stake in the field individual trees for approval by the Owner prior to commencing planting operations. Include plant identification on marker stake.

3.2 GENERAL PLANTING OPERATIONS

- A. Transportation and Handling: Take precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Spray deciduous plants in foliage with an approved "Anti-Desiccant" immediately after digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury. Do not hold or move trees by stems. Support and protect root balls.
- B. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Landscape Architect.
- C. Protect plants from drying out. When plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Architect. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches. Cover plants transported on open vehicles with protective covering to prevent wind burn. Do not hold or move trees by stems. Support and protect root balls.
- D. Provide dry, loose prepared planting soil for planting bed mixes. Frozen or muddy soil is not acceptable.
- E. Excavate tree pits as dimensioned and located on drawings. When soils harmful to plant materials are encountered, immediately notify the Landscape Architect.
- F. Plants shall be set plumb and straight and at such a level that after settlement, a normal or natural relationship of the crown of the plant with the ground surface will be established. Each plant shall be planted in the center of the pit. When balled, burlap, and platformed plants are set, the platform shall first be removed from the pit and topsoil shall be carefully tamped under and around the base of each ball to fill voids. Burlap, ropes, and wires shall be removed from the sides and tops of balls, but no burlap shall be pulled out from under the balls.
- G. Plants shall be planted in the planting soil mixture which shall be thoroughly watered and tamped. On level ground or slight slopes, a shallow basin a little larger than the diameter of the plant pit shall be left around each plant as shown on the drawings or as directed by the Architect. On steep slopes, the soil on the lower side of the plant shall be graded in such a manner that it will catch and hold water as shown on the drawings or as directed by the Landscape Architect.
- H. Staking: Trees 2- inch caliper or less shall be staked with two stakes. The trunks of trees larger than 2- inches shall be staked with three stakes, equally spaced about the tree, set vertically and securely fastened. The trees shall be guyed with two or three strands of wire as specified, which shall run through the rubber hose and be securely tightened.
- J. Mulching: Spread continuous four (4") inches settled depth of mulch over finished surface of each plant, plant bed, or hedge trench as detailed. Water plants thoroughly

after mulching. NOTE: The Landscape Architect may field check depth of mulch for proper weed control barrier since no weed control fabric is required.

- K. Wrap deciduous trees with tree wrap to first branch and secure wrap.
- L. Pruning: Each shrub or tree shall be pruned to preserve the natural character of the plant. Remove dead wood and crossing branches. Do not prune terminal leaders. Refer to drawings for additional tree pruning details.
- M. Anti-Desiccant: Immediately after planting and staking, trees and shrubs shall be sprayed with anti-desiccant, using an approved power sprayer to apply an adequate film over trunks, branches, twigs, and/or foliage. Apply according to manufacturer's recommendations.
- N. Replacements: Remove as determined by the Landscape Architect, to be unsatisfactory during the initial planting installation. Owner shall purchase replacement plant materials if necessary. Install replacement plants within the one-year guarantee period from date of Substantial Completion.

3.4 MAINTENANCE

- A. Maintenance by Contractor begins as soon as plants are installed. Protect plants from drought, washout and wind erosion. In general, maintain new plantings, including watering, weeding, pruning, applications of herbicides, fungicides, insecticides and pesticides, until healthy, vigorous plants are accepted by the Architect. Specifically:
 - 1. Protect: Protect plantings against harsh weather, trespass and vandalism by wrapping, staking, temporary fencing or other means.
 - 2. Water: The Owner shall furnish water at the building face(s). The Contractor shall provide labor, hoses, sprinklers and watering equipment, water bags or mats to maintain plants, prevent them from drying (browning) out, and keep plants in a healthy, growing condition until final acceptance.
 - 3. Cultivate: Cultivate plants by straightening any settled plant materials, restaking and guying, rewrapping, pruning dead and broken branches, weeding and re-applying anti-desiccant, herbicide, fungicide, insecticide and pesticide.
- B. Maintenance by the Contractor continues until Certificate of Final Acceptance, or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later. Maintenance by Owner begins as soon as the Architect issues Certificate of Final Acceptance or Final Punch List is satisfactorily completed and accepted by the Landscape Architect, whichever is later.

- 3.5 STANDARDS FOR ACCEPTANCE: Review to determine acceptance of plantings will be made by the Landscape Architect upon request. Provide notification at least five (5) working days before requested review date.

- A. New plantings will be acceptable provided requirements, including maintenance, have been complied with. Healthy, well-formed, vigorous plants, true to species and size on Plant List, must be established, free of disease, broken branches and insects.
- B. Any plant which is poorly formed, structurally unsound, not true to species and size on Plant List, diseased, contains broken branches, or is generally unhealthy (containing 25% or more browned out foliage), shall be rejected and replanted at no additional cost to the Owner.

3.6 GUARANTEE

- A. Contractor shall guarantee plant materials to be true to species and size on Plant List, and in vigorous growing condition, for a period of one (1 yr.) year from the date given on the Certificate of Substantial Completion or Final Punch List is satisfactorily completed and accepted by the Landscape Architect, whichever is later.
- B. Any plant material that does not meet the Standards for Acceptance shall be replaced as soon as weather conditions permit. Replacement plantings shall be made in accordance with the specifications and drawings. Replacements shall be subject to inspection, acceptance, and guaranteed for one (1 yr.) year after date of replanting and acceptance by the Landscape Architect.

3.7 CLEAN UP

- A. During the contract and at intervals as directed by the Landscape Architect and as planting is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, neat, well draining condition.
- B. Repair lawns that may have been damaged resulting from planting operations.

END OF SECTION 329001

SECTION 329201 – SEEDED & SODDED LAWNS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of the lawn work is shown on the drawings. The lawn work limits equal the Contract Limit Line except as noted on the drawings. Non-paved, non-roofed areas within the Contract Limit Line shall receive four (4") inches settled depth of topsoil and lawn seed per Base Bid.. Existing lawn areas that are not disturbed require no additional work. Lawn types as shown on the drawings are defined as follows:
1. BASE BID - Seeded Lawn: Strip and stockpile 4" topsoil, remove debris, replace 4" topsoil and seed & mulch.
 2. ALTERNATE - Sodded Lawn: Strip and stockpile 4" topsoil, remove debris, replace 4" topsoil and install commercially grown SOD.
 3. Lawn repair: Areas with *minor* lawn disturbance due to construction operations shall receive 1" screened topsoil and seed.
- B. Lawn work includes, but is not limited to, the following:
1. Placing and spreading stockpiled topsoil
 2. Importing, placing and spreading topsoil (*if required*)
 3. Lawn bed preparation
 4. Seeding or sodding lawns
 5. Mulching and fertilizing
 6. Maintenance requirements
 7. Clean Up
- C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation (Topsoil Stripping)
- B. Section 312201 - Site Earthwork
- C. Section 329001 - Planting

1.3 REFERENCES

- A. ASTM D4972 - Standard Test Method for pH of Soils
- B. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes
- C. ASTM D422 and D1140 - Standard Test Method for Particle Size Analysis of Soils

- D. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effect
- E. ASTM F1647 - Standard Test Method for Organic Material Content of Athletic Field Rootzone Mixes.
- F. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sportsfield Rootzone Mixes
- G. ASTM F2060 - Standard Guide for Maintaining Cool Season Turfgrasses on Athletic Fields
- H. National Turfgrass Federation, Inc.
- I. National Turfgrass Evaluation Program (NTEP).
- J. Cornell Universities: Sportsfield Management Guidelines
- K. Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

1.4 SUBMITTALS: (See Section 311201, 1.5)

- A. Furnish name of Landscape Contractor or Nurseryman to perform lawn work and a list of completed projects including contact information for each project demonstrating compliance with applicable qualification requirements outlined in 1.5 "Quality Assurance" of this specification section.
- B. Provide Material Certificates and MPD for:
 - 1. Sod species and source, location for sod producer
 - 2. Seed species and source
 - 3. Limestone
 - 4. Fertilizers
 - 5. Hydromulch
- C. Provide Topsoil Test Report (*for Imported Topsoil if required*): Submit test results from Architect approved independent testing laboratory on their letterhead. Report shall:
 - 1. Certify soil texture, organic content, and particle size analysis.
 - 2. Chemical analysis testing nitrogen, phosphorus, potassium, calcium, magnesium, cation exchange capacity, base saturation percentages, micronutrients and acidity (pH).
 - 3. Provide timing and rates of soil additives, liming and fertilizers. (Materials and procedures regarding soil amendments and fertilizers specified in this section are approximate.) Adjust all soil amendments to comply with test results based on actual soil tests and as directed by the Architect at no additional cost to the Owner.

- D. Provide letter on Contractor's letterhead certifying that only topsoil from the above tested source was used on the project.
- E. Lawn Seed Mix: Submit one (1 lb.) pound seed sample for each mix specified in supplier's unopened package with supplier's certification statement clearly showing the following:
 - 1. Name and address of labeler
 - 2. Lot number
 - 3. Kind and variety of turfgrass seed listed in order of predominance
 - 4. Percent by weight of pure seed of each species and variety (percent purity)
 - 5. Germination percentage (percent viable seed)
 - 6. Percent by weight of other crop seed
 - 7. Percent by weight of weed seed
 - 8. Percent undesirable grass seed
 - 9. Percent by weight of inert matter
 - 10. Date on which the germination test was conducted
- F. Submit seed tags from **ALL** used or partially used seed bags. At times throughout the project, the Architect may request seed samples of onsite seed bags.
- G. Provide schedule for review and approval as outlined under "Sequence and Scheduling" of this specification section.

1.5 QUALITY ASSURANCE

- A. General Lawn Contractor: Work shall be contracted to a single, established Landscape Contracting or Nursery firm having sufficiently experienced crews, supervisor(s), specialized equipment, and an excellent record of performance. Provide expert turfman to direct the work in the field on a regular, daily basis. The expert turfman shall be employed by the same company engaged in the installation of the lawn work for a minimum of five (5) years.
- B. Sod Standards: Comply with the Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.
- C. Nomenclature: Seed names shall conform to the National Turfgrass Federation, Inc.
- D. Seed Quality Rating: Shall meet testing standard for New York State outlined by the National Turfgrass Evaluation Program (NTEP).
- E. Testing: If required by the Architect for poor lawn grow in, engage an Architect approved independent, qualified New York State testing service and turfgrass specialist to evaluate Contractor grow in practices and materials used. Pay for all testing/inspection services, materials, and manpower to correct lawn areas as approved by the Landscape Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod:

1. Cut, deliver, and install sod within a 24-hour period. Sod cutting and shipping shall be coordinated with the sod installers.
2. Do not harvest or transport sod when moisture content may adversely affect sod survival.
3. Protect sod from sun, wind, and dehydration prior to installation.
4. Do not tear, stretch or drop sod during handling and installation.
5. Store sod materials at site in an orderly manner at location(s) acceptable to the Landscape Architect.

B. Seed:

1. Packing and Shipping: Ship seed and associated materials with certificates of inspections required by governing authorities.
2. Do not make substitutions. If specified seed material is not obtainable, submit to the Architect proof of non-availability and a proposal for use of equivalent material with similar performance criteria as the originally specified seed material.
3. Store all seed at the site in a cool, dry place in a manner to prevent wetting and deterioration, as approved by the Architect. Replace any seed damaged during storage as directed by the Architect.
4. Deliver seed in supplier's unopened packages bearing labels showing the supplier's name and seed analysis by weight.

C. Fertilizer:

1. Deliver fertilizer in the manufacturer's standard sized bags showing the weight, analysis, and manufacturer's name. Store all fertilizer under a waterproof cover or in a dry place as approved by the Architect.

1.7 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. Lawn Work:

1. Perform lawn work after planting, fine grading and other work affecting the ground surfaces in the lawn work areas has been completed satisfactorily.
2. Where practical, the Owner will provide a connection to the water system such as, but not limited to, existing yard hydrants, building hose bibs, etc. If this

source is insufficient, not available or practical to provide a source of sufficient water to meet the requirements herein, the Contractor shall secure a water source sufficient to meet the water requirements herein such as, but not limited to, municipal hydrants, water truck, etc. at no additional cost to the Owner.

3. Contractor shall provide all watering equipment and appurtenances such as, but not limited to, meters, backflow preventer, labor, hoses, sprinklers, irrigation and watering equipment. The Owner will pay for the water usage.
4. Calendar dates for seeding and sodding under "Sequence and Scheduling" of this specification section shall apply.
5. Place sod only when ground surface is free of mud, frost, snow or debris.
6. Protect newly seeded/sodded lawns from vehicles, vandalism, or trespass. Provide temporary fencing or barriers as necessary.

C. Construction Review:

1. Upon completion of topsoil spreading and sod and/or seed bed preparation, notify Landscape Architect to review work.
2. The Landscape Architect may review fine graded areas by the Contractor to check for surface smoothness and general compliance with grading requirements. Fill or cut by hand raking or other acceptable means to achieve smooth, even well-draining lawn surfaces free of "bird baths" and breaks in grade as directed by the Landscape Architect at no additional expense to the Owner.

1.8 SEQUENCING AND SCHEDULING

A. Schedule: Prior to construction, provide a schedule which addresses the following lawn thresholds involving erosion control stabilization and maintenance:

1. Seeding and Sodding Installation:
 - a. Unless otherwise directed in writing by the Landscape Architect, seed and sod lawns from April 1 to June 15, and from August 15 to October 1. Seeding and sodding between June 16 and August 14 is not acceptable unless adequate water supply is available and applied to the turfgrass as required herein and approved by the Landscape Architect.
 - b. Proceed with and complete seeding and sodding as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
2. Substantial Completion: "Standards For Substantial Completion Of Lawns" of this specification section. The date of substantial completion is anticipated approximately 30 days after lawn installation presuming all Contractor maintenance operations have been vigorously performed.

3. Final Acceptance: The date of final acceptance is anticipated approximately 30 days after substantial completion presuming all Contractor maintenance operations have been vigorously performed.
4. Owner Maintenance: After final acceptance of the lawns, the Owner will maintain.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Source: On-site stockpile or provide from off site, when stripped, stockpiled and amended quantity is inadequate to provide four (4") inches settled depth of topsoil for all lawn areas at no additional cost to the Owner.
- B. Texture and Content: Provide topsoil conforming to the following:
 1. Soil texture and content:
 - a. Sandy loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material. Topsoil shall be entirely free of dense material, hardpan, clay, stones over 3/4" in diameter, sod, or any other objectionable foreign material, including but not limited to, glass, debris, toxins, hazardous wastes and chemicals (such as atrazine or muriatic acid within the past seven (7) years) that may be injurious to humans, animals and plant materials.
 - b. Organic Matter: Containing not less than 5% or more than 10% organic matter in that portion of a sample passing a 1/4" sieve when determined by the wet combustion method on a sample dried at 105 degrees F.
 2. pH Value: Containing a pH value within the range of 6.0 to 7.0 on that portion of the sample which passes a 1/4" sieve.
 3. Soluble salt content: Not higher than 500 parts per million.
 4. Sieve Analysis for general lawn work: Shall be screened or rock picked to meet the following gradation:

<u>Sieve Designation</u>	<u>% Passing</u>
3/4"	100
1/4"	97-100
No. 200	20-65 (of the 1/4" sieve)
- C. No lawn shall be seeded or sodded on topsoil that has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. The Contractor shall assume full responsibility for any loss or damage to turfgrass sod or the inability to grow a sufficient stand of grass from seed, as indicated herein, arising from improper use of chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

2.2 LAWN SEED MIX

- A. Provide fresh, clean, new-crop seed mixed in the proportions specified for species and variety, and conforming to Federal, State, latest American Association of Nurseryman (AAN) Standards and National Turf Evaluation Program (NTEP).
- B. Acceptable material in a seed mixture other than pure live seed consists of nonviable seed, chaff, hulls, live seed of crop plants and inert matter. The percentage of weed seed shall not exceed 0.05% by weight.
- C. All seed must be fresh seed. Seed that is left over from the previous year and beyond sell by date is not acceptable.
- D. Grass seed shall be certified "Blue Tag" seed composed of a blend of varieties mixed in proportion by weight and tested for minimum percentages of purity and germination. Submit the proposed mixture to the Architect for approval.
- E. Provide the following lawn seed mix for minor lawn repair areas:

<u>Amount by Weight</u>	<u>Species or Variety</u>	<u>Percentage Purity</u>	<u>Germination</u>
40% (Min.)	Kentucky Bluegrass Blend*	95%	85%
35% (Max.)	Fine Textured Endophytic Perennial Rye**	98%	90%
<u>25%</u> (Min.)	Creeping Red Fescue***	97%	85%
100%			

- * Kentucky Bluegrass Blend shall contain no more than 25% of any one cultivar and always at least two (2) different cultivars. Acceptable cultivars: Rambo, Princeton-105, Wildwood, Allure, Coventry, Champagne, Northstar, Cardiff, Nimbus, Raven, SR2100, Misty, America, Brilliant, Limousine, Conni, Liberator, Apollo, NuGlade, Total, Eclipse, Unique, Impact, Midnight, Arcadia, and Serene or Architect approved equal.
- ** Perennial Rye Blend shall contain no more 30% of any one (1) cultivar and always at least three (3) different cultivars. Acceptable cultivars: Palmer III, Calypso II, Brightstar II, Secretariat, Monterey, Catalina, Pennant II, Premier II, Sonata, Sunshine and Ascend or Architect approved equal.
- *** SR5000 is acceptable.

- F. Acceptable Seed Suppliers:

 United Agri Products
 Steve Hyde (315) 383-5035;

 Matrix Turf Solutions
 Jerry Clark (315) 480-7340;

Lesco, Inc.
Will Abel (315) 437-3423;

Preferred Seed
Jack Bryant (716) 895-7333;

Or Architect approved equal.

2.3 SODDED LAWN

- A. Sod shall conform to NYSDOT Item 713-14 and be approved nursery grown mineral soil sod with **80% Tall Fescue and 20% Kentucky Bluegrass blend** with a minimum (4) varieties. Muck grown sod is NOT acceptable. Installation of plastic netting is NOT acceptable
- B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch and extraneous material viable and capable of growth and development when planted. Sod is considered free of weeds when less than five (5) weeds are found per one hundred (100 s.f.) square feet.
- C. Thickness of Cut: Furnish sod machine cut at a uniform soil thickness of 0.60 inch at the time of cutting and of supplier's standard width, length, and thickness: uniformly 1" to 1-1/2" thick with clean cut edges. Measurement of thickness shall exclude top growth and thatch. Mow sod before stripping.
- D. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 1 to 1-1/2 inches.
- E. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (un-compressed).
- F. Pad Size:
 - 1. For General Lawn: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 inch on width and plus or minus 5% on length. Broken pads and torn or uneven ends will not be acceptable.
- G. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.
- H. Standard of Quality: Shall be Premium Sod supplied by Batavia Turf (800) 333-1472, Sky High Turf Farms (315) 687-6510, Saratoga Sod Farm (518) 664-5038, Lakeside Sod (716) 741-2877 or Architect approved equal.

2.4 LIMESTONE

- A. Shall be ground limestone in the producer's standard bags containing not less than 85% total carbonates and conforming to the following gradations:
- | <u>Sieve Designation</u> | <u>% Passing</u> |
|--------------------------|------------------|
| No. 100 | 50-100 |
| No. 20 | 100 |
- B. The lime shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use will be rejected.

2.5 TACKIFIER FOR SEEDED LAWNS

- A. Shall be liquid concentrate diluted with drinkable water forming a transparent three-dimensional film-like crust permeable to water and air, containing no agents toxic to seed germination to hold straw mulch in place.
- B. Standard of quality shall be Terra Tack or Landscape Architect approved equal.

2.6 FERTILIZER

- A. For Starter Fertilization: Immediately prior to seeding, fertilize with a commercial starter fertilizer, granular, non-burning product, with not less than 90% organic slow acting, micro nutrients and 1% iron, guaranteed analysis commercial fertilizer. Fertilizer ratio shall be: (1-2-1). Apply at a rate of 0.33 - 0.66 lbs of nitrogen (N) per 1,000 sf.
- B. For Subsequent and Final Fertilizations: Apply commercial fertilizer, poly coated granular non-burning product with not less than 90% organic slow acting, guaranteed analysis
1. For Spring and Fall Lawn Work: Fertilizer ratio shall be: (3-0-1). Apply at rate of 1.5 - 2 lbs. nitrogen (N)/1,000 s.f.

2.7 MULCH FOR SEEDED LAWNS

- A. Dry Application Straw: Shall be straw consisting of clean stalks of oats, wheat, rye or other approved crops well seasoned before baling which are free of noxious weed seeds and roots. Weight shall be based on 15% moisture.
- B. Hydro Applications: Shall be hydro-mulch containing 100% wood fiber mulch. Standard of quality shall be Mat Fiber as manufactured by Mat, Inc. and distributed by Matrix Turf Solutions, (315) 468-6000 or Architect approved equal.

- 2.8 WATER: Free of substance harmful to lawn, other plants, humans and animals.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify limits of lawn work in the field with drawings and Owner.
- B. Examine finish surfaces, grade, topsoil quality, and depth.
- C. Do not start lawn work until unsatisfactory conditions are corrected to the satisfaction of the Architect.

3.2 SPREAD TOPSOIL

- A. Limit preparation to areas which will be immediately seeded or sodded.
- B. Perform topsoil spreading operations only during dry weather.
- C. To insure a proper bond with the topsoil, disc, harrow, or otherwise scarify and loosen the lawn subgrade to a depth of four (4") inches before spreading topsoil.
- D. Spread topsoil to ensure a minimum settled depth of four (4") inches in sodded lawn areas. Provide a minimum of 1" topsoil top-dress in lawn repair areas.

3.3 PREPARE LAWN AREAS

- A. Perform a pH test, sieve, and nutrient analysis of the topsoil and advise the results to the Architect prior to adding limestone or other soil amendments. Soil amendments shall be uniformly incorporated into the top four (4") inches of topsoil by discing, harrowing or other approved methods.
- B. Remove debris and stones 3/4" or larger by handpicking, fine tooth aluminum grading rakes, and mechanized stone picker. When topsoil has hardened, cultivate soil to a four (4") inch depth by plowing, discing, harrowing, or otherwise scarifying and loosening the topsoil.
- C. Grade lawn areas to a smooth, free draining even surface with a loose, moderately coarse texture. Scarify, rake, level, and roll with a light static roller as necessary to obtain true, even lawn surfaces and fill depressions as required to drain. Correct irregularities in the surface resulting from tillage operations to prevent formation of depressions or water pockets.
- D. Cultivate soil to provide a firm bed of minimum of four (4") inches deep, free of clods, stones, or foreign matter over 3/4" in diameter from the top of soil. Do not move heavy objects except necessary lawn making equipment over the lawn areas after the soil is prepared unless it is again loosened and graded. Remove stones and all debris greater than one 3/4" in diameter during cultivation. Level undulations and irregularities in the surface.
- E. For pH correction provide adjusted rate of application as recommended in Topsoil Test Report submittal. For low pH correction: Add ground limestone at the rate indicated by the soil test. For high pH correction: Materials and application rates shall be determined by appropriate soil tests.

- F. Place starter fertilizer at the rate of 0.33 - 0.66 lbs. of nitrogen (N) per 1,000 sf. and mix into full depth of topsoil.
- G. Rake area with fine toothed aluminum grading rake before placing seed to obtain a smooth surface at the proper elevation. Drag area with a wood float to level out minor humps and hollows. Beds shall have a smooth friable uniform surface, free of areas ponding water.

3.4 LAWN SEEDING

- A. Seed lawns immediately after preparation of bed and Architect's approval.
- B. Seeding Rate: 6 lbs. per 1,000 S.F.

3.5 MULCHING SEEDED AREAS

- A. Mulch immediately after seeding.
- B. Dry Mulch Application: Place mulch by hand or by machine at a rate of one bale/1,000 s.f. to produce a light even mulch cover so that 50% of soil is visible through the mulch layer.
- C. Hydro Application: Place hydromulch by machine at a rate of one bale/1,000 sq. ft. to produce a light even mulch cover so that 50% of soil is visible through the mulch layer. NOTE: Seeding with a hydroseeder is NOT acceptable.
- D. Anchor mulch by thorough heavy coat of tackifier over entire area and watering.
- E. Protect seed bed from washout, wind erosion, rutting and drying out. Do not use machinery that leaves ruts in the seed bed. It is the Contractor's responsibility to add or remove mulch as needed to encourage optimum seed germination and growth.

3.6 SODDING

- A. Moistening the Soil: During periods of higher than optimal temperature for species being specified and after unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to laying the sod.
- B. Sod immediately after preparation of bed and Architect's approval.
- C. Lay sod to form a solid mass with tightly-fitted joints in strips parallel to contours. Butt ends and sides of sod strips. Do not overlap edges yet allow for pad shrinkage. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with finish grade of adjacent curbs, pavements, drainage structures and seeded areas.
- D. Do not lay dormant sod or install sod on soil surfaces that are hot, dry, saturated or rutted.
- E. When sodding slopes, install initial row of sod in a straight line, beginning at bottom of slope. Place subsequent rows parallel to and lightly against previously installed row.

- F. Sod abutting existing lawn or seeded lawns shall meet flush with top of sod pad (soil and thatch). Remove excess topsoil as necessary to meet flush.
- G. Stake sod in lawn swales and on lawn slopes 3H to 1V (horizontal to vertical) and steeper to prevent slippage. Use two (2) biodegradable stakes per square yard of sod. Stakes are to have their flat sides against the slope and be driven flush with sod surface.
- H. Roll with light static lawn roller to ensure contact with subgrade.
- I. As sodding is completed in anyone section, water sod thoroughly to a depth sufficient to ensure the underside of the new sod pad and topsoil immediately below the pad is thoroughly wet. Contractor is responsible to ensure there is an adequate water supply available prior to installation. Do not allow sod to dry out.

3.7 MAINTENANCE

- A. Maintenance by Contractor begins as soon as lawns are sodded or seeded. Protect lawns from drought, washout and wind erosion. In general, maintain new installed lawn areas, including watering, fertilizing, spot weeding, over-seeding, mowing, applications of herbicides, fungicides, insecticides, and re-sodding until a full, uniform, healthy, vigorous stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect. Specifically:
 - 1. Watering Seeded Lawns:
 - a. First Week: In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week to maintain moist soil to promptly germinate the lawn seed, preventing it from drying out, and keeping it in a healthy, growing condition until final acceptance. Lawn areas shall receive a minimum of one (1") of water per week, by natural rainfall, irrigation or a combination of both. Water daily until 2nd mowing (just enough water to keep the top ½" of soil moist, 1 time daily).
 - 2. Watering Sodded Lawns:
 - a. First Week: Soil on sod pads shall be kept moist. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least four (4") inches.
 - 3. Second and Subsequent Weeks: Contractor shall provide water to the lawns as required to maintain adequate moisture, in the upper four (4") inches of soil, necessary for the promotion of deep root growth until final acceptance. After 2nd mowing, water two (2) times weekly until thoroughly established.
 - 4. Protect: Protect lawn areas against trespass, vandalism and routine pedestrian traffic and Owner maintenance traffic by temporary fencing or other means.

5. Repair: Repair, rework, resod and overseed (as originally specified) areas that have washed out, eroded, do not germinate and are vandalized or otherwise damaged. Overseeding rates are to be adjusted to 6 lbs. of seed per 1,000 s.f.
6. Mow: Initial mowing shall begin when the blade height reaches 2" and the soil will bear the weight of the lawn mower. Use mowers with low impact tires. For the first 3 mowings cut the grass blades to 1.5 inches. After that mow the grass when it reaches a height of about 3.5" to a height of about 2.5". Never remove more than 1/3 of the grass blade at anyone mowing. **A minimum of three (3) mowings are required to establish final acceptance.** Notify the Architect of dates in writing as mowing is performed. Excess clippings shall be carefully raked so as not to remove healthy grasses, and removed.
7. Fertilizer: Apply subsequent fertilizer at the rate of 1.5-2 lbs./1,000 s.f. prior to final acceptance.
8. Weed Control: When infestation of weeds or crabgrass develops, treat infestation by hand weeding or herbicides control appropriate to the area. Furnish and install weed chemical control as recommended by manufacturer. Herbicides controls must be acceptable to the Owner. Obtain and pay for permits. Use as directed by the manufacturer and applicable laws, codes, ordinances and regulatory requirements. Under NO circumstances is it acceptable to seed or overseed over Nutsedge, Crabgrass or other grassy/broadleaf weeds.

- B. Maintenance by the Contractor continues through the certificate of substantial completion to final acceptance by the Architect as described below. Maintenance by Owner begins after final acceptance of the lawn.

3.8 STANDARDS FOR SUBSTANTIAL COMPLETION OF LAWNS: Review to determine substantial completion of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

- A. Lawn areas will be substantially complete provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, partially mature stand of lawn is established free of weeds, undesirable grass species, disease, and insects
- B. Lawn areas shall not have more than 10% dead/bare spots.
- C. The Landscape Architect will prepare a written punch list of items which need correction prior to final acceptance.

3.9 STANDARDS FOR FINAL ACCEPTANCE OF LAWNS: Review to determine final acceptance of lawns will be made by the Landscape Architect, upon request. Provide notification at least five (5) working days before requested review date.

- A. Lawn areas will be acceptable provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, full stand of lawn is established free of weeds, undesirable grass species, disease, and insects

- B. Any lawn which contains disease, more than 1% dead/bare spots, or any dead/bare area greater than one (1) square foot shall be rejected and the unacceptable area(s) repaired as originally specified at no additional cost to the Owner.

3.10 CLEAN UP

During the contract and at intervals as directed by the Architect and as lawn work is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, neat, well-draining condition.

END OF SECTION 329201

SECTION 331101 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of the water distribution system is shown on the drawings.
- B. The water distribution work includes, but is not limited to, the following:
 - 1. Trenching and Backfilling
 - 2. Piping and jointing
 - 3. Connections to existing water system
 - 4. Installing water meter, (*provided by others*)
 - 5. Testing
 - 6. Clean Up
- C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications including trenching, pipe bedding, backfill, compaction, testing, and site restoration from the ROW to Campus Safety Building entrance. Install water meter.
- D. Work by Village of Hamilton, including providing and installing corporation stop, tap, curb stop, trenching, pipe bedding, backfill, compaction, and road pavement restoration within the ROW.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 321301 – Site Concrete
- C. Section 331102 - Disinfection of Water System

1.3 REFERENCES (AWWA, latest edition)

- A. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association (ANSI/AWWA C104/A21.4).
- B. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
- C. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association (ANSI/AWWA C151/A21.51).
- D. AWWA C502 - Dry Barrel Fire Hydrants; American Water Works Association (ANSI/AWWA C502/C502a).
- E. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association (ANSI/AWWA C509/C509a).
- F. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association (ANSI/AWWA C600).

G. NSF/ANSI 61 – Drinking Water System Components.

1.4 SUBMITTALS: (See Section 311201, 1.5)

A. Provide Manufacturer's Product Data (MPD) for:

1. Water pipe and joints

B. Provide Material Certificates and samples as noted:

1. Granular Backfill: Material Certificates and sample.

2. 4,000 psi concrete: Material Certificate showing design mixes.

C. Permits, Notification, Certification, and Test Reports: Provide per 1.5, C, D and 3.3, F & G below.

1.5 JOB CONDITIONS

A. Job conditions in Section 334001 apply.

B. Water distribution work shall conform to standards of applicable government authorities having jurisdiction.

C. Obtain and pay for permits and approvals required by local authorities. Copy permit to Architect.

D. Notify Municipal Engineer in writing two (2 wks.) weeks prior to start of work. Copy letter to Architect.

E. Construction Review: Notify the Architect when the work is approximately 25%, 75% and 95% complete.

F. Verify location for new water meter and service entrance.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with NYS Health Department Standards.

B. Codes and Standards: ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete", comply with applicable provisions except as otherwise indicated.

1.7 TESTING

A. Notify Architect and Municipal Engineer a minimum of forty-eight (48 hrs.) hours in advance.

B. Provide materials and labor to carry out testing in the presence of the Architect and/or Municipal Engineer. Test water system with an hydrostatic pressure test for two hours in conformance with AWWA Standard C600 or ASTM F2164.

1. Do not exceed the following leakage rates per 1,000 feet of pipe, respectively, for the two hour test period at 150 psi:

Pipe Diameter	Allowable Leakage
¾"	0.124 gal.
1"	0.165 gal.
1 ½"	0.248 gal.
2"	0.331 gal.
2 ½"	0.414 gal.
4"	0.662 gal.
6"	0.993 gal.
8"	1.324 gal.
10"	1.655 gal.
12"	1.986 gal.

2. Valid test pressure shall not vary more than (+/-) 5 psi.
3. Any leakage beyond limits described shall be located and repaired. Retest system to insure adequate performance of pipe.

PART 2 - PRODUCTS

2.1 PIPING, FITTINGS, AND BACKFILL

- A. Copper pipe for three quarter inches (¾") shall be ASTM B88, Type K soft-tempered copper pipe, with flared fittings.
- B. Fittings/ copper: Standards ASME B16.22; ASTM B75 Alloy C12200; ISO 9001; MSS SP-104; NFPA 99; Pamphlet G4.1; Third-Party Certified 372; Third-Party Certified NSF/ANSI 61; UL 207
- C. Backfill shall be as specified in Section 312201, 2.1, B.
- D. Concrete for thrust blocks shall be 4,000 psi as specified in Section 321301, 2.1.

2.1 WATER METER

- A. Provided by others.

PART 3 - EXECUTION

3.1 CONNECTIONS TO OTHER WATER SYSTEMS

- A. Connections at Buildings:
 1. Locate accurately per site and plumbing drawings. Verify inverts, locations, and sizes. Notify Architect of any discrepancies immediately prior to installation.

2. Connect existing building service piping to new distribution main using smooth flexible coupling to join dissimilar pipes to provide watertight joint with low friction loss characteristics.
 3. Wall penetrations shall be sealed and made watertight.
- B. Connections to the existing water supply system:
1. Provide the Municipality with at least two (2) weeks notice prior to conducting work so that field procedures and installations can be reviewed by a representative of the Municipality. Copy letter to Architect.
 2. Locate accurately per site drawings. Verify inverts, locations, and sizes. Notify Architect of any discrepancies prior to installation.

3.2 TRENCHING AND BACKFILL

- A. See Section 312201 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe. Remove all stones greater than 4" diameter to a depth of at least 6" below the bottom of the pipe.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction and dead ends as shown on the Contract Drawings. Place concrete to permit full access to pipe and pipe accessories. Care shall be exercised in the placement of concrete to allow disassembly of mechanical joints.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.3 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with details shown on Contract Drawings.
- B. Water pipe shall have a minimum of five and one half (5- 1/2') feet of cover as measured from the top of the pipe to finish grades. Bed pipe as detailed. Place backfill around pipes to equal depths on both sides as work progresses. When pipe laying is not actually in progress, the open ends of the pipes shall be closed temporarily with pipe plugs or by other means. When water is in the trench, plugs shall not be removed until danger of water entering the pipe has passed.
- C. Install pipe to indicated elevation to within tolerance of 1 inch.
- D. No pipe shall be laid upon a foundation in which frost exists, nor at any time when there is a danger of the formation of ice, or the penetration of frost at the bottom of the excavation.
- E. Route pipe in straight line.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

- G. Install access fittings to permit disinfection of water system performed under Section 331102.
- H. Compact trenches to at least ninety five (95%) percent maximum density as specified in Section 312201. Settlement shall be repaired by the Contractor at no additional cost to the Owner.
- I. Install concrete cradles, saddles and thrust blocks where shown on drawings as detailed and specified in Section 321301, Part 3. Provide bracing and blocking at bends, 22-1/2 degrees or greater, tees, crosses and plugs. Block and anchor with concrete so that there will be no movement of the pipe in the joints due to internal or external pressures. The concrete shall be placed around the fittings and completely fill the space between the fittings and walls of the trench, from 6" below the fittings of pipe, to 12" above the fittings. The anchor concrete shall be so placed that the bell and spigot joints or other joints may be recaulked or tightened if necessary. Concrete thrust blocks shall conform dimensionally to details shown on drawings.

3.4 WATER METER

- A. Install the meter in accordance with manufacturer and local water authority standards.

3.5 FIELD QUALITY CONTROL

- A. All new water piping and fittings shall be thoroughly flushed prior to pressure testing. The flushing rate shall be at least 2.5 ft./sec.
- B. Pressure test all new water piping and fittings using a test pressure not less than 150 psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to the Owner.
- D. After all work has been successfully inspected and tested, the new water piping, valves, and fittings shall be disinfected by the Contractor in accordance with AWWA C651, latest edition as specified in Section 331102 of these Specifications.

3.6 CLEAN UP

During the contract and at intervals as directed by the Architect and as the water distribution system is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 331101

SECTION 331102 - DISINFECTION OF WATER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Disinfection of site domestic water lines and appurtenances specified in Section 331101.
- B. Testing and reporting results.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 331101 - Water Distribution

1.3 REFERENCES

- A. AWWA B300 - Hypochlorites; American Water Works Association; 1992 (ANSI/AWWA B300).
- B. AWWA B301 - Liquid Chlorine; American Water Works Association; 1992 (ANSI/AWWA B301).
- C. AWWA B302 - Ammonium Sulfate; American Water Works Association; 1995 (Revised) (ANSI/AWWA B302).
- D. AWWA B303 - Sodium Chlorite; American Water Works Association; 1995 (Revised) (ANSI/AWWA B303).
- E. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 1992 (ANSI/AWWA C651).

1.4 SUBMITTALS: (See Section 311201, 1.5)

- A. Test Reports: Indicate results comparative to specified requirements.
- B. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- C. Disinfection report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- D. Bacteriological report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.

3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of NYS Department of Health.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.6 REGULATORY CERTIFICATION REQUIREMENTS

- A. Provide certificate of compliance from authority having jurisdiction indicating approval of water system. Provide written certification from Village Public Works Superintendent that water system has been tested for leakage and sterilized and disinfected in a manner satisfactory to the Health Department having jurisdiction, but in no event less stringent than that provided for in AWWA Standard for disinfecting water mains C601, latest issue. Hypochlorites and liquid chlorines used in disinfection shall conform to most recent AWWA Standards B300 and B301. Provide certification prior to Architect issuing final acceptance. No water main or pipes shall be placed into service until test results are provided documenting that the water system is bacteriologically safe.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.2 EXECUTION

- A. Provide specific water main taps located adjacent to ends of main and attach required equipment to perform the work of this Section.
- B. Inject treatment disinfectant along with potable water into piping system. Chlorine shall be fed at a constant metered rate into the feed water so that the chlorine concentration will result in at least 50 milligrams per liter (parts per million) concentration. Chlorine required to produce .50 mg/l concentration per 100 feet of pipe shall be as follows: 4" - 0.33 Gal. of 1% chlorine solution, 6" - 0.73 Gal. of 1% Chlorine Solution; 8" - 1.30 Gal. After filling the main pipe with chlorine solution, open each service line and hydrant

branch to fill them with the same chlorine solution. Test the solution as it is withdrawn from each point until at least 50 mg/l concentration is obtained.

- C. Maintain disinfectant in system for 24 hours. Read and record chlorine residual after the 24 hour contact time; Minimum allowable level shall be 20 ppm.
- D. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water. After flushing, take 2 samples, one from the domestic service line at its connection to the building plumbing system and one from a hydrant remote from the domestic service connection. Submit these samples for bacteriological analysis. Submit test reports to the Architect. If the initial disinfection fails to produce acceptable results, the procedure shall be repeated until a satisfactory report is obtained.
- E. Temporary taps shall be excavated, shut off and abandoned following satisfactory quality test results. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

- A. Test samples in accordance with AWWA C651.

3.4 CLEAN UP

- A. During the contract and at intervals as directed by the Architect and as the disinfection of water system is completed, clear the site extraneous materials and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 331102

SECTION 333000 - SITE SANITARY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of Site Sanitary work is shown on the drawings.
- B. Sanitary work includes, but is not limited to:
 - 1. Sanitary Manholes
 - 2. Concrete manhole adaptors
 - 3. Trenching and Backfilling
 - 4. Piping and jointing
 - 5. Cleanout at ROW
 - 6. Connections to existing sanitary systems
 - 7. Testing
 - 8. Clean Up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications, including: trenching, pipe bedding, backfill, compaction and site restoration, (both in ROW and campus).
- D. Work by Village of Hamilton: Road pavement restoration within ROW associated with sanitary work only.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 334001 - Storm Drainage

1.3 SUBMITTALS: (See Section 311201, 1.5)

- A. Provide Manufacturer's Product Data (MPD) and Shop Drawings for:
 - 1. Precast Structure (Manholes, castings): Also, certification that structures meet H-20 loading requirements specified.
 - 2. Pipe and jointing MPD only
 - 3. Concrete manhole adaptors
- B. Provide Material Certificates: Also, samples as noted.
 - 1. Granular Backfill: Sample

1.4 JOB CONDITIONS

- A. Job conditions in Section 334001 – Storm Drainage apply.
- B. Sewer work shall conform to standards of applicable government authorities having jurisdiction. Obtain and pay for permits and approvals required by local authorities. Copy permits to Architect.

- C. Notify Municipal Engineer/ Village DPW or applicable government authority having authority in writing two (2 wks.) weeks prior to start of work. Copy letter to Architect.
- D. Certification: The sanitary system must be installed and certified by a licensed county Plumber when required by municipal or state law.
- E. Construction Review: Notify the Architect when the sanitary sewer system is approximately 25%, 75% and 95% complete.

PART 2 - PRODUCTS

2.1 SANITARY MANHOLE

- A. Shall conform to Section 334001 - 2.2, A., 2.3, 2.5, and 2.6.
- B. Manhole frames and covers shall be Syracuse Casting Sales Corp. Pattern 1030, Neenah Foundry Co. R-1642 with Type "A" lid of Architect approved equal. Lid shall have raised lettering on the cover to designate "SANITARY SEWER". Frames and covers shall be machined to prohibit rocking.
- C. Pipes entering manhole shall have concrete manhole adaptors as manufactured by (CMA) FERNCO or Architect approved equal.

2.2 GRANULAR BACKFILL

- A. Backfill for piping and sanitary structures shall be as specified in Section 312201, 2.1, B.

2.3 PIPING

- A. P.V.C. Gravity Sewer Pipe shall conform to ASTM D-3034, SDR 35. Joints shall be rubber flexible gasketed joints conforming to the ASTM F477.

2.4 APPURTANANCES

- A. Pipe fittings, (Wyes/ Elbows/ Tees/ Couplings): P.V.C. Gravity Sewer Pipe shall conform to ASTM D-3034, SDR 35, Charlotte Pipe schedule 40, or equal.
- B. Cleanouts: Cast iron, EJ #3648 or equal.
- C. Adaptors: FERNCO PVC flexible couplings.

2.5 TESTING

- A. Deflection testing of plastic sewer piping "Go/ No Go" mandrel. Pull/retrieval ropes.
- B. Exfiltration testing equipment: Plugs. Pump. Measuring Device.

PART 3 - EXECUTION

3.1 CONNECTIONS TO OTHER SANITARY SYSTEMS

A. Connections at Building(s): *(if applicable)*

1. Locate accurately per site and plumbing drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.
2. Install pipe and jointing to five (5') feet from the exterior building face.
3. Cap end and mark.
4. The Plumbing Contractor will make connection.

B. Connections to existing Sanitary Systems:

1. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation. Coordinate with the Municipality and other agencies having authority. Obtain require permit(s).
2. The Village of Hamilton DPW to review and approve sewer main connection at street prior to backfilling.
3. Notify governing agency in writing a minimum of two weeks prior to anticipated date of connection. Copy letter to Architect.
4. Connect the site sanitary system to the laterals or manholes as indicated. Core drill exiting manholes for new connections with tolerance for waterproof manhole adapter.
5. Connect lateral lines into main with approved, water-tight duplex adaptor and 45-degree bend to the sewer main.
6. TEE lateral Connection to sewer main: Geneco T-wye saddle with stainless steel t-bolts and stainless-steel swivel pins, strap and nuts.
7. Manhole connections shall be made with approved concrete manhole adaptors.
8. Pipe sleeves shall be 2 pipe sizes larger than the specified pipe diameter.
9. College Facilities to witness deflection/ lamp testing of installed sanitary main.

3.2 TRENCHING AND BACKFILL

Shall be as described in Section 334001, 3.2.

3.3 CASTINGS

Shall be as described in Section 334001, 3.4.

3.4 PIPE LAYING

- A. Bed pipe in granular backfill or concrete as shown on drawings, compact under spring line of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.
- B. Place backfill around pipes to equal depths on both sides as work progresses. Compact trenches to at least ninety-five (95%) percent maximum density as specified in Section 312201.

- C. P.V.C. pipe push type joints shall be made using the flexible gaskets specified. Push together pipes so that the gasket is firmly seated in the socket.
- D. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

3.5 TESTING

- A. Deflection Testing of Plastic Sewer Piping: Perform vertical ring deflection testing on PVC sewer piping after backfilling has been in place for at least 30 days. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter. Perform deflection testing using "go, no go" mandrel. Mandrel Diameter: Not less than 95 percent of base or average ID of pipe. Pipe Diameter: Comply with ASTM D2122. Perform testing without mechanical pulling devices. Locate, excavate, replace, and retest piping that exceeds allowable deflection.
- B. Exfiltration Testing of Pipes Larger Than 24 Inches in Diameter: Perform exfiltration testing not exceeding 100 gal. for each inch of pipe diameter for each mile per day for each reach of piping undergoing testing. Perform testing with minimum positive head of 2 feet.

3.6 PROVIDE CERTIFICATION

- A. Provide written certification from the Municipal Engineer that the sanitary work in the public right of way has been installed in a manner satisfactory to the governing agency having authority over the work. Provide certification prior to Architect issuing final acceptance.
- B. Patch road cuts, sidewalks, lawns or other surfaces in accordance with Municipal DPW standards.
- C. Provide record survey of finished sewer work.

3.7 CLEAN UP

During the contract and at intervals as directed by the Architect and as the sanitary sewer system is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 333000

SECTION 334001 - STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of the storm drainage is shown on the drawings.
- B. Storm drainage work includes, but is not limited to:
 - 1. Trenching, backfilling and compaction
 - 2. Storm structures, castings, and appurtenances
 - 3. Piping, jointing and fittings
 - 4. Connection(s) to other storm system(s)
 - 5. Underdrain(s)
 - 6. Storm Water Retention Structure (*subsurface storage system*)
 - 7. Sleeves and seals
 - 8. Inspection Ports
 - 9. Quality Control Testing and Submittals
 - 10. Clean Up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312501 - Erosion, Sediment and Pollution Control
- C. Section 312201 - Site Earthwork: For Elaboration of Shoring and Bracing, Dewatering, Backfilling, Compaction and Field Quality Control Testing.
- D. Section 333000 - Sanitary

1.3 REFERENCES

- A. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

1.4 SUBMITTALS: (See Section 311201, 1.5)

- A. Shop Drawings (SD) required for:
 - 1. Precast concrete drainage structures showing sizes, elevations for openings and, HS-20 loading certification.
 - 2. Storm Water Retention Structures, (*subsurface storage system*)
- B. Manufacturer's Product Data (MPD) required for:
 - 1. Drainage structures and castings

2. Pipe, joints and fittings
 3. Underdrain(s)
 4. Geotextiles
 5. Sleeves and seals
 6. Storage Chambers
- C. Material Certificates (MC) showing mechanical analysis and samples required for:
1. Drainage Stone
- D. Quality Control Submittals:
1. Provide a list of completed projects including Owner's contact information for each project, demonstrating compliance with applicable "Experience Requirements" specified in "Quality Assurance" of this specification section.
 2. Provide Infiltration Testing Report(s) for infiltration system as described in "Quality Assurance" of this specification section. Stormwater facility design may be adjusted by Architect depending on results of tests.

1.5 QUALITY ASSURANCE

- A. Drainage Contractor Experience Requirements:
1. Submit business name, business owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Drainage for this Project.
 2. Provide a list of at least four (4) Drainage work projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.
- B. Infiltration Testing Required by Contractor: (*Subsurface Storage System*)
1. Perform three, (3) infiltration tests in locations as directed by the Architect and as specified.
 2. May be done through a boring or open excavation as described in NYSDEC, Division of Water, published in Standards of Wastewater Treatment Works, 1988 or latest revision.
 3. Install casing (solid 4-6 inch diameter, 30" length) to 24" below finished grade.
 4. Remove any solid surface and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester's discretion, a two (2") inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with *clean* water to a depth of 24" and allow to pre-soak for twenty-four hours.

5. Twenty-four hours later, refill casing with another 24" of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a total of four observations. Upon tester's discretion, the final field rate may either be the average of the four observations, or the value of the last observation. The final rate shall be reported in *inches per hour*.
6. Upon completion of the testing, the casing shall be immediately pulled, and the test pit shall be backfilled and site restored.

1.6 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Plan and execute piping work so that trenches are not opened for more than two hundred (200') feet in advance or left unfilled more than one hundred (100') feet behind. No overnight open excavation is permitted.
- C. **CERTIFICATION OF STORM SYSTEM:** The storm system must be installed and certified by a licensed County Plumber when required by municipal code or state law.
- D. **CONSTRUCTION REVIEW:** Notify the Architect when:
 1. Storm structures are set, prior to backfilling.
 2. Subgrade elevation is achieved for the subsurface storage system.
 3. Subsurface storage system/ structures are installed, prior to backfilling

1.7 SUBSTITUTIONS

- A. Contractor is responsible for design/ calculations / certifications of any substituted systems or units specifies under Section 334001 by a NYS licensed engineer. Submit to Architect for approval.
- B. If a product is being submitted as a substitution to the specified product; the Contractor shall submit and request a product material substitution with the bid. The Contractor shall at a minimum provide the following for review by the Architect and Owner:
 1. All submittals as specified herein
 2. Product comparison
 3. Cost Information (including proposal of change in Contract Sum)
 4. Contractor's certification that proposed substitution complies with requirements in the Contract Documents
 5. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

PART 2 - PRODUCTS

2.1 BACKFILL

- A. Backfill for pipes and drainage structures shall be as specified in Section 312201.

2.2 STORM STRUCTURES AND CASTINGS

- A. Storm Inlets, Manholes and Control Structures:

1. Shall be precast reinforced portland cement concrete conforming to the size(s) and shape shown on drawings, designed for AASHTO HS-20 loading. The materials and structural design of the structures shall be per ASTM C478 and ASTM A497, Grade 60. The minimum compressive strength of the concrete in the structure base, riser, and top section shall be 5,000 psi. The minimum wall thickness shall be one twelfth of the internal diameter of the riser or largest cone diameter. All joints shall be waterproofed with O-ring rubber gaskets and sealed with a mastic treatment in accordance with ASTM C990. Any grout used within the system shall meet the ASTM C 1107. Manhole connector holes shall be equipped with a seal gasket that meets or exceeds material specification of ASTM C-923 or other locally approved methods. Base units shall be extended. Standard of quality shall be as manufactured by Zeiser Wilbert, Jefferson Concrete, Fort Miller or Architect approved equal.
2. Castings: Provide HS20 loading and bike safe grates, ductile iron meeting grade 65-45-12 as determined by ASTM A536-84, sizes as noted on the plans. Frames, covers and grates shall be machined to prohibit rocking. Standard of Quality shall be Neenah Foundry, East Jordan Iron Works, US Foundry, or Architect approved equal.

2.3 STORM STRUCTURE APPURTENANCES

- A. Precast Concrete Adjustment Rings: Shall be square or round depending on structure. Built in accordance to ASTM C478, and made of 5,000 psi concrete and reinforced steel, meeting ASTM A615 Grade 60, as manufactured by Fort Miller, Zeiser Wilbert, Jefferson Concrete or Architect approved equal.
- B. Steps: Shall be copolymer polypropylene plastic reinforced with 1/2" diameter grade 60 steel as manufactured by M.A. Industries or Architect approved equal.
- C. Mortar: Shall be lime, cement, and clean sand, 1:1:3 measured by volume, meeting ASTM C1107.

2.4 PIPING

- A. High Density Polyethylene Pipe (HDPE): Shall be heavy duty dual wall, high density polyethylene (HDPE) pipe conforming to ASTM F2648 for 4" to 60" pipe with a smooth inner wall, annular corrugations, "n" flow rating of 0.012, and HS-20 loading capability with minimum one (1') foot cover for 4" to 48" pipe and two (2') foot cover for 6-" pipe. Joint couplings for pipe shall be connected using a bell & spigot joint, meeting AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Standard of quality shall be N-

12 Mega Green ST IB pipe as manufactured by Advanced Drainage Systems, Inc., 800-821 6710, or Architect approved equal.

2.5 UNDERDRAIN(S)

- A. Pipe and fittings shall be flexible, corrugated, perforated (or slotted) and filter-wrapped polyethylene tubing meeting requirements ASTM F-667 for underdrain 4" to 24" diameter. Standard of quality shall be ADS Drain Guard and Sock with prefabricated fittings, as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051, or Architect approved equal. Size pipe(s) as noted on drawings.
- B. Backfill: Shall be clean, coarse, concrete sand as indicated in Section 312201.

2.6 STORM WATER RETENTION STRUCTURES_(*Subsurface Storage System*)

- A. Chamber Design:
 - 1. Only stormwater chamber systems evaluated by a NYS licensed design engineer and found to meet AASHTO section 12.12 safety factors will be considered.
 - 2. Stormwater chambers shall be designed in accordance with ASTM F 2418-16a or F 2922 Standard Specification for Polypropylene (PP) or Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers
 - 3. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LFRD bridge design specifications, section 12.12, are met for: 1) Long-duration dead loads and 2) Short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.
 - 4. Stormwater chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F 2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) Instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) Maximum permanent (75-yr) cover load and 3) Allowable cover with parked (1-week) AASHTO design truck.
 - 5. Stormwater water retention structures standard of quality shall be: **StormTech Model MC-3500** as manufactured by **Advanced Drainage Systems, Inc.**, (614)
- B. Performance:
 - 1. Upon request by the Architect or Owner, the chamber manufacturer shall submit a structural evaluation for approval before delivering chambers to the project site as follows:
 - a. The structural evaluation shall be sealed by a NYS licensed professional engineer.
 - b. The structural evaluation shall demonstrate that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the

minimum required by ASTM F 2787 and by sections 3 and 12.12 of the AASHTO LFRD bridge design specifications for thermoplastic pipe.

- c. The test derived creep modulus as specified in ASTM F 2922 shall be used for permanent dead load design except that it shall be the 75-year modulus used for design.
3. Only mechanical and material properties that were determined in accordance with ASTM test methods shall be allowed for structural design of the chambers.
4. Only chambers affixed with the ASTM F 2418-16a or F 2922 designation shall be considered as meeting ASTM F 2418-16a or F 2922.
5. The contractor shall submit design summary by the manufacturer that demonstrates that the system is designed to convey peak flow rates without scour of foundation stone.

C. Materials:

1. Chamber:

- a. Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene or polyethylene copolymers.
- b. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance functions.
- c. Inspection ports shall be installed and constructed per project plans. Note that inspection ports shall only be installed along the Treatment Row to allow for inspection of the sediment build up over time.
- d. The chambers shall be open-bottomed.
- e. The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be built. Chamber models may be cut at the job site to improve site optimization and reduce product waste.

2. Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

3. End Caps:

- a. End caps shall be injection molded or roto molded from polyethylene or polypropylene resin and allow pipe connections with polyethylene pipe. End caps shall have a curved face capable of resisting typical horizontal and vertical loads.
- b. All chamber rows shall be terminated with an end cap. End cap placement on end of chamber will vary depending on chamber model.
- c. End caps may incorporate cutting guides to allow easy field cutting for various diameters of pipe. Cutting guides shall be located at both the top and bottom of each end cap.

4. Manifold Piping:

- a. Manifold piping shall be designed to ensure that peak flows are distributed to the rows of chambers without scour of foundation stone.
- b. Manifold piping shall be of dual wall HDPE piping such that accepted equations of hydraulics can be used as a basis for design.

5. Stone:

- a. The foundation, embedment and cover stone shall be in accordance with the chamber manufacturer's installation instructions.
- b. Foundation and Backfill for "MC" chambers shall be clean, crushed, angular stone meeting the following gradation as determined by ASTM-C136 and AASHTO M43:

<u>Standard Sieve Sizes</u>	<u>Percent Passing By Weight</u>
2" or 50 mm	100%
1-1/2" or 37.5 mm	90 - 100%
1" or 25 mm	20 - 55%
3/4" or 19.0 mm	0 - 15%

6. Fabric:

- a. Fabric between the chamber bottom and the stone foundation located along the entire length of the Treatment Row and the first 14.5 ft of all inlet rows.
- b. Fabric shall be Mirafi 500X as manufactured by TenCate or Architect approved equal for sediment capture, filtration and scour protection.
- c. Fabric between the top of the Treatment Row chambers and the embedment stone and surrounding the entire chamber system shall be Mirafi 140N as manufactured by TenCate or Architect approved equal for filtration.
- d. If shown and labeled on the drawings, a non-reinforced 30 mil PVC liner with solvent welded seams will be installed around the entire system to prevent water migration. See manufacturer's Tech Sheet #2 for guidance on PVC liners for the system.

D. Stormwater Treatment Row:

- 1. The stormwater chamber system shall incorporate an Treatment Row for stormwater treatment and system maintenance. An Treatment Row is a chamber row enclosed in geotextile fabric for sediment capture and maintenance.
- 2. The Treatment Row shall remove a minimum of 80% of Total Suspended Solids (TSS), 80% Total Petroleum Hydrocarbons (TPH), 80% Suspended Sediment Concentration, 60% Total Phosphorus, and 605 Total Zinc as verified by 3rd party testing.
- 3. Stormwater treatment system inspection and maintenance shall be in accordance with the Operations and Maintenance (O&M) section of the Stormwater

Pollution Prevention Plan (SWPPP) and the product manufacturer's published guidance.

- E. Accessories:
 - 1. Spacers can be used to obtain the required minimum spacing between chamber rows.
 - 2. During construction inlet filters or pipe plugs on all inlet pipes to the stormwater chamber system shall be used to prevent construction sediment from entering the Treatment Row system. Pipe plugs to be removed once construction of the system is complete and no further construction sediment loading is expected.
- F. Imported Granular Backfill above Stormwater Retention Structures: Shall be as specified in Section 312201, 2.1, B.

2.7 PIPE SLEEVE AND WATERPROOF SEALS

- A. Sleeves shall be constructed of steel with a waterstop and anchor collar, 2" minimum. Sleeve length shall equal foundation wall thickness. Waterproof seals shall be rubber. Standard of quality: shall be the Link Seal Wall Sleeve and Link Seal Gasket as manufactured by the Thunderline Corporation or Architect approved equal.

2.8 INSPECTION PORT

- A. Lamp hole shall be ductile iron as manufactured by Neenah, East Jordan Ironworks, US Foundry or Architect approved equal.
- B. Two, (2) inspection ports required for each subsurface infiltration field.

PART 3 - EXECUTION

3.1 CONNECTIONS TO OTHER STORM SYSTEM

- A. Connections at Building(s):
 - 1. Locate accurately per site and plumbing drawings. Verify invert and sizes. Notify Architect of any discrepancies immediately, prior to installation.
 - 2. Install pipe and jointing to within five (5') feet of each building exterior. Install temporary plugs, cap end, mark above grade, and protect. Coordinate with Plumbing Contractor. Connection will be made by Plumbing Contractor.
 - 3. The Plumbing Contractor shall be responsible for connecting the building drains and leaders to the site storm system.
 - 4. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.
- B. Connections to existing Storm Systems:

1. Coordinate with the Municipality and other agencies having jurisdiction. Notify governing agency in writing a minimum of two (2) weeks prior to anticipated date of connection so that field procedures and installation can be reviewed by a representative of the Municipality. Copy letter to Architect.
2. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.
3. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

3.2 TRENCHING AND BACKFILL

- A. Reference: Refer to Section 312201 for elaboration of shoring and bracing, supporting, rock, dewatering, and backfilling.
- B. Trenching:
 1. Remove material encountered to the depth shown on drawings and with a maximum width of fourteen (14") inches and a minimum of nine (9") inches each side of conduit springline as detailed. Provide safe shoring, sheeting, and bracing. Remove before backfilling. Backfill excess or over excavation as described in Section 312201 to proper line and grade. Compact to 95% density.
 2. When unsatisfactory soil materials are encountered at design elevations, immediately notify the Architect in writing via email. Continue as directed by the Architect. When conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price basis in accordance with specification Section 312201.
- C. Water: Remove from trenches; drain trenches and/or provide sump pits and pumping equipment as necessary to keep trenches stable and dry at no additional cost to the Owner.
- D. Soft Material in Trench Bottom: Dry out and stabilize or remove and replace with imported granular backfill material to achieve firm, stable foundation at no additional cost to the Owner.
- E. Rock: Remove boulders and rock within one (1'-0") foot of pipe. Provide one (1'-0") foot of granular backfill between rock and conduits at no additional cost to the Owner.
- F. Backfill: Conform to details on drawings and as specified. Compact backfill to a minimum 95% of optimum density.

3.3 STORM STRUCTURES INSTALLATION

- A. Pre-Cast Structures:
 1. Install with corresponding extended precast base section. Precast base units shall be modified in the factory to have the correct size openings for piping.

2. Provide drainage structures as detailed, built to finished grades given. Backfill with imported granular backfill material around drainage structure and compact to 95% density to avoid settlement.
3. Mortaring: Thoroughly wet concrete risers before laying. Mortar joints. Joints shall be completely full and struck flush.
4. Install any required steps in a continuous flight, avoiding any conflict with piping.
5. Construct channels in base of storm structures for positive flow from inlet to outlet piping where detailed.
6. Build completed structure to avoid any infiltration or exfiltration of water except at underdrains or storm water management trenches.

3.4 CASTINGS

- A. Provide the type specified and shown on drawings. Build to the finish grade as shown on drawings.
- B. Set castings firmly. Loose or rocking castings shall be rejected by the Architect.

3.5 ADJUSTING EXISTING UTILITIES

Adjust existing utilities as necessary to maintain utility service and meet finished grade conditions. Existing utilities include but are not limited to; water valves, gas valves, electric pull boxes or manhole rims, storm drainage rims, cable and telephone markers, sanitary cleanouts.

3.6 PIPE LAYING

- A. Shall be in accordance with ASTM D2321 and pipe manufacturer requirements.
- B. Bed pipe in granular backfill or concrete as shown on drawings, compact under springline of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.
- C. Pipe joints shall be made using the flexible gaskets specified. Clean bell end of any debris and lubricate. Remove protective wrap from gasket. Do not allow lubricated section to touch dirt or backfill. Foreign matter could adhere to surface and compromise joint integrity. Push together pipes so that the gasket is firmly seated in the socket. Always push spigot end into bell, not bell end into spigot.
- D. Place backfill around pipes to equal depths on both sides as work progresses.
- E. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

3.7 UNDERDRAIN

- A. Use only pipe which is undamaged and flexible (have not been exposed to direct sunlight for more than six (6) months causing brittleness, cracking or splitting prior to placement). Pipe shall be stored for at least twenty-four (24 hrs.) hours in an area having a minimum temperature of fifty (50) degrees F.
- B. Provide underdrains as shown on the drawings and backfill as detailed. Wrap all underdrains with continuous envelope of soil separation fabric overlapping fabric joints as noted. Slope pipe parallel with the finish grade, level, or as noted on the drawings.
- C. Compact backfill in trenches to the maximum density of adjacent materials.

3.8 PIPE SLEEVE AND WATERPROOF SEAL

- A. Locate and install sleeves where indicated on the drawings. Maintain the same line and grade of the storm pipe. Coordinate the installation of the sleeve with the other contractors prior to installation.
- B. Provide the waterproof seal between sleeve and storm pipe. Installation shall be approved by the Architect before backfill is installed.

3.9 INSPECTION PORT

- A. Install as detailed. Locations to be approved by Architect.
- B. Construct flush with finished grade.

3.10 STORM WATER RETENTION STRUCTURES (*subsurface infiltration system*)

- A. Locate, stabilize and protect areas prior to bed excavation. Delineate perimeter of beds with silt fence to keep silt and heavy equipment out.
- B. Chambers shall not be installed until the manufacturer's representative has completed a pre-construction meeting with installers.
- C. Install as detailed and according to manufacturer's recommendations. Do not use crushed or recycled concrete in the installation or for backfill on the installation. Compact backfill to maximum density of adjacent materials.
- D. Chambers are not to be backfilled with a dozer or an excavator situated over the chambers.
 - 1. Manufacturer recommends three backfill methods:
 - a. Stoneshooter located off the chamber bed.
 - b. Backfill as rows are built using an excavator on the foundation stone or subgrade.
 - c. Backfill from outside the excavation using a long boom hoe or excavator.

- E. The foundation stone shall be leveled and compacted prior to placing chambers.
- F. Joints between chambers shall be properly seated prior to placing chambers.
- G. Maintain minimum - nine (9") inches spacing between the chamber rows.
- H. Inlet and outlet manifolds must be inserted a minimum of twelve (12") inches into chamber end caps.
- I. Stone must be placed on the top center of the chamber to anchor the chambers in place and preserve row spacing.
- J. Continue protecting beds during and after installation until final acceptance. Prevent heavy equipment and stockpiled materials from crushing or damaging the units and misaligning the pipes. Remove and replace damaged units, pipes and materials. Do not incorporate damaged materials into any installation.

3.11 FIELD QUALITY CONTROL

- A. Density Testing: Perform all density testing for piping trenches and structure backfill as indicated in Section 312201.

3.12 CLEAN UP

- A. During the contract and at intervals as directed by the Architect and as storm drainage is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, neat condition.
- B. Clean drainage structures, storage chambers and pipes: Clean out sediment, rubbish, construction debris, and foreign objects thoroughly, immediately prior to final acceptance.

END OF SECTION 334001