
PROJECT MANUAL

NEW YORK STATE INSURANCE FUND BUFFALO PARKING LOT PROJECT

06/03/2026

CHA PROJECT #: 104748.000

Prepared for:

**NEW YORK STATE INSURANCE FUND
225 OAK ST, BUFFALO, NY 14203**

Prepared by:

**CHA
III Winners Circle
Albany, New York 12205
(518) 453-4500**

**NEW YORK STATE INSURANCE FUND
225 OAK ST, BUFFALO, NY 14203**

**NEW YORK STATE INSURANCE FUND
BUFFALO PARKING LOT PROJECT**

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

Division 26 – Electrical

260001 Electrical

Division 31 – Earthwork

310519.13 Geotextiles
311000 Site Clearing
312000 Earth Moving
312333 Trenching and Backfilling
312500 Erosion and Sediment Control

Division 32 – Exterior Improvements

321116 Subbase Courses
321216 Asphalt Paving
321630 Concrete Sidewalks
321723 Pavement Marking
329000 Planting
329113 Soil Preparation
329200 Turf and Grasses

Division 33 – Utilities

330500 Common Work Results for Utilities
330513 Manholes and Structures
334100.20 High Density Polyethylene Storm Utility Drainage Piping

SECTION 260001 – ELECTRICAL

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Provide all labor, material, tools, equipment, transportation, and services necessary for and incidental to completion of all electrical work as indicated on the Drawings and/or as specified herein.

1.2 DRAWING USE AND INTERPRETATION

- A. The Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or details. Exact equipment locations and raceway routing, etc. shall be governed by actual field conditions and/or instructions of the Engineer and/or Owner's Representative.

1.3 COMPLETE SYSTEMS

- A. General: Furnish and install all materials as required for complete systems, including all parts obviously or reasonably incidental to a complete installation, whether specifically indicated or not. All systems shall be completely assembled, tested, adjusted and demonstrated to be ready for operation prior to Owner's acceptance.
- B. Wiring: The wiring specified and/or shown on the Drawings is for complete and workable systems. Any deviations from the wiring shown due to a particular manufacturer's or subcontractor's requirements shall be made at no cost to either the Contract or the Owner.

1.4 CODES AND REGULATIONS

- A. General: Comply with the latest recognized edition of the National Electrical Code (NEC) and all governing federal, state, and local laws, ordinances, codes, rules, and regulations. Where the Contract Documents exceed these requirements, the Contract Documents shall govern. In no case shall work be installed contrary to or below minimum legal standards.
- B. Utilities: Comply with all applicable rules, restrictions, and requirements of the utility companies serving the project site/facilities.
- C. Non-Compliance: Should any work be performed which is found not to comply with any of the above codes and regulations, provide all work and pay all costs necessary to correct the deficiencies.

1.5 REFERENCE STANDARDS

- A. All latest published standards of the following associations/organizations shall be followed and applied where applicable as minimum requirements:
 - 1. (ADA), Americans with Disabilities Act.
 - 2. (ANSI), American National Standards Institute.
 - 3. (ASTM), American Society for Testing and Materials.
 - 4. (CBM), Certified Ballast Manufacturer.
 - 5. (EPACT), National Energy Policy Act.
 - 6. (ETL), Electrical Testing Laboratory.
 - 7. (ICEA), Insulated Cable Engineers Association.

8. (IEEE), Institute of Electrical and Electronic Engineers.
9. (IESNA), Illuminating Engineering Society of North America.
10. (NBFU), National Board of Fire Underwriters.
11. (NEMA), National Electrical Manufacturers Association.
12. (NESC), National Electrical Safety Code.
13. (NFPA), National Fire Protection Association.
14. (UL), Underwriter's Laboratories.

1.6 PERMITS

- A. General: Obtain and pay for any and all permits required by all applicable agencies, prior to commencing work.

1.7 SUBMITTALS

- A. General: Prepare and submit for approval, per the procedures set forth in Division 1, all submittals required by Division 1, this section, and by all other Contract Documents.
- B. Types: Required submittals may include: Schedule of Values; List of Subcontractors; Product Data; Shop Drawings; Samples; Test Reports; Certifications; Warranties; Maintenance Manuals; Record Drawings; and various administrative submittals.
- C. Number of Copies: As indicated in Division 1, Division 26, or elsewhere in the Contract Documents. For quantities indicated in the Contract Documents or specification sections other than Division 26 sections, increase number of copies by one to allow for the Engineer's record copy. Minimum number of copies per submittal: three.
- D. Product Data: Submit for all basic electrical equipment, devices, and materials to be used on the project. Product data to consist of manufacturer's standard catalog cuts, descriptive literature and/or diagrams, in 8-1/2-inch-by-11-inch format, and in sufficient detail so as to clearly indicate compliance with all specified requirements and standards. Mark each copy to clearly indicate proposed product, options, finishes, etc.
- E. Shop Drawings: Submit for all custom equipment and systems (e.g., panelboards) to be used on the project. Shop Drawings to be newly prepared, specifically for this project, and shall include all information listed in the Shop Drawings submittal requirements in the respective specification section. Include all pertinent information such as equipment/system identification, manufacturer, dimensions, nameplate data, sizes, capacities, types, materials, performance data, features, accessories, wiring diagrams, etc., in sufficient detail so as to clearly indicate compliance with all specified requirements and standards. For control systems, provide computer generated control ladder diagrams specifically developed for this project (standard diagrams not acceptable).
- F. Maintenance Manuals: Include operating and maintenance data in accordance with Division 1. Include all Product Data/Shop Drawing submittals as well as descriptions of function, normal operating characteristics and limitations, and manufacturer's printed operating maintenance, trouble shooting, repair, adjustment, and emergency instructions, and complete replacement parts listing.
- G. Record Documents: Prepare and submit in accordance with Division 1. In addition to Division 1 requirements, indicate actual installed locations for all equipment and devices, routing of major interior raceways, locations of all concealed and underground equipment and raceways, and all approved modifications to the Contract Documents, and deviations necessitated by field conditions and change orders.

1.8 QUALITY ASSURANCE

- A. Manufacturers' Qualifications: Not less than three years of experience in the actual production of the specified products.
- B. Installers' Qualifications: Firm with not less than five years of experience in the installation of electrical systems and equipment similar in scope and complexity to those required for this Project, and having successfully completed at least ten comparable scale projects.
- C. Incidental Work: Excavation, backfill, painting, patching, welding, carpentry, mechanical work, concrete pads and the like related to or required for Division 26 work shall be performed by craftsman skilled in the appropriate trade, but shall be provided for under Division 26.

1.9 INSPECTIONS

- A. General: During and upon completion of the work, arrange and pay all associated costs for inspections of all electrical work installed under this contract, in accordance with the Conditions of the Contract.
- B. Inspections Required: As per the laws and regulations of the local and/or state agencies having jurisdiction at the project site.
- C. Inspection Agency: Approved by the local and/or state agencies having jurisdiction at the project site.
- D. Certificates: Submit all required inspection certificates.
- E. Coordination: Coordinate inspections with the local utility.

1.10 DELIVERY STORAGE AND HANDLING

- A. Comply with Division 1 requirements.
- B. Packing and Shipping: Deliver products in original, unopened packaging, properly identified with manufacturer's identification, and compliance labels.
- C. Storage and Protection: Comply with all manufacturer's written recommendations. Store all products in a manner, which shall protect them from damage, weather, and entry of debris.
- D. Damaged Products: Do not install damaged products. Arrange for prompt replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Where Specified: Materials and equipment shall be as specified herein and/or as indicated on the Drawings.
- B. General Requirements: All materials and equipment shall be in accordance with the Contract Documents, and to the extent possible, standard products of the various manufacturers, except where special construction or performance features are called for. All materials and equipment to be new, clean, undamaged, and free of defects and corrosion.

- C. Acceptable Products: The product of a specified or approved manufacturer will be acceptable only when that product complies with or is modified as necessary to comply with all requirements of the Contract Documents.
- D. Common Items: Where more than one of any specific item is required, all shall be of the same type and manufacturer.
- E. UL Listing: All electrical materials and equipment shall be Underwriters' Laboratories (UL) listed and labeled where UL standards and listings exist for such materials or equipment.

2.2 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to the Conditions of the Contract and Division 1.

2.3 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP, free of clay, rock, or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetable, and other deleterious matter.

2.4 CONCRETE WORK

- A. Concrete:
 - 1. Minimum Strength: 3000 psi at 28 days.
 - 2. Aggregate: 3/4 inch aggregate.
 - 3. Cement: 588 #/cubic yard minimum, Type I or II.
 - 4. Slump: 4 inches maximum.
 - 5. Air: 5 to 7 percent.
- B. Reinforcing: Grade 60 bars, sized as indicated, and 6 inches by 6 inches – W1.4 by W1.4 mesh and other reinforcing as indicated.
- C. Forms: Wood, metal, or other approved materials constructed so as to withstand the forces of the newly placed concrete.
- D. Equipment Pads: Minimum 4 inches thick indoor, 12 inches thick outdoor (with 9 inches below grade), with 1 inch by 45-degree chamfer on all top edges. For on grade installations, provide 12-inch layer of crushed stone beneath pad. For pads to be placed on concrete floors, provide anchors into concrete floor.
 - 1. Comply with equipment manufacturer's specifications and/or utility company requirements.

2.5 RACEWAY SYSTEMS

- A. Raceway Sizing: As required by the NEC (minimum) with oversized raceways as indicated and where required for ease of pulling cable.
 - 1. Minimum conduit size: 3/4 inch, unless indicated otherwise.

- B. Raceway Types: Rigid galvanized steel conduit, electrical metallic tubing (EMT), flexible steel conduit, liquid-tight flexible steel conduit and Schedule 40 heavywall and Schedule 80 extra-heavywall rigid non-metallic (PVC) conduit conforming to applicable ANSI, NEMA and UL standards.
- C. Fittings: All raceway fittings (except for rigid non-metallic conduit) to be steel or malleable iron and UL-listed for the intended application. EMT fittings to be compression type.
- D. Outlet Boxes (Concealed in Walls): Non-gangable, galvanized steel with square cornered tile (or masonry) type extension rings or cover.
 - 1. Minimum size: two-gang masonry box or 4-inch square box with single-gang adapter (plaster) ring. Depth of adapter ring to suit application.
 - 2. Minimum depth: 1-1/2 inches.
 - 3. Minimum capacity: 21 cubic inches.
- E. Outlet Boxes (Surface Mounted): Cadmium plated cast or malleable iron.
- F. Pull and Junction Boxes, and Wireways: Use as indicated and required. Junction and pull boxes for general indoor use (dry locations) to be of galvanized code gauge steel construction, minimum 4-inch square by 1-1/2 inches deep with screw-on covers. Wireways to be UL listed, sheet steel construction with screw-on covers. For exterior and damp or wet indoor locations, use boxes and wireways approved for such use.
- G. Handholes: Light-weight and high-strength, constructed of fiberglass reinforced polymer concrete, gray color, suitable for use at temperatures down to -50 DegF, and resistant to sunlight, weathering, chemicals and freeze-thaw cycles, with bolt-on cover (with standard logo indicating type of service), and designed for in-grade use in areas with light vehicular traffic (5,000-pound load over a 10-inch by 10-inch area).
 - 1. Acceptable Manufacturers:
 - a. Quazite "Composolite."
 - b. Styles "PC" or "PG."
- H. Pipe Sleeves: Rigid steel conduit or iron pipe.
- I. Conduit Seals: For Cast-in-Place Concrete Applications:
 - 1. Acceptable Manufacturers:
 - a. O-Z/Gedney Type "FSK."
 - b. Thunderline Corp. "Link Seal" with "Link Seal Wall Sleeve."
- J. For Core Drilled and Pre-Cast Opening Applications:
 - 1. Acceptable Manufacturers:
 - a. O-Z/Gedney Type "CSML."
 - b. Thunderline Corp. "Link Seal."
- K. Pull Wires: No. 14 AWG zinc-coated steel monofilament plastic line with 200-pound tensile strength.

2.6 600 VOLT CLASS WIRE

- A. General: All wire and cable shall be constructed in accordance with all applicable ICEA, NEMA and IEEE published standards, and shall be UL-listed and labeled. Single-conductor, 98 percent

conductivity, annealed, uncoated copper conductors with 600-volt rated type "THHN/THWN" insulation.

- B. Wire shall be annealed bare copper per ANSI/ASTM B3, UL 83, and Federal Specification JC-30A with 600 volt insulation, be stranded (except for #10 AWG and smaller may be solid), and be minimum size #12 AWG (except for control wiring and signal circuits).
- C. Insulation: Provide THHN/THWN insulation for all conductors except XHHW insulation may be used for conductors #4 and larger.
- D. Ampacity of conductors shall be rated for 75 DegC regardless of temperature of conductor insulation when combining circuits in one conduit. Derate conductors and increase size per NEC when installing multiple circuits in a raceway, utilizing 75 DegC ampacity table.
- E. Connectors: Nylon shell insulated metallic screw-on connectors for #14-10 AWG and bolted pressure or compression type lugs and connectors with insulating covers for #8 AWG and larger.

2.7 WIRING DEVICES

- A. Receptacles (General Use): 125 volt, 20 amp, NEMA 5-20R, duplex type.
 - 1. Acceptable Manufacturers:
 - a. Leviton.
 - b. Arrow-Hart.
 - c. Hubbell.
 - d. Pass and Seymour.
- B. GFI Receptacles: Ground fault circuit interrupter, feed-through, duplex type, 125 volt, 20 amp, NEMA 5-20R, with solid-state ground-fault sensing and 5 mA trip level.
 - 1. Acceptable Manufacturers:
 - a. Leviton.
 - b. Arrow-Hart.
 - c. Hubbell.
 - d. Pass and Seymour.
- C. Device Color: Brown, unless directed otherwise.
- D. Coverplates (Interior Devices): For finished spaces, nylon coverplates to match wiring device. For unfinished spaces (e.g., mechanical room, electrical room, etc.), minimum .032-inch thick, Type 430 stainless steel with U.S. #32D satin finish.
- E. Coverplates (Exterior Locations): Weatherproof cast aluminum or polycarbonate. Receptacles installed in damp or wet locations shall have an enclosure and cover that are weatherproof with the attachment plug inserted or removed per NEC 406.9.

2.8 EQUIPMENT CONNECTIONS

- A. Materials as specified in this section, and as required.

2.9 HANGERS AND SUPPORTS

- A. General: All hangers, supports, fasteners and hardware shall be zinc-coated or of equivalent corrosion resistance by treatment or inherent property, and shall be manufactured products designed for the application. Products for outdoor use shall be hot dip galvanized.
- B. Types: Hangers, straps, riser supports, clamps, U-channel, threaded rods, etc., as indicated and/or required.
- C. Seismic restraints and supports as indicated and/or required.

2.10 ELECTRICAL IDENTIFICATION

- A. Nameplates: Three-layer laminated plastic with minimum 3/16-inch high white engraved characters on black background, and punched for mechanical fastening. Fasteners: self-tapping stainless-steel screws or number 10-32 stainless steel machine screws with nuts and flat and lock washers. Each nameplate on all panelboards and switchgear shall indicate the following:
 - 1. Panel Name.
 - 2. Voltage, Phase, Number of Wires.
 - 3. Source.
- B. Underground Warning Tape: 6-inch wide polyethylene tape, permanently bright colored with continuous-printed legend indicating general type of underground line below and "CAUTION." Colors as follows:
 - 1. Red – Electric.
 - 2. Orange – Communications.
- C. Marking Pens: Permanent, waterproof, quick drying black ink.
 - 1. Acceptable Manufacturers:
 - a. Sanford Fine Point "Sharpie."
 - b. Or equal.
- D. Wire Tags: Vinyl or vinyl-cloth self-adhesive wraparound type indicating appropriate circuit number, etc.
- E. Arc Flash Panelboard Stickers: Provide per NEC 110.16.

2.11 SAFETY SWITCHES

- A. General: Heavy duty, horsepower rated, fully enclosed, fusible (with rejection fuse clips) or non-fused as indicated, quick-make, quick-break switching mechanism interlocked with cover and NEMA-1 enclosure for dry locations and NEMA-3R enclosure for wet locations unless indicated otherwise. Switches to be labeled as "Suitable for Use as Service Entrance Equipment" where so indicated or required.
- B. Ratings: Provide switches with ratings as indicated. If ratings are not indicated, provide switch with ratings to suit the electrical system and load served.
- C. Acceptable Manufacturers:
 - 1. General Electric.
 - 2. Square D.

3. Cutler-Hammer.
4. Siemens.

2.12 GROUNDING

- A. General: Ground rods, conductors, clamps and connectors, etc., as required.
- B. Ground Rods: Minimum 5/8-inch diameter by 10-foot long copper clad steel.
- C. Welded Connectors: Exothermic process.

2.13 PANELBOARDS

- A. Types: Two-row, bolt-on circuit breaker branch circuit panelboards, and circuit breaker or fusible switch-type distribution panelboards, as indicated or required.
- B. General: Ratings, mains, mounting and complement of branch overcurrent protective devices as indicated below or on the Drawings.
- C. Short Circuit Ratings: Minimum 10,000 amps for 208/120 volt panelboards and 14,000 amps for 480/277 volt panelboards. Provide panelboards with higher ratings as indicated or as required.
- D. Enclosures: NEMA-1 for dry locations and NEMA 3R for wet locations (unless indicated otherwise). Provide galvanized steel rough-in box and cover with gray enamel finish. Panel fronts are to have a door (circuit breakers) in door (circuit breakers & wiring gutters) in trim with concealed hinges and flush type tumbler lock. All panels shall be keyed alike. Doors in excess of 48 inches high shall be equipped with a three-point catch and vault handle with integral tumbler lock. Panel shall be dead front, safety type and be multi-section as noted or as necessary to comply with NEC.
- E. Bussing: Full capacity copper, include solid copper ground bus, bonded to enclosure and solid copper neutral bus with lug for each branch circuit.
- F. Fusible Switches: Quick-make, quick-break, horsepower rated with rejection fuse clips, padlockable handle, and hinged door with defeatable interlock.
- G. Acceptable Manufacturers:
 1. General Electric "A Series" and "Spectra Series."
 2. Square D "NQOD," "NEHB," "I-Line," and "QMB."
 3. Cutler-Hammer "Pow-R-Line C."
- H. Panelboard Schedules: Refer to the schedules on the Drawings.

2.14 CIRCUIT BREAKERS

- A. General: Molded case with thermal and magnetic trips unless indicated otherwise. Minimum 10,000 amps interrupting capacity for 208V and 240V, 14,000 amps interrupting capacity for 480V and higher ratings as indicated or required.
- B. For Panelboard Mounting: Bolt-on type.
- C. Individually Mounted: NEMA-1 enclosures for indoor application, NEMA-3R for outdoor application, unless indicated otherwise.

- D. Breakers to be added to Existing Panelboards: Same manufacturer, type, and interrupting rating as for the existing breakers in same panelboard.

2.15 LIGHTING FIXTURES

- A. General:
 - 1. Fixture types as described below or indicated on the Drawings. Lighting fixture manufacturers' series or catalog numbers listed indicate general quality, type, and style but may not cover all required design features and details. Provide lighting fixtures having all features, details, and accessories as noted in the fixture descriptions. Provide all fittings, hangers, clamps, brackets, yokes, flanges, and miscellaneous devices required for a complete installation.
 - 2. Whenever possible, (based upon design requirements) provide lighting fixtures with ballasts provided integral to fixture and prewired.
- B. LED Lamps: Minimum 40,000 hours lamp life before 20 percent loss of output, 3500°K interior, 4500°K site and parking lot lighting unless indicate otherwise.
 - 1. Acceptable Manufacturers:
 - a. Philips.
 - b. Cree.
 - c. Luxeon.
 - d. OSRAM.
- C. Site Lighting Fixtures: Include foundations, poles, luminaries, lamps, drivers and all miscellaneous accessories as indicated or required for a complete assembly. Unless indicated otherwise, foundations to be cast-in-place concrete and spirally wrapped treated paper forms for round foundations. Provide concrete as specified in this section or in Division 3, anchor bolts, and reinforcing steel as indicated or required. Provide a 1-inch by 45-degree chamfer at top of each foundation. Poles to be able to withstand wind loads based on the latest AASHTO wind map without damage to the poles, attached luminaries or accessories/cameras. Provide pole bases with handholes, handhole covers finished to match the pole finish, and ground lug.

2.16 LIGHTING CONTROL CONTACTORS

- A. 277-volt AC (all loads), 30-amp, 8 poles lighting contactors as Normally open, mechanically-held, 120-volt coil with "Hand-Off Auto" selector switch, NEMA-3 enclosure with engraved nameplate "LIGHTING CONTROL," interior mounting panel, and hinged, lockable cover.
 - 1. Acceptable Manufacturers:
 - a. Square D.
 - b. Or equal by GE or Westinghouse.
 - 2. In auto position contactors shall closed based on photocell signal and open based on timer signal
- B. Photoswitches: Raintight, 120 volt or 277 volt as indicated or required with SPST contacts rated for 2000 watts with field adjustable light level sensitivity (1-15 FC) and time delay.
 - 1. Acceptable Manufacturers:
 - a. Tork #2100 Series.
 - b. Or approved equal.
- C. Time Switches: Two-channel, programmable, astronomic, seven-day digital time switch with 365-day, holiday capability (16 single dates and 5 holiday blocks), and capable of 48 events per channel, per week. Unit to include automatic adjustment for daylight savings switchovers and leap

years corrections, manual on-off override control for each channel, 72-hour battery backup, and NEMA-1 metal enclosure. Astronomic feature to be field adjustable for 10- to 60-degree Northern or Southern latitudes, and selectable to one or both channels, with adjustable 1-99 minute offset from sunrise or sunset. Time switches to be suitable for operation from a 120- or 277-volt power source as indicated or required. Contacts to be rated 10 amp resistive, 7.5 amp inductive and 1/3 horsepower at 120 VAC and 10 amp resistive at 277 VAC.

1. Acceptable Manufacturers:
 - a. Tork #DZS200A Series.
 - b. Or equal by Paragon or Intermatic.

PART 3 – EXECUTION

3.1 GENERAL

- A. The installation of all electrical work shall be in accordance with the intent of the Contract Documents as determined by the Engineer.
- B. Installation Requirements: All materials and equipment shall be installed as recommended by the respective manufacturers, by mechanics experienced and skilled in their particular trade, in a neat and workmanlike manner, in accordance with the standards of the trade, and so as not to void any warranty or UL listing.
- C. Administration and Supervision: All electrical work shall be performed under the Contractor's direct supervision using sufficient and qualified personnel as necessary to complete the work in accordance with the progress schedule. The Contractor shall assign one or more competent supervisors who shall have authority to accept and execute orders and instructions, and who shall cooperate with the other Contractors and subcontractors, the Engineer, and Owner in all matters to resolve conflicts and avoid delays.

3.2 EXAMINATION

- A. Conditions Verification: Examine the areas and conditions under which the work is to be performed, and identify any conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.3 COORDINATION

- A. General: Sequence, coordinate and integrate the installation of all electrical materials and equipment for efficient flow of work, in conjunction with the other trades. Review to the Drawings for work of the other trades, and report and resolve any discovered discrepancies, prior to commencing work.
- B. Cooperation: Cooperate with the other Contractors and individual disciplines for placement, anchorage, and accomplishment of the work. Resolve interferences between work of other disciplines or Contractors, prior to commencing installation.
- C. Chases, Slots, and Openings: Arrange for chases, slots, and openings during the progress of construction as required to allow for installation of the electrical work.
- D. Supports and Sleeves: Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

- E. Obstacles and Interferences: When installing equipment and raceways, provide offsets, fittings, accessories, and changes in elevation or location as necessary to avoid obstacles and interferences, per actual field conditions.
- F. Space Requirements: Electrical equipment sizes indicated on the Drawings are generally based on specified manufacturer. Verify that the proposed equipment will fit in the space indicated on the drawings. Maintain clearances required by NEC.

3.4 DIMENSIONS

- A. Building Dimensions: For exact locations of building elements, refer to dimensioned drawings. However, field measurements take precedence over dimensioned drawings.
- B. Site Dimensions: Field measurements take precedence over scaled electrical site plans.
- C. Limiting Dimensions: Equipment outlines shown on detail drawings of 1/4" = 1'-0" scale or larger and dimensions indicated on the Drawings are limiting dimensions. Do not install equipment exceeding dimensions indicated by outlines on Drawings or equipment or arrangements that reduce indicated clearances.
- D. Establish the exact location of electrical equipment based on the actual field verified dimensions of equipment furnished.

3.5 EQUIPMENT PROTECTION

- A. Protect all electrical equipment, and materials and work from the weather elements, paint, mortar, construction debris and damage until project is substantially complete. Repair, replace, and clean all electrical work so affected.

3.6 ELECTRICAL INSTALLATION - GENERAL

- A. Unfinished and Finished Areas: For the purposes of these electrical specifications, "unfinished" areas shall include mechanical, electrical and telephone equipment rooms. All other areas shall be considered "finished" spaces unless indicated or approved otherwise.
- B. In Unfinished Areas: Raceways, equipment, and devices may be installed concealed or exposed unless indicated otherwise.
- C. In Finished Areas: Conceal all raceway and flush mount all electrical boxes, equipment, and devices unless indicated or approved otherwise. The space above suspended ceilings or behind furred spaces is considered outside finished areas and electrical materials installed within these areas are considered concealed.
- D. Minimum Mounting Height: Install exposed raceway and all other electrical equipment (e.g., lighting fixtures) with not less than 7 feet and 6 inches clear to finished floor unless indicated or approved otherwise, and excluding raceway and equipment mounted on walls.
- E. Dimensions and Clearances: Field measure all dimensions and clearances affecting the installation of electrical work in relation to established datum, building openings and clearances, and work of other trades as construction progresses.
- F. Rough-In Locations: Verify final locations for rough-ins with field measurements and requirements of actual equipment being installed.

- G. Door Swings: Verify the swings of all doors before switch outlets or other electrical devices are installed. If necessary, relocate devices so they are not obstructed by doors when doors are open.
- H. Ceiling Mounted Devices: The locations indicated on the architectural reflected ceiling plans take precedence over the electrical documents, in the event of conflict.
- I. Install equipment according to manufacturer's written instructions.
- J. Install equipment, conduit, cable tray, hangers, and supports to withstand seismic forces for the seismic zone of the installation.

3.7 LAYOUT

- A. General: Install electrical systems, materials and equipment level and plumb, and parallel and perpendicular to other building systems and components, where installed exposed.
- B. Serviceability: Install electrical equipment and raceways, etc., to readily facilitate servicing, maintenance, and repair or replacement of components and so as to minimize interference with other equipment and installations.
- C. Clearances: Prior to commencing work, verify that all electrical equipment will adequately fit and conform to the indicated and code required clearances in the spaces indicated on the Drawings. If rearrangement is required, submit plan and elevation drawings or sketches indicating proposed rearrangement for the Engineer's approval. Do not rearrange without express written permission of the Engineer.
- D. Right-Of-Way: When laying out electrical work, give priority in available space to steam and condensate lines, sanitary lines, drain lines, fire protection piping, and sheet metal duct work. Provide offsets as required to avoid conflicts. Resolve all conflicts before commencing installation.

3.8 MOUNTING HEIGHTS

- A. General: Indicated heights are measured from the center of the device outlet box to finished floor or grade, unless indicated otherwise. Request instructions for mounting heights not indicated.

3.9 HOLES, SLEEVES, AND OPENINGS

- A. General: Provide all holes, sleeves, and openings required for the completion of Division 26 work and restore all surfaces damaged to match surrounding surfaces. Maintain integrity of all fire and smoke rated barriers using approved firestopping systems. When cutting holes or openings, or installing sleeves, do not cut, damage, or disturb structural elements or reinforcing steel unless approved in writing by the Project Structural Engineer.
- B. Conduit Penetrations: Size core drilled holes so that an annular space of not less than 1/4 inch and not more than 1 inch is left around the conduit. When openings are cut in lieu of core drilled, provide sleeve in rough opening. Size sleeves to provide an annular space of not less than 1/4 inch and not more than 1 inch around the conduit. Patch around sleeve to match surrounding surfaces.

3.10 CUTTING AND PATCHING

- A. General: Provide all cutting, drilling, chasing, fitting, and patching necessary for accomplishing the work of Division 26, which includes any and all work necessary to: uncover work to provide for the installation of ill-timed work; remove and replace defective work and work not conforming to the

requirements of the Contract Documents; and install equipment and materials in existing structures, in addition to that required during the normal course of construction.

- B. Comply with the cutting and patching requirements of Division 1.
- C. Building Structure: Do not endanger the integrity of the building structure by cutting, drilling, or otherwise modifying any structural member without specific approval. Do not proceed with any structural modifications without written permission of the Project Structural Engineer.
- D. Repairs: Repair any and all damage to work of other trades caused by cutting and patching operations using skilled mechanics of the trades involved.

3.11 WELDING

- A. General: Where welding is required, such welding shall be performed in a skilled manner by certified welders. Verify that welds are free from cracks, craters, undercuts, and strikes, weld spatter, and any other surface defects. Clean and re-weld any welds deemed unacceptable in size or configuration. Do not weld to structural steel without prior written permission from the Project Structural Engineer.

3.12 UNDERGROUND ELECTRICAL WORK

- A. General: Perform all excavating, trenching, backfilling, etc., as indicated or required for the installation of all underground electrical work. Coordinate work with other trades and verify existing underground services and conditions.
- B. Conduit Burial Depth: 30 inches below finished grade or 6 inches below bottom of frost line, whichever is deeper, unless indicated otherwise. All excavation and burial depths indicated are below finished grade.
- C. Excavating: Do not excavate below required depth except as necessary for removal of unstable soil or when rock is encountered. When rock is encountered, excavate 6 inches below the required depth and backfill with a minimum 6-inch layer of crushed stone or gravel between rock bearing surface and the electrical installation. Stockpile satisfactory excavated materials where directed until required for backfilling. Remove and legally dispose of excess excavated materials and materials not suitable for backfill use. Shore and brace as required for stability of excavation. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting off at an elevation of 30 inches below finished grade.
- D. Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavations.
- E. Existing Utilities: Remove existing electrical and other utility lines so indicated. Where existing utilities, which are to remain, exist within areas of excavation, locate such utilities and support and protect during excavation operations.
- F. Trenching: Cut all trenches neatly and uniformly and so as to provide ample working room and at least six inches clearance on both sides of raceways, etc., unless otherwise noted. Take necessary precautions when working near existing underground utilities, and coordinate with the installation of concurrent utilities by other trades. Unless indicated otherwise, pitch all electrical conduit runs downward away from buildings, manholes, and pad mounted equipment. Excavate trenches to depth indicated or required. Limit length of open trench to that in which installations can be made and trenches backfilled within the same day.

- G. Sand Envelope: Install a minimum envelope of 3 inches (top, bottom, and sides: 3 inches each) of fine grain sand around all electrical cables and conduits installed below grade unless indicated otherwise.
- H. Preparation for Backfilling: Backfill excavations as promptly as work permits but not until completion of inspection, testing, approvals, and recording of underground utility locations. Prior to backfilling, remove all concrete form work, shoring, bracing, trash, and debris.
- I. Backfilling: Use only approved materials free from boulders, sharp objects, and other unsuitable materials. Match the final elevations and materials of areas affected by electrical excavating, trenching, and backfilling. Replace conduit and cables damaged by improper backfilling. Replace surface materials to match existing surface materials if no other utility or site work is being done in area. Place specified soil materials in 4- to 8-inch layers to required subgrade elevations for area classifications as follows:
1. Under Sidewalks: Use combination of subbase materials and excavated or borrowed materials.
 2. Under Building Slabs: Use drainage fill materials.
 3. Under Piping and Equipment: Use subbase materials where required over rock bearing surfaces and for correction of unauthorized excavation.
 4. For Raceways Less than 30 inches below Surface of Paved Areas or Roadways: Provide 4-inch thick concrete base slab support. After raceway installation, provide 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase. Refer to Contract Documents for Conduit Encased in Concrete Details.
- J. Backfill Placement: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- K. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
- L. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils, which exhibit a well-defined, moisture-density relationship (cohesive soils), determined in accordance with ASTM D1557 and not less than the following percentages of relative density, determined in accordance with ASTM D2049, for soils, which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
1. Areas under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive materials and 95 percent relative density for cohesionless materials.
 2. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive materials and 95 percent relative density for cohesionless materials.
 3. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive materials and 90 percent relative density for cohesionless materials.

- M. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- N. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.13 CONCRETE WORK

- A. General: All concrete shall be prepared from approved materials and poured on clean, stable surfaces.
- B. Exterior Base Surfaces: 12-inch layer of crushed stone over well-consolidated, stable, undisturbed soil. Where the underlying soil contains excess organic material, trash or voids, or fails to provide solid bearing for any other reason, excavate to the depth required for solid bearing and re-establish the required elevation with approved granular materials.
- C. Finishing: Trowel all exposed surfaces smooth. Round-off or chamfer all exposed edges.
- D. Curing: Beginning immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury. Maintain minimal moisture loss at relatively constant temperature throughout period necessary for hydration of cement and hardening of concrete.

3.14 ELECTRICAL DEMOLITION

- A. General: Provide electrical demolition work as indicated and as required for removal and/or abandonment of systems, equipment, devices, etc., made obsolete by this Project and as required for demolition and remodeling by the other trades.
- B. Existing Conditions: In general, existing electrical systems, equipment, and devices are not shown on the Drawings unless pertinent to the demolition and/or remodeling work. Existing electrical conditions, where indicated, are based on casual field observations and must be verified. Report any discrepancies to the Engineer before disturbing the existing installation.
- C. Examination: Prior to bidding, examine the site to determine all actual observable conditions. No additional compensation will be granted on account of extra work made necessary by the Contractor's failure to investigate such existing conditions.
- D. Scheduling and Phasing: Coordinate demolition and changeover work with the other trades involved and with the Owner's Representative.
- E. Protection of Adjacent Materials: During execution of demolition work, primary consideration shall be given to protecting from damage, the building structure, furnishings, finishes, and the like, which are not specifically indicated to be removed. Existing items or surfaces to remain, which are damaged as a result of this work, shall be refinished, repaired, or replaced to the satisfaction of the Owner at the Contractor's expense.
- F. Patching: When electrical materials are removed, patch and finish walls, surfaces, etc., to match surrounding surfaces. Provide blank coverplates as required, etc. Materials used for patching shall be in conformance with the applicable sections of the Project Manual. Where materials are not

specifically described, but required for proper completion of the Work, they shall be as selected by the Contractor subject to approval of the Engineer.

- G. Inspection: Before commencing demolition work, carefully inspect the project site and become familiar with existing systems and conditions.
- H. Items To Be Salvaged: Verify with the Owner, all systems, materials, and equipment which are to be salvaged and those which must be removed. The Owner reserves the right to salvage any or all existing electrical materials and equipment at the project site.
- I. Disconnections: Disconnect all electrical devices and equipment as indicated and required. Disconnect electrical connections to mechanical and other equipment being removed by other trades.
- J. Wiring Removals: Where existing electrical devices or equipment are indicated to be removed, remove all associated wiring. Remove all abandoned or dead wiring back to source.
- K. Raceway Removals: Remove all abandoned raceways, boxes, supports, etc., where exposed and where they interfere with new work of any trade. Cut conduits flush with walls and floors, and cap.
- L. Existing Electrical Work to Remain: Protect and maintain access to existing electrical work, which must remain. Reinstall existing electrical work disturbed.
- M. Reconnections: Where electrical work in adjoining areas, or electrical work indicated to remain, becomes disconnected or affected by demolition work, reconnect circuits, etc., as required to restore original operation. Restoration work to comply with requirements for new work.
- N. Existing Electrical Work to be Relocated: Disconnect, remove, reinstall and reconnect existing devices and equipment indicated to be relocated and where required to accommodate remodeling or new construction. Extend existing installations as required. Materials and methods used for relocations and extensions to conform to requirements for new work.
- O. Shutdowns: All shutdowns to existing electrical services to be scheduled and approved, in writing, by the Owner's Representative.

3.15 RACEWAY SYSTEMS

- A. Raceway Types: Unless indicated otherwise, use raceway types as follows:
 - 1. Indoors, Concealed in Walls or Above Ceilings: EMT.
 - 2. Indoors, Exposed: Use rigid galvanized steel conduit below 10 feet above finished floor. EMT may be used above 10 feet.
 - 3. Indoors, Below Floor Slab: (Minimum 3/4 inch size). Schedule 80 rigid non-metallic conduit. Stub up using rigid galvanized steel elbows.
 - 4. Outdoors, Below Grade: (Minimum 1 inch size). Schedule 40 rigid non-metallic conduit. Stub up using rigid galvanized steel elbows.
 - 5. Outdoors, Exposed: Rigid galvanized steel conduit.
 - 6. Flexible Steel Conduit: Use (in dry locations only) for connections to transformers, vibrating equipment, and equipment requiring minor adjustments in positions for final connections to recessed lighting fixtures and between outlet boxes in metal stud partitions.
 - 7. Liquid-Tight Flexible Steel Conduit: Use where flexible steel conduit connections are required in damp, wet, or oily locations, and for final connections to all motors and similar equipment.

- B. Raceway Routing: As required by job conditions unless specific routes or dimensioned positions are indicated on the Drawings. Install tight to slabs, beams, and joists wherever possible. Route exposed conduit, and conduit installed above ceilings, parallel or perpendicular to walls ceilings and structural members. Install to maintain minimum headroom and to present a neat appearance. Run parallel raceways together with bends made from same center line. Verify exact locations of all raceways, pull boxes, and junction boxes. Resolve any conflicts before installation.
- C. Raceway Installation: Cut conduit ends square using saw or pipecutter and ream each cut end smooth. Carefully make all conduit bends and offsets so that the inside diameter of pipe is not reduced. Make bends so that legs are in the same plane. Make offsets so that legs are in the same plane and parallel. Protect stub-ups from damage, and carefully rebend when necessary.
- D. Fittings: Make up all raceway fittings tight so that final installation of raceway, fittings and enclosures constitutes a firm mechanical assembly and a continuous electrical conductor. Where required, provide bonding jumpers to assure electrical continuity.
- E. Protection: Protect all raceways, enclosures, and equipment during construction to prevent entry of concrete, debris and other foreign matter. Free clogged conduits of all obstructions, or replace, prior to pulling wire. Do not pull wire within buildings until buildings are completely enclosed.
- F. Boxes: Install all outlet, pull, and junction boxes rigidly, plumb, and level. Support and secure boxes independently from conduits terminating at box. Install all boxes so as to be accessible and so that covers may be easily removed.
- G. Handholes: Provide as indicated, installed plumb and level. Where not indicated, install every 200 feet at a minimum.
- H. Conduit Seals: Install conduit seal for each conduit penetrating an exterior building wall below grade (unless penetration is below lowest building floor slab) and elsewhere as indicated, and so as to achieve a sealed watertight installation.
- I. Pull Strings: Provide pull strings in all spare conduits.

3.16 CONDUCTORS - 600 VOLT AND BELOW

- A. Minimum Conductor Size: All branch circuit wiring shall be minimum #12 AWG. All control circuit wiring shall be minimum #14 AWG unless indicated otherwise. Provide larger sizes as indicated or required.
- B. Branch Circuit Conductor Sizes: Provide branch circuit conductor sizes as indicated on the panelboard schedules, plans, or elsewhere. Neutral conductor size to match phase conductors unless indicated otherwise. Provide branch circuit switch legs and travelers as required for the switching indicated.
- C. Equipment Grounding Conductor Required: For each branch circuit and feeder run, provide an equipment grounding conductor for continuous length of run, sized per NEC 250-122 (minimum), larger if so indicated.
- D. Feeders: Provide feeder conductor sizes and quantities as indicated.
- E. In Raceway: Install all wiring in conduit or other specified raceway unless indicated otherwise.
- F. Terminations: Furnish and install terminations including lugs (if necessary) to make all electrical connections indicated or required. Make connections and terminations for all stranded AWG

conductors using crimp, clamp, or box-type connectors and terminators. Enclose all strands of stranded conductors in connectors, and lugs.

- G. Color: Conductors #10 and smaller shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. #8 and larger shall have stripes, bands, hash marks, or color pressure-sensitive plastic tape. Color code all branch circuit and feeder conductors as follows:

1. 208/120 Volts:

PHASE	COLOR
A	Black
B	Red
C	Blue
Neutral	White

2. Equipment Grounding Conductors: Green

- H. Phase Arrangement: Arrange phases in all electrical equipment as follows:

1. A, B, C: Front to Rear.
2. A, B, C: Top to Bottom.
3. A, B, C: Left to Right when facing established front of equipment.

- I. Provide conductors with not less than 90 DegC rated insulation when branch circuit wiring is attached to high temperature light fixtures (e.g., fluorescent and HID), boilers, incinerators, ovens, ranges, kitchen exhaust fans, other heat-producing equipment, and "100 percent rated" overcurrent protective devices. Use special higher temperature wire as required for connection to specialty equipment as required by equipment manufacturer.

3.17 EQUIPMENT CONNECTIONS

- A. Connect complete, all equipment requiring electrical connections, furnished as part of this Contract or by others unless indicated otherwise.
- B. Equipment Variations: Note that equipment sizes and capacities as shown on the Contract Documents are for bidding purposes and as such may not be the exact unit actually furnished. Contractor shall anticipate minor variations in equipment and shall include in his Bid all costs required to properly connect the equipment actually furnished.
- C. Verification: Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished by others. Examine actual equipment to verify proper connection locations and requirements.
- D. Coordination: Sequence electrical rough-in and final connections to coordinate with installation and start-up schedule and work by other trades.
- E. Rough-In: Provide all required conduit, boxes, fittings, wire, connectors, miscellaneous accessories, etc., as necessary to rough in and make final connections to all equipment requiring electrical connections. In general, motors and equipment shall be wired in conduit to a junction box (or safety switch) near the unit, and from there to the unit in flexible metal or liquid-tight flexible steel conduit.
- F. Connections: Provide properly sized overload and short circuit protection for all equipment connected, whether furnished under this Contract or by others. Verify proper connections with

manufacturer's published diagrams and comply with same. Verify that equipment is ready for electrical connections, wiring, and energization prior to performing same.

- G. Control Wiring: Provide all control wiring to remote devices or equipment as indicated or required. Modify equipment control wiring, install or disconnect jumpers, etc., as required.

3.18 HANGERS AND SUPPORTS

- A. General: Rigidly support and secure all electrical materials, raceway, and equipment to building structure using hangers, supports, and fasteners, suitable for the use, materials and loads encountered. Provide all necessary hardware.
- B. Overhead Mounting: Attach overhead mounted equipment to structural framework or supporting metal framework. Do not make attachments to steel roofing, steel flooring, or ceiling mineral tile.
- C. Wall Mounting: Support wall mounted equipment by masonry, concrete block, metal framing, or sub-framing.
- D. Exterior Walls: Mount all electrical equipment located on the interior of exterior building walls at least 1 inch away from wall surface using suitable spacers.
- E. Structural Members: Do not cut, drill, or weld any structural member.
- F. Independent Support: Do not support electrical materials or equipment from other equipment, piping, ductwork, or supports for same.
- G. Temporary Conditions: Do not attach to or support electrical work from removable or knockout panels or temporary walls or partitions.
- H. Raceway Supports: Rigidly support all raceway with maximum spacings per NEC and so as to prevent distortion of alignment during pulling operation. Use approved hangers, clamps, and straps for individual runs. Do not use perforated straps or tie wires. Where multiple parallel raceways are run together, use trapeze type hanger arrangement made from U-channel and accessories, suspended by threaded rods, and allow at least 25 percent spare capacity for future installation of additional raceways. Rigidly anchor vertical conduits serving floor-mounted or "island" type equipment mounted away from walls with metal bracket or rigid steel conduit extension secured to floor.
- I. Miscellaneous Supports: Provide any additional structural support steel brackets, angles, fasteners, and hardware as required to adequately support all electrical materials and equipment.
- J. Seismic restraints and supports: Provide as indicated and/or as required per seismic zone indicated.

3.19 ELECTRICAL IDENTIFICATION

- A. General: Locate nameplate, marking, or other identification means on outside of equipment or box front covers when above ceilings and when in mechanical or electrical equipment rooms or other unfinished areas, and on inside of front cover when in finished rooms/areas. Use Contract Document designations for identification unless indicated otherwise.
- B. Nameplates: Provide nameplate engraved with equipment designation for each safety switch, panelboard, transformer, motor starter, and all other electrical cabinets, etc.

- C. Underground Warning Tape: During trench backfilling for each underground electrical, telephone, signal, and communications line, provide a continuous underground warning tape located directly above line at 6 to 8 inches below finished grade.
- D. Marking Pen Labeling: Mark each junction and pull box indicating source designation and circuit number(s) for the enclosed conductors.
- E. Wire Tags: For power circuits, apply wire tag indicating appropriate circuit or feeder number to each conductor present in distribution panel and panelboard gutters, and to each conductor in pull and junction boxes where more than one feeder or multi-wire branch circuit is present. Where only a single feeder or multi-wire branch circuit is present, box cover labeling and conductor color coding is sufficient. For control, communications, and signal circuits, apply wire tag indicating circuit or termination number at all terminations and at all intermediate locations and boxes where more than one circuit is present.
- F. Panelboard Circuit Directories: At completion of project, accurately complete each panelboard circuit directory card, identifying load served or “spare” or “space” for each circuit pole. When modifying, adding or deleting circuits at an existing panelboard, update the existing (or provide new) circuit directory card to accurately reflect final conditions.
- G. Abandoned Equipment: Label all abandon equipment as “Abandon as of _____.” For conduits and conductors, include opposite end location.

3.20 GROUNDING

- A. General: Provide all system and equipment grounding as indicated and required by the NEC.
- B. Equipment Grounding: Provide a green equipment grounding conductor, sized per NEC 250-122 (larger if so indicated), with each feeder and branch circuit run.
- C. Provide exothermic welded connections where indicated.

3.21 PANELBOARDS

- A. Secure rough-in boxes to building structure or steel framing, independent of conduits. Install with top of cabinet at 7 feet 0 inches above floor but with minimum 8-inch clearance above floor unless so doing would exceed maximum 6-foot 6-inch disconnect height allowed by NEC.
- B. Cover all unused overcurrent protective device spaces.

3.22 LIGHTING FIXTURES

- A. Lamps and Ballasts: Replace all burned out, defective, and inoperative lamps, and all noisy, defective, and inoperative ballasts, starters, etc., prior to Owner’s acceptance.

3.23 LIGHTING CONTROL EQUIPMENT

- A. Lighting Control Relays: Connect “Auto” position of relay H-O-A selector switch through photoswitch and timer, and the “HAND” position to override the automatic control.
- B. Photoswitches: Adjust sensitivity for proper operation.

3.24 CHECKOUT, TESTING, AND ADJUSTING

- A. General: Provide testing equipment, materials, instruments, and personnel to perform all test procedures and adjustments required by the Contract Documents and/or deemed necessary by the Engineer to establish proper performance and installation of electrical systems and equipment. All test instruments to be accurately calibrated and in good working order.
- B. Scheduling: Schedule tests at least three days in advance, and so as to allow Engineer and Owner representative(s) to witness the test, unless directed otherwise. Do not schedule tests until the system installation is complete and fully operational unless indicated or directed otherwise.
- C. Manufacturer's Authorized Representatives: For all new and modified systems and equipment, arrange and pay for the services of the manufacturer's authorized representative(s) to be present at time of equipment or system start-up, to supervise the start-up, and to conduct and/or certify all required testing and adjusting.
- D. Test Reports: Submit test reports neatly typewritten on 8-1/2-inch-by-11-inch sheets indicating system or equipment being tested, methodology of testing, date, and time of test, witnesses of test, and test results. Submit test reports in three (3) copies to the Engineer for review within five (5) days after test is performed, and include a copy with the appropriate operation and maintenance data.
- E. Correction/Replacement: After testing, correct any deficiencies, and replace materials and equipment shown to be defective or unable to perform at design or rated capacity. Retest without additional cost to the Owner or Contract. Submit finalization report indicating corrective measures taken and satisfactory results of retest.

3.25 SYSTEMS DEMONSTRATION

- A. Instruct the Owner's representative(s) in the start-up, operation, and maintenance of all electrical systems and equipment in accordance with Division 1 and as requested by the Owner's Representative.

3.26 CLEANING AND TOUCH-UP PAINTING

- A. Perform cleaning required by Division 1.
- B. General: Periodically remove from the project site, all waste, rubbish, and construction debris accumulated from construction operations, and maintain order. The premises shall be left clean and free of any debris and unused construction materials prior to final acceptance.
- C. Electrical Equipment: Remove all dust, dirt, debris, mortar, wire scraps, rust, and other foreign materials from the interior and exterior of all electrical equipment and enclosures, and wipe down. Clean accessible current carrying elements and insulators prior to energizing.
- D. Light Fixtures: Thoroughly clean all new or relocated light fixtures and lamps, just prior to final inspection. Fixture enclosures, reflectors, lenses, etc., shall be cleaned free of dust, dirt, fingerprints, etc., by an approved method.
- E. Touch-Up Painting: Restore and refinish to original condition, all surfaces of electrical equipment scratched, marred, and/or dented during shipping, handling, or installation. Remove all rust, and prime and paint as recommended by the manufacturer.

END OF SECTION

ELECTRICAL

PAGE 21 OF 21
CHA PROJECT NO. 104748
SECTION 260001

SECTION 310519.13 – GEOTEXTILES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the installation of separation/stabilization fabric as shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. The latest edition of the following standards, as referenced herein, shall be applicable.
 - 1. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit Manufacturer's material specifications, product literature and installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver sufficient materials to the site to prevent interruption of the work.
 - 2. All materials shall be inspected by Contractor upon delivery. Contractor shall notify Engineer of any damage. Products received at the site torn, with holes, deteriorated, or otherwise damaged will not be approved and shall be returned and replaced at no expense to the Owner.
- B. Storage:
 - 1. All material shall be stored in strict accordance with the manufacturer's recommendations and as approved by the Engineer.
 - 2. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements, if stored outdoors, elevate, and protect geotextile with waterproof cover.
- C. Handling:
 - 1. All material shall be handled in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 – PRODUCTS

2.1 WOVEN GEOTEXTILE

- A. Stabilization Fabric: To be used beneath roadways and walks.
- B. Composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.
- C. Calendered or finished so yarns will retain their relative position with respect to each other.
- D. Polymeric Yarn: Long-chain synthetic polymers (polyester or polypropylene) with stabilizer or inhibitors added to make filament resistant to deterioration due to heat and ultraviolet light exposure.

- E. Sheet Edges: Selvaged or finished to prevent outer material from separating from sheet.
- F. Unseamed Sheet Width: Minimum 12 feet.
- G. Physical Properties: Conform to requirements noted below:

PROPERTY	DESIGN VALUE	TEST METHOD
Tensile Strength	315 pounds	ASTM D4632
Elongation	12 percent	ASTM D4632
Trapezoidal Tear	113 pounds	ASTM D4533
CBR Puncture Strength	900 pounds	ASTM D6241
A.O.S.	40 (US Sieve)	ASTM D4751
Permittivity	.05 sec ⁻¹	ASTM D4491

2.2 NONWOVEN GEOTEXTILE

- A. Separation/Filtration Fabric: To be used in drainage ditches, haybale installation, culvert outfall installations, rip-rap outfall installations, and cover material separation.
- B. Pervious sheet of polyester, polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Nonwoven geotextile shall be composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding.
- C. Geotextile Edges; selvaged or otherwise finished to prevent outer material from pulling away from geotextile.
- D. Unseamed Sheet Width: Minimum 12 feet.
- E. Physical Properties: Conform to the requirements noted below:

PROPERTY	DESIGN VALUE	TEST METHOD
Tensile Strength	160 pounds	ASTM D4632
Elongation	50 percent	ASTM D4632
Trapezoidal Tear	60 pounds	ASTM D4533
CBR Puncture Strength	400 pounds	ASTM D6241
A.O.S.	70 (US Sieve)	ASTM D4751
Permittivity	1.4 sec ⁻¹	ASTM D4491

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for the installation, and seaming of geotextile fabric in accordance with the specifications and the manufacturer's recommendations, as approved by the Engineer.

3.2 SUBGRADE PREPARATION

- A. Surfaces to be covered with geotextile fabric shall be smooth and free of rocks, sticks, roots, sharp objects, and all debris that may damage the fabric. The surface to be covered shall be firm and

unyielding, with no sudden changes or breaks in grade. There shall be no standing water or excessive moisture on the surface when the fabric is placed.

- B. The compacted subgrade shall be maintained in a smooth, uniform, and compacted condition during installation of the fabric.

3.3 GEOTEXTILE INSTALLATION

- A. The fabric shall be cleaned of all debris or other materials that may negatively affect the fabric's performance.
- B. Mechanical equipment shall not be permitted to operate directly on the fabric unless authorized to do so by the manufacturer and approved by the Engineer.
- C. Geotextile Placement:
 - 1. Fabric shall be placed as recommended by the manufacturer and approved by the Engineer on surfaces which have been prepared to conform with these Specifications and found acceptable for fabric installation.
 - 2. The fabric shall be placed as smooth and wrinkle-free as possible.
 - 3. When installing geotextile in trenches, swales, ditches, etc., overlap geotextile in the direction of flow.
 - 4. All areas of fabric damaged during installation as determined by the Engineer shall be repaired or replaced by the Contractor as specified at no additional cost to the Owner. Should the fabric be damaged during any step of the installation, the damaged section shall be repaired by covering it with a piece of fabric which extends at least 24 inches in all directions beyond the damaged area. The fabric shall be secured by sewing or bonding as approved by the Engineer.
 - 5. At time of installation, fabric will be rejected if it has defects, ribs, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling, or storage. Damaged materials shall be removed and replaced at no additional cost to the Owner.
 - 6. Fabric shall be placed with long dimension down slope.
 - 7. Fabric shall be protected at all times during construction from contamination by surface run-off and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.
- D. Seams and Overlaps of Geotextile:
 - 1. All overlaps shall be a minimum of 18 inches (450 mm).

3.4 COVER MATERIALS OVER GEOTEXTILES

- A. Granular materials shall be placed on geotextiles as shown on the Drawings. During backdumping and spreading, a minimum depth of 6 inches of granular material shall be maintained at all times between the fabric and wheels of trucks or spreading equipment. All equipment used in spreading or traveling on the cover layer for any reason shall exert low ground pressures and shall be approved by the manufacturer and Engineer. Dozer blades, etc., shall not make direct contact with the fabric; however, if tears occur in the fabric during the spreading operation, the granular material shall be cleared from the fabric and the damaged area repaired as previously described.
- B. The granular material shall be spread in the direction of fabric overlap. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Occasionally, large folds may reduce the fabric overlap width. Special care shall be given to maintain proper overlap and fabric continuity.

- C. All equipment spreading cover material or traveling on the cover layer shall avoid making sharp turns, quick stops, or quick starts.
- D. Fabric shall be covered as soon as possible after placement to minimize exposure to sunlight. Fabric shall not be exposed for more than 5 days.

3.5 DISPOSAL OF SCRAP MATERIALS

- A. On completion of installation, the Contractor shall legally dispose of all trash and scrap material off-site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION

SECTION 311000 – SITE CLEARING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Removing existing groundcovers and grass.
 - 2. Clearing and grubbing.
 - 3. Removing above- and below-grade site improvements.
 - 4. Disconnecting, capping or sealing, and abandoning site utilities in place removing site utilities.

1.2 DEFINITIONS

- A. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots.

1.3 MATERIAL OWNERSHIP

- A. Except for excess stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Detour routes shall be identified by adequate signs in accordance with the MUTCD.
- B. Protect areas outside limits of disturbance from encroachment by construction personnel or equipment, regardless of property Ownership. Access shall be by specific, written permission or easement only
- C. Utility Locator Service: Properly notify utility locator service for area where Project is located before site clearing in accordance with local protocol.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- E. Contractor shall verify existing grades prior to performing work under this section. If existing grades are at variance with the drawings, notify the Owner and receive instructions prior to proceeding. No

additional compensation will be considered resulting from grade variances once site clearing has commenced.

PART 2 – EXECUTION

2.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

2.2 UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner's Representative and owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's Representative written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

2.3 CLEARING AND GRUBBING

- A. Completely remove obstructions, trees, shrubs, stumps, roots, grass, and other vegetation to permit installation of new construction.
 - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 2. Use only hand methods for grubbing within tree protection zone.
 - 3. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations in accordance with Section "Earth Moving" unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm) and compact each layer to a density equal to adjacent original ground.

2.4 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

2.5 DISPOSAL

- A. Burning of debris onsite is not permitted.
- B. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 312000 – EARTH MOVING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the preparation of the site, protection, excavation, embankment, drainage, dewatering, for site grading, as shown on the Drawings, and as herein specified.
- B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.
- C. The Engineer shall determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable.
 - a. "Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering."
 - b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
- B. The Contractor shall comply with the requirements for soil erosion and sedimentation control, and other requirements of governmental authorities having jurisdiction, including the State of New York.
- C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications in accordance with Section "Quality Requirements."

1.3 SUBMITTALS

- A. Samples:
 - 1. The Contractor shall furnish earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.
- B. Test Results:
 - 1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

- A. Notify the Engineer of any unexpected subsurface condition.
- B. Protection of Existing Utilities:
 - 1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate support and protection during earthwork operations, comply with OSHA requirements.
 - 2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.

3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
 4. Demolish and completely remove from the site any existing underground utilities designated to be removed as shown on the Drawings or as specified in Section "Site Clearing."
 5. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the Owner.
- C. Protection of Persons and Property:
1. Barricade open excavations occurring as part of this work, and post with warning lights.
 2. Operate warning lights as recommended by authorities having jurisdiction.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 4. Perform excavation within drip-line of large trees to remain by hand and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1-inch diameter and larger with emulsified asphalt tree paint.

PART 2 – PRODUCTS

2.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

- A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The test shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.
1. Particle Size Analysis:
 - a. Method: ASTM D422.
 - b. Number of Tests: One (1) per potential source.
 - c. Acceptance Criteria: Gradation within specified limits.
 2. Maximum Density Determination:
 - a. Method: ASTM D1557, Modified Proctor.
 - b. Number of Tests: One (1) per potential source.
 3. Re-establish gradation and maximum density of fill material if source is changed during construction.

2.2 MATERIALS

- A. Select Granular Material: Sound, durable, sand, gravel, stone or blends with these materials, free from organic, frozen, or other deleterious materials, conforming to the requirements of NYSDOT Section 304 and meeting the following gradation requirements (NYSDOT Type 4):

SIEVE	PERCENT PASSING
2"	100
1/4"	30 - 65
No. 40	5 - 40
No. 200	0 - 10

- B. Selected Fill: Sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen or other deleterious materials.

SIEVE	PERCENT PASSING
4"	100
No. 40	0 - 70
No. 200	0 - 10

1. Fines passing No. 200 shall be non-plastic.
2. Particle size analysis shall show no gap grading.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.
- C. Establish location and extent of utilities before commencement of grading operations.

3.2 EXCAVATION

- A. Excavation shall consist, in general, of the excavation of whatever substance is encountered to the lines, grades, and sections shown on the Drawings including excavation as necessary for grading and other similar features.
- B. All suitable materials removed in excavation shall be used in the construction of embankments, subgrade, shoulders, slopes, and at such other places as directed. The Engineer shall be the sole judge of what constitutes suitable material.
- C. During construction, the grading operations shall be executed in such a manner that the excavation will be well drained at all times. All grading shall be finished on neat, regular lines conforming to the sections and contours shown on the Plans.
- D. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.
- E. Excavation shall be performed in proper sequence with all other associated operations.
- F. Maintain the slopes of excavation in a safe condition until completion of the grading operation.
- G. All excavation work shall be inspected and approved by the Engineer before proceeding with construction.
- H. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

3.3 FILL

- A. All site fill shall be “selected fill” unless otherwise shown on the Drawings or directed by the Engineer. “Select granular fill” shall be placed in lieu of selected fill where directed by the Engineer.

- B. Before depositing fills, the surface of the ground shall be cleared of all refuse, brush, and large stones. Conform to Section "Site Clearing."
- C. Prior to placing fill over undistributed material, scarify to a minimum depth of 6 inches.
- D. Where fills are made on hillsides or slopes, the slope of the original ground upon which the fill is to be placed shall be plowed or scarified deeply or where the slope ratio of the original ground is steeper than 2 horizontal to 1 vertical, the bank shall be stepped or benched.
- E. The original ground shall be proof rolled until the underlying soil is thoroughly compacted to the satisfaction of the Engineer before any filling is begun. A steel-wheel tandem roller weighing 8 to 10 tons or equipment capable of obtaining the same effort shall be used to obtain a thoroughly compacted subgrade. Remove or recompact any soft or loose soils as determined by the Engineer prior to filling.
- F. A thoroughly and satisfactorily subgrade is defined as having a minimum dry density of 95 percent of the maximum density of the material used. The subgrade material shall be compacted at a moisture content suitable for obtaining the required density.
- G. Place backfill and fill materials in layers not more than 12 inches in loose depth unless shown otherwise on the Drawings. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 12 inches as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, or extraneous debris.
- H. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced by compacted granular fill.
- I. Moisture Control:
 - 1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.
 - 2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.
- J. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used.

3.4 GRADING

- A. The present and finished grade lines are shown on the Drawings. Grade over the entire area, as shown on the drawings, shall be to the finished subgrade levels. Upon completion of this work, all debris shall be cleaned out and removed from the premises.
- B. All cutting, filling, backfilling and grading necessary shall be done to bring the area to the following grade or subgrade levels:
 - 1. For roadway surface areas to the finished subgrade levels specified on the contract drawings.

2. For areas to be topsoiled and seeded to within 6 inches of the finished grade.
 3. For other surface treatments as detailed on the Drawings.
- C. Sufficient grading must be done during the progress of the work so that the entire site shall be well drained and free from water pockets.
- D. Finish grading, including dressing swales, cleaning up excess footing excavation, dressing terraces, disposing of excess material and all other work necessary to prepare the site for topsoil and seeding shall be done after construction of structures and roadway surface areas is substantially complete.

3.5 COMPACTION EQUIPMENT

- A. Compaction equipment used for the Work is subject to approval by the Engineer. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.
- B. Vibratory Drum Compactors: A self-propelled compactor classified for use according to the developed compactive force rating (CFR) per linear inch of drum width (PLI). The actual operating frequency of the compactor will determine the PLI rating. Compute the CFR at the actual operating frequency for the compactor in accordance with the applicable portions of NYSDOT Section 203-3.03.2.b and the corresponding maximum lift thickness in accordance with Figure 203-2.
1. Furnish one vibratory reed tachometer for the exclusive use of the Engineer. Tachometers shall have a frequency range adequate to cover the operating frequencies of all vibratory compactors on the project with scale divisions of 50 vibrations per minute or less. The tachometer will be returned by the Owner's Representative at the closeout of the project.
 2. Approval of vibratory compactors usage is contingent upon proper operation of equipment at all times during compaction operations.
 3. Compaction equipment other than vibratory drum compactors may be used subject to the approval of the Owner's Representative. Submit specifications at least two (2) weeks prior to use of this equipment.
 4. Do not use vibratory drum compactors after concrete is poured.

3.6 DRAINAGE AND DEWATERING

- A. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.
- B. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to the stability of subgrades.
- C. Provide and maintain the pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to convey water away from excavations.
- D. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas.
- E. Dewatering operations shall be as directed by the Engineer and performed in accordance with Section "Dewatering."

3.7 FIELD QUALITY CONTROL

- A. Notify the Engineer at least one (1) working day in advance of all phases of filling and backfilling operations.
- B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
 - 1. In-place relative density:
 - a. Method: AASHTO T310, Nuclear Method.
 - b. Number of Tests: One (1) per 8-inch vertical lift.
 - 1) Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2,000 square feet or less of paved area of building slab, but in no case fewer than three (3) tests.
- C. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.
- D. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and retested. Subsequent test failures shall be followed by removal and replacement of the material.

3.8 CLEAN UP

- A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.
- B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.
- C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION

SECTION 312333 – TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the excavation of trenching, backfilling, compacting, dewatering, excavation support and disposal, as shown on the Contract Drawings, and as herein specified.
- B. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable.
 - a. "Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering."
 - b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
 - c. American Society for Testing and Materials (ASTM).
 - d. National Electric Code (NEC).
- B. The Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State.
- C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications in accordance with Section "Quality Requirements."

1.3 SUBMITTALS

- A. Samples:
 - 1. The Contractor shall furnish representative earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.
- B. Test Results:
 - 1. The testing laboratory shall submit written reports of all tests, investigations, findings, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

- A. Notify the Engineer of any unexpected subsurface condition.
- B. Protect excavations by shoring, bracing, sheet piling, or by other methods, as required to ensure the stability of the excavation. Comply with OSHA requirements.
- C. Underpin or otherwise support structures adjacent to the excavation, which may be damaged by the excavation. This includes service lines.

- D. Protection of Existing Utilities:
 - 1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.
 - 2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
 - 3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
- E. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.
- F. Repair any damaged utilities as acceptable to the Owner, Engineer, and utility company at no additional cost to the Owner.
- G. Contractor shall comply with maintenance and protection requirements as approved by the authority having jurisdiction.
- H. Protection of Persons and Property:
 - 1. Barricade open excavations occurring as part of this work and post with warning lights, if required.
 - 2. Operate warning lights as recommended by authorities having jurisdiction.
 - 3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 4. Perform excavation within drip-line of trees to remain by hand and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint cut roots of 1-inch diameter and larger with emulsified asphalt tree paint.

PART 2 – PRODUCTS

2.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

- A. General:
 - 1. Sufficient size samples shall be obtained from the potential borrow source to allow completion of tests listed in paragraph B below. Samples may be obtained from test borings, test pits, or from borrow pit faces provided that surficial dry or wet soil is removed to expose undisturbed earth. Tests listed below shall be performed on each sample obtained. A minimum of 3 representative samples from each potential borrow source shall be furnished to the testing laboratory for prequalification testing. Test data shall be provided to the Engineer a minimum of 2 weeks prior to construction for approval of borrow source. Three test reports completed within three months prior to construction may be submitted for commercial earth borrow sources or suppliers of stone products (crushed stone or graded stone products) in lieu of prequalification tests as approved by the Engineer.
- B. Material Tests:
 - 1. Particle Size Analysis:
 - a. Method: ASTM D422.
 - b. Number of Tests: One (1) per sample; three (3) per potential source.
 - c. Acceptance Criteria: Gradation within specified limits.

2. Maximum Density Determination:
 - a. Method: ASTM D1557 - Modified Proctor.
 - b. Number of Tests: One (1) per sample; three (3) per potential source.
3. Re-establish gradation and maximum density of fill material if source is changed during construction.

2.2 MATERIALS

- A. Pipe Zone Bedding: Select mixture of graded crushed stone, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT Section 703-02 and meeting the following gradation requirements (NYSDOT Size 2):

SIEVE	PERCENT PASSING
1-1/2"	100
1"	90 – 100
1/2"	0 – 15

- B. Pipe Zone Backfill: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT Section 304 and meeting the following gradation requirements (NYSDOT Subbase Type 4):

SIEVE	PERCENT PASSING
2"	100
1/4"	30 – 65
No. 40	5 – 40
No. 200	0 – 10

- C. Suitable Material: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT 203-2.0 and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
4"	100
No. 40	0 – 70
No. 200	0 – 15

1. Run-of-trench material, meeting the above criteria, shall be considered suitable material and shall be used for trench backfill only after tested in accordance with Section "Quality Requirements" and approved by the Engineer. The Contractor shall pay for all additional testing required to determine the conformance of run-of-trench material, if at any time during the Work this material appears to be in non-conformance in the opinion of the Engineer.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points; re-establish if disturbed or destroyed at no additional cost to the Owner.
- C. Establish location and extent of existing utilities prior to commencement of excavation.

3.2 EXCAVATION

- A. All excavation shall be made to such depth as required and of the width shown on the Drawings to provide suitable room for building the structures and laying the pipe(s) they are to contain and for sheeting, shoring, pumping and draining as necessary, and for removing peat, silt, or any other materials which the Engineer may deem unsuitable. Hand trench excavation may be required to protect existing utilities and structures.
- B. Trench excavation for pipes shall be made by open cut to accommodate the pipe or structure at the depths indicated on the Drawings. Excavation shall be made to such a depth and to the width indicated on the Drawings so as to allow a minimum of 8 inches of pipe zone bedding to be placed beneath the bottom of all structures and barrels, bells or couplings of all pipes installed unless otherwise specified on the Drawings.
- C. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material as required for each section of pipe. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.
- D. Stockpile excavated subsoil for reuse where directed or approved.
- E. Over excavation/undercut: If, in the opinion of the Engineer, existing material below the trench grade is unsuitable for properly placing bedding material and laying pipe, the Contractor shall excavate and remove the unsuitable material and replace the same with an approved pipe zone bedding material properly compacted.
- F. Stability of Excavation: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavation in safe condition until completion of backfilling.
- G. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

3.3 DEWATERING

- A. The Contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times until the work is completed and excavation is backfilled or have sufficient weight to resist uplift pressures. Groundwater levels shall be depressed to a minimum of 2 feet below excavation subgrade. No pipe or structure is to be laid in water and water shall not be allowed to rise on or flow over any pipe or structure until such time as approved by the Engineer.
- B. Provide a suitable point of discharge from dewatering operations shall be conveyed in a non-erosive manner satisfactory to the Engineer.
- C. Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipe lines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected.

3.4 BEDDING AND BACKFILLING

- A. All pipe trenches backfill (pipe zone bedding, pipe zone backfill and trench backfill) shall be compacted by tamping or rolling to achieve a minimum dry density of 90 percent of the modified

Proctor maximum dry density of the material used (ASTM D1557). Backfill in pipe trenches to be covered with pavement shall be compacted to a minimum of 95 percent of modified Proctor maximum dry density. Backfill materials shall be placed with water content within plus or minus 4 percent of optimum moisture content per the modified Proctor method (ASTM D1557). Any water used for compaction shall be provided by the Contractor at his own expense. The Contractor is responsible for the repair of any trench settlement at no expense to the owner.

- B. Bedding and backfilling shall be accomplished in three stages unless otherwise specified on the Contract Drawings. The first stage shall involve placement of "pipe zone bedding" as a layer(s) of selected material required to support, or to stabilize unsound or unsatisfactory foundation conditions. The second stage shall involve placement of "pipe zone backfill" from the top of the bedding material up to 1 foot above the pipe. The third stage involves the placement of "trench backfill" in the remainder of the trench up to the surface of the ground or the bottom of any special surface treatment subgrade elevation.
- C. The bedding material shall be placed in the trench after the trench has been excavated a minimum of 8 inches below the bell of the pipe to permit the placing of not less than 8 inches of bedding material unless otherwise specified on the Drawings. Where, in the opinion of the Engineer, more than 8 inches of bedding material shall be required, the excavation shall be performed and bedding placed to the depth ordered by the Engineer.
- D. Provide uniform bearing and support for each section of pipe at every point along the entire length except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.
- E. The bedding material shall be placed to the full width of trench. The bedding material shall be placed in loose lifts not exceeding 6 inches to the elevation shown on the Drawings or directed by the Engineer. The bedding material shall be tamped and compacted to form a firm and even bearing surface.
- F. Pipe zone backfill shall be placed to the elevation shown on the Drawings in loose lifts not-to-exceed 6 inches in thickness, before compaction. The backfill shall be placed on both sides of the pipe at the same time and to approximately the same elevation. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense. Each layer shall be thoroughly compacted by hand-tamping or mechanical means being careful not to damage the pipe. When the pipe zone backfill reaches 1 foot over the top of the pipe, the entire surface shall be compacted by mechanical means.
- G. The remainder, if any, of the trench above the pipe zone backfill shall be backfilled with suitable material in loose lifts not exceeding 6 inches in thickness before compaction. Each layer shall be thoroughly compacted by mechanical means.

3.5 BACKFILLING AROUND STRUCTURES

- A. The Contractor shall not place backfill against any structure without obtaining the approval of the Engineer. No dumping shall be allowed where materials would flow against or around such structures. Backfill material shall be deposited in horizontal layers not exceeding 6 inches in loose thickness or as shown on the Drawings and thoroughly compacted by hand or by mechanical means to the satisfaction of the Engineer.

3.6 SUSPENSION OF WORK

- A. Whenever the work is suspended, excavations shall be protected and the roadways, if any, left unobstructed. Within or adjacent to private property, material shall be stored at such locations as will not unduly interfere with traffic of any nature and in no case shall materials be stored in locations which will cause damage to existing improvements.

3.7 DISPOSAL OF MATERIAL

- A. Excess and unsuitable materials shall be disposed of by the Contractor on the site in an area approved by the Engineer or legally disposed of off- site at the Contractor's expense.

3.8 FIELD QUALITY CONTROL

- A. Notify the Engineer at least 3 working days in advance of all phases of filling and backfilling operations.
- B. In-place density testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
 - 1. In-place relative density:
 - a. Method: AASHTO T310, Nuclear Method.
- C. Perform initial density testing to verify that contractors proposed compaction effort will obtain the minimum required densities.
- D. In-place density tests on trench backfills shall be provided for every 500 cubic yards of fill or in vertical lifts not exceeding 2 feet and at least once daily.
- E. One particle size analysis (ASTM D422) and one modified Proctor compaction test (ASTM D1557) shall be completed for every 5,000 cubic yards of material placed.
- F. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.
- G. Acceptance Criteria: The criteria for acceptability of in-place fill shall be in-situ dry density and moisture content. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 312500 – EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section covers work necessary for stabilization of soil to prevent erosion and sedimentation during and after construction and land disturbing activities. The work shall include the furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified and as indicated on the Drawings. This shall include installation, maintenance, and final removal of all temporary soil erosion and sediment control measures. All erosion and sediment control methods and devices used shall conform to the latest requirements imposed by federal, state, and local authorities.
- B. Comply with the latest version of New York Standards and Specifications for Erosion and Sediment Control.
- C. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. The right is reserved to modify the use, location, and quantities of soil erosion and sediment control measures based on activities of the Contractor and as the Engineer considers to be the best interest of the Owner.
- D. The Contractor shall be responsible for repair of any damage caused and shall be financially responsible for any penalties imposed.

1.2 QUALITY ASSURANCE

- A. Soil erosion and sediment control measures shall be implemented in accordance with the requirements and procedures outlined in this Specification, Contract Drawings and documents, state standards or guidelines for soil erosion and sediment control, and all regulatory authorities having jurisdiction. Where conflicts between requirements exist, the more restrictive rules shall govern.
- B. The Contractor shall provide all temporary control measures shown on the Drawings, or as directed by the Owner, Owner's representative, or soil conservation district for the duration of the contract. Erosion and sediment control Drawings are intended to be a guide to address the stages of work shown. Additional measures not specified on the Drawings may be necessary and shall be implemented to address intermediary stages of work and any conditions that may develop during construction at no cost to the Owner.
- C. Temporary control provisions shall be coordinated with permanent erosion control features to the extent practical to assure economical, effective, and continuous erosion and sediment control throughout the construction and post-construction period.
- D. Soil erosion and sediment control measures shall at all times be satisfactory to the Owner's Representative. Owner's Representative will inform the Contractor of unsatisfactory construction procedures and operations if observed. If the unsatisfactory construction procedures and operations are not responded to and corrected within 48 hours, the Owner's Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected. Such suspension shall not be the basis of any claim by the Contractor for additional compensation nor for an extension of time to complete the work. Any complaints, fines, etc. relating to ineffective erosion control, shall be the sole responsibility of the Contractor.

- E. The Contractor shall inspect all soil erosion and sediment control measures at least at the beginning and end of each day to ascertain that all devices are functioning properly during construction. Maintenance of all soil erosion and sediment control measures on the project site shall be the responsibility of the Contractor until final stabilization is complete, and until the permanent soil erosion controls are established and in proper working condition.
- F. The Contractor shall protect adjacent properties and watercourses from soil erosion and sediment damage throughout construction.

1.3 GENERAL

- A. Soil erosion stabilization and sediment control measures consist of the following elements:
 - 1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
 - 2. Installation and maintenance of stabilized construction entrance(s).
 - 3. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
 - 4. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
 - 5. Topsoil and Seeding: Placement and maintenance of Temporary Seeding on all areas disturbed by construction. Placement of permanent topsoil, fertilizer, and seed, etc., in all areas not occupied by structures or pavement unless shown otherwise.
 - 6. Soil Stabilization Seeding: Placement of fertilizer and seed, etc., in areas as Specified hereinafter.
- B. The Contractor shall be responsible for phasing Work in areas allocated for his exclusive use during this Project, including any proposed stockpile areas, to restrict sediment transport. This will include installation of any temporary erosion control devices, ditches, or other facilities.
- C. The areas set aside for the Contractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for his exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to both control all sediment transport away from the area.
- D. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.
- E. All permanent stockpiles shall be seeded with soil stabilization seed and protected by construction of silt fences completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.
- F. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences as necessary. The Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance.
- G. The Contractor shall maintain all elements of the Soil Erosion Stabilization and Sedimentation Control systems and facilities to be constructed during this Project for the duration of his activities on this Project.
- H. Formal inspections made jointly by the Contractor and the Engineer shall be conducted every 2 weeks to evaluate the Contractor's conformance to the requirements of these Specifications.

- I. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Contractor within 24 hours after receiving written notice from the Engineer.
- J. If the Contractor has not complied with any of the above maintenance efforts to the satisfaction of the Engineer within 2 working days after receiving written notification from the Engineer, the Owner shall have the prerogative of engaging others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Contractor's monthly partial payment the costs for such efforts in accordance with the General Conditions of the Contract.

1.4 SUBMITTALS

- A. Submittals shall be made in accordance with Section 013300 "Submittal Procedures."
- B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- C. Results of all tests and investigations, including recommendations.
- D. Submit product data, samples, specifications and manufacturer's installation procedures for approval as directed by Engineer prior to use.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Contractor shall provide all materials necessary to perform the work in accordance with the SWPPP or as shown on the Drawings or specified herein.

2.2 PERMANENT SEED

- A. Refer to Section "Turf and Grasses."

2.3 SOIL STABILIZATION AND TEMPORARY SEED

- A. Temporary Seed: Rye grass, cereal grasses, or other quick growing species suitable to the area as a temporary cover, which will not compete with the grasses specified for permanent cover or as specified in the SWPPP or on the Drawings.

2.4 TOPSOIL

- A. Topsoil shall be as specified under Section "Soil Preparation."

2.5 FERTILIZER

- A. Refer to Section "Turf and Grasses."

2.6 LIME

- A. Ground dolomite limestone not less than 85 percent total carbonates and magnesium, ground so that 50 percent passes through a No. 100 mesh sieve and 90 percent passes a No. 20-mesh sieve. Coarser

material will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the No. 100-mesh sieve.

2.7 STRAW MULCH

- A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds or clean salt hay.

2.8 COMPOST FILTER SOCK

- A. Compost infill shall consist of decomposed (matured at least 3 months), weed-free, organic material that is aerobically composted, possess no odors, and contain less than 1%, by dry weight, of man-made material. The compost infill should meet the following specifications. All biosolids compost produced in New York State must meet NYS DEC's 6 NYCRR Part 360 (Solid Waste Management Facilities) requirements or more stringent than 40 CFR Part 503 to ensure safe standards for pathogen reduction and heavy metal content.

Organic Matter Content	25% - 100% (dry weight)
Organic Portion	Fibrous and elongated
pH	6.0 – 8.0
Moisture Content	30% - 60%
Particle Size	100% passing a 1" screen and 10-50% passing a 3/8" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) maximum

- B. Compost filter sock fabric material shall meet the minimum requirements and specifications listed in the following tables.

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photodegradable	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Sock Diameters	12", 18"	12", 18", 24", 32"	12", 18", 24", 32"	12", 18", 24", 32"	12", 18", 24", 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years

2.9 MANUFACTURED INSERT INLET PROTECTION

- A. The sack structure shall consist of woven geotextile fabric equal to or exceeding the performance standard for the silt fence fabric.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall comply with and implement the Stormwater Pollution Plan provided in the contract documents.

- B. Review the soil erosion and sediment control Drawings as they apply to current conditions. Any deviation from the Drawings must be submitted for approval to the site Engineer in writing at least 72 hours prior to commencing that work.
- C. Initial soil sediment and erosion control devices shall be in place prior to any land disturbing activity in their proper sequence and maintained until permanent protection is established.
- D. The limit of the area of any earthwork operations in progress shall be commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current and in accordance with the accepted schedule for construction phasing. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Representative, temporary erosion control measures shall be provided immediately by the Contractor at no expense of the Owner.
- E. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.
- F. The Contractor shall incorporate all permanent erosion control features (stabilization) into the project at the earliest practical time to minimize the need for temporary controls.
- G. A stabilized construction entrance (SCE) shall be installed and maintained at any point where construction vehicles enter a public right-of-way, street, or parking area. The SCE shall be used to eliminate mud from the construction area onto public right-of-way. The SCE shall be constructed as shown on the Drawings. Any mud or debris tracked on streets shall be cleaned up immediately.
- H. Dust Control: The Contractor shall provide a commercial grade; enclosed broom mechanical street sweeper to control sediment and/or dust that is tracked on to the adjacent streets. The street sweeper shall be equipped with a water storage tank to wet the area prior to sweeping. Where on site controls do not prevent material from being tracked on to adjacent streets, the street sweeper shall be used to clean the adjacent streets immediately. In addition, at a minimum, the adjacent streets shall be swept at the end of each week or as directed by the Engineer.
- I. Any disturbed or stockpiled areas that will be left exposed more than 14 days or less according to State NPDES General Stormwater Permits shall immediately receive temporary or permanent seeding. Mulch/straw shall be used if the season prevents the establishment of a temporary cover. Disturbed areas shall be limed and fertilized prior to temporary seeding.
- J. Permanent vegetation shall be established as specified on all exposed areas within 7 days or less according to State NPDES General Stormwater Permits after final grading. Mulch as necessary for seed protection and establishment. Lime and fertilize seedbed prior to permanent seeding.
- K. Slopes shall be permanently seeded and mulched. Any slopes that erode easily shall be temporarily seeded and mulched. Any slopes deeper than 3:1 or steeper or as indicated on Drawings shall be protected with Erosion Control Blanket per specifications.
- L. All storm drainage outlets must be stabilized, as specified, before the discharge points become operational. Equip all inlets with inlet protection immediately upon construction.
- M. Manufactured insert inlet protection shall be installed and anchored in accordance with the manufacturers recommendations and design details. The Contractor shall maintain all manufactured insert inlet protection units until the project is stabilized and shall remove and dispose of the sediment

accumulation properly when the units are more than 1/3 full. Replace and reinstall the unit if necessary.

- N. Discharge from dewatering operations for the excavated areas shall not be directed to surface waters without first properly removing the suspended sediment through filtration and/or settlement. The Contractor shall obtain any required permits associated with dewatering activities.
- O. Filter Socks shall be placed at locations indicated on plans or as directed by the Engineer. They should be installed parallel to the base of the slope or other affected area. The Contractor shall maintain the Filter Socks and they shall be inspected weekly and after each rain event. If the Filter Sock requires repair, it shall be repaired in accordance with the manufacturer's recommendations or replaced within 24 hours of inspection notification. Biodegradable filter socks shall be replaced after 6 months; photodegradable filter socks after 1 year. Polypropylene socks shall be replaced according to the manufacturer's recommendations.
- P. Soil erosion and sediment control shall include but not be limited to the approved measures. The Contractor shall be responsible for providing all additional measures that may be necessary to accomplish the intent of the Drawings.
- Q. Comply with all other requirements of authorities having jurisdiction.
- R. Soil Stabilization and Temporary Seeding:
 - 1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days.
 - a. Lime.
 - b. Fertilizer.
 - c. Seed.
 - d. Mulch.
 - e. Maintenance.
 - 2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Should the Contractor elect to apply soil stabilization seeding by hydroseeding methods, he shall submit his operational plan and methods to the Engineer.
 - 3. Temporary Seeding is to be placed and maintained over all disturbed areas prior to Permanent Seeding. Maintain Temporary Seeding until such time as areas are approved for Permanent Seeding. As a minimum, maintenance shall include the following:
 - a. Fix-up and reseedling of bare areas or re-disturbed areas.
 - b. Mowing for stands of grass or weeds exceeding 6 inches in height.
- S. Topsoil and Permanent Seeding: conform to the requirements of Section "Soil Preparation" and Section "Turf and Grasses."

END OF SECTION

SECTION 321116 – SUBBASE COURSES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes provisions for prepared subbase courses for under walks and pavements.
- B. Proof rolling of subgrade for walks and pavements is included in this Section.
- C. Replacement of unsuitable subgrade materials is included in another Section.
- D. Final grading of pavement subbase is specified in this Section.
- E. Stabilization fabric is included in another Section.

1.2 REFERENCES

- A. The latest edition of the following standards, as referenced herein, shall be applicable:
 - 1. Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.
 - 2. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
 - 3. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Source Quality Control Test Reports: Submit test reports directly to Engineer from the testing agency with copy to Contractor.
- B. Field Testing Reports: Submit results of field testing directly to Engineer with copy to Contractor. Reference testing location to plan, and cross-reference to all retesting required to accept installed subbase material.
 - 1. Note action taken next to all sub-standard test results.

1.4 QUALITY ASSURANCE

- A. Testing Laboratory Qualifications: To qualify for acceptance, the soil testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E699, that it has the experience and capability to conduct the required testing without delaying the progress of the Work.
- B. Field Testing and Inspection Service: Contractor shall retain the services of the same independent soil testing laboratory used for source qualification testing to provide soil testing during pavement subbase installation.

PART 2 – PRODUCTS

2.1 OPTIONAL TYPES:

- A. Select one of the following subbase options:
 - 1. Subbase course consisting of a single layer of Type 2 subbase material.

2.2 SOURCE QUALIFICATION TESTING

- A. Contractor shall employ and pay for a qualified independent soil testing laboratory to perform soil testing services for source qualification.
 - 1. Obtain a 100-pound minimum representative sample from each potential aggregate source. Obtain samples for each different material gradation known to exist in the pit. Mix each sample thoroughly in accordance with AASHTO T87 and submit to the testing laboratory for reduction to specimen size. The laboratory shall perform the following tests in the order shown. Each material shall pass all tests in order to qualify.
 - a. Particle Size Analysis:
 - 1) Method: ASTM D422.
 - 2) Number of Tests: 2 per potential source.
 - 3) Acceptance Criteria: Gradation within specified limits.
 - b. Plasticity Index Determination:
 - 1) Method: ASTM D424.
 - 2) Number of Tests: 1 particle size analysis on material passing no 40 mesh.
 - 3) Acceptance Criteria: Plasticity Index within specified limits.
 - c. Maximum Density Determination:
 - 1) Method: ASTM D1557 Modified Proctor.
 - 2) Number of Tests: 2 per potential source.
 - d. Magnesium Sulfate Soundness Loss Test:
 - 1) Method: NYSDOT Standard Test Method 11.
 - 2) Number of Tests: 2 per potential source.
 - 3) Acceptance Criteria: 4 cycle loss within specified limits.
 - 2. Re-establish subbase material properties if source is changed during construction.

2.3 MATERIALS

- A. Processed Gravel Subbase Course: Materials shall consist of sound, durable blast furnace slag, stone, sand, gravel or blends of these materials.
- B. Crushed Rock Subbase Course: Materials shall consist solely of approved blast furnace slag or stone which is the product of crushing ledge rock NYSDOT Type 2.

- C. All materials shall be well graded from course to fine and free from organic or other deleterious materials, conforming to the requirements of NYSDOT Section 304, and meeting the following gradation requirements:

TYPE	SIEVE	PERCENT PASSING
2	2"	100
	1/4"	25-60
	No. 40	5-40
	No. 200	0-10
	1/4"	30-75

1. Magnesium Sulfate soundness loss after 4 cycles shall be less than 20 percent for types 1, 2, and 4. Magnesium sulfate soundness loss after 4 cycles shall be less than 30 percent for type 3.
 2. Plasticity Index of material passing No. 40 sieve shall not exceed 5.0.
 3. Not more than 30 percent, by weight, of the particles retained on a 1/2-inch sieve shall consist of flat or elongated particles. A flat or elongated particle is defined as one which has its greatest dimension more than 3 times its least dimension.
 4. All material shall meet the specified gradation prior to placement. All processing shall be completed at the source.
 5. Stabilization Fabric: Conform to Section "Geotextiles."
- D. Material substitutions and/or additives such as glass, Blast Furnace Slag, Recycled Portland Cement Concrete Aggregate (RCA) and Reclaimed Asphalt Pavement shall be allowed for Types 1, 3 and 4, in accordance with NYSDOT Section 304 and are subject to approval and acceptance by the Engineer.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to Owner.
- C. Proof-roll existing subgrade to the satisfaction of the Engineer. Should the subbase course become unstable at any time prior to the placement of the overlying course(s), correct the unstable condition to the satisfaction of the Engineer. Replace unstable or weak subgrade materials with suitable material as provided in the Specifications.
- D. Place stabilization fabric in locations as directed on the plans and in accordance with Section "Geotextiles" after subgrade has been proof-rolled and accepted by the Engineer.

3.2 INSTALLATION

- A. Place subbase material in uniform horizontal layers, with a maximum compacted thickness of 12 inches.
- B. Place subbase in a manner to avoid segregation. Uncontrolled spreading shall not be permitted.
- C. Do not place Type 3 material within 4 inches of the bottom of a pavement course.

3.3 COMPACTION

- A. Where subbase courses must be moisture-conditioned before compaction, uniformly apply water to the surface. Prevent free water from appearing on the surface during or subsequent to compaction operations.
- B. Compact all portions of each layer to a density not less than 95 percent of the maximum density.
- C. Final tolerances for the top surface of the subbase course requires that the surface does not extend more than 1/4 inch above nor more than 1/4 inch below the specified grade at any location.

3.4 TRAFFIC ON SUBBASE

- A. The movement of vehicular traffic over the final surface of the subbase may be permitted at locations designated by, and under such restrictions as ordered by the Engineer, provided such movements take place prior to the final finishing of this course to the specified tolerance. The movement of construction equipment on this course may be permitted, at locations designated by and under such restrictions as ordered by the Engineer at locations where permission is granted for such movement, the temporary surface of the course upon which the construction traffic is running, shall be placed and maintained for at least 2 inches above the final surface of this course. Just prior to paving, and after all construction traffic not required for the removal has ceased, remove the 2-inch protective layer, prepare the exposed surface of the course, and compact to the specified tolerance.
- B. Should the subbase become mixed with the subgrade or any other material, through any cause whatsoever, remove such mixture and replace it with the specified subbase material.

3.5 FIELD QUALITY CONTROL

- A. Notify the Engineer at least 1 working day in advance of all phases of subbase installation.
- B. Comply with the requirements of this Section for in-place relative density testing.
 - 1. In-place relative density:
 - a. Method: AASHTO T310, Nuclear Method.
 - b. Number of Tests: 1 per specified interval.
 - 2. Compaction tests shall be provided for every 1000 square yard of subbase placement. A minimum of 3 for each lift is required.
 - 3. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions.
 - 4. Acceptance Criteria: The sole criterion for acceptability of in-place subbase shall be in situ dry density. Minimum dry density for all subbase shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 321216 – ASPHALT PAVING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for asphalt concrete paving over prepared subbase.
- B. This section includes provisions for replacing pavement removed during the course of the Work, or damaged resulting from Contractor's operations.

1.2 REFERENCES

- A. The latest edition of the following standards, as referenced herein, shall be applicable:
 - 1. "Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering".
 - 2. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
 - 3. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- B. Field Test Reports: Submit results of field testing directly to the Engineer.
- C. Request for placement of Top Course: If applicable, request Owner/Engineer approval for placement of Top Course outside of seasonal limitations noted herein. Include a copy of the Limited Warranty for approval.

1.4 SITE CONDITIONS

- A. Temperature and Seasonal Limitations:
 - 1. Do not place asphalt plant mix on any wet surface or when surface temperature is less than specified in Table 404-3.01, Temperature and Seasonal Requirements in the latest edition of the NYSDOT Standard Specifications.
 - 2. Apply tack coats when ambient temperature is above 50 DegF and when temperature has not been below 35 DegF for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
 - 3. Place Top Course between April 15 and October 31. Placing Top Course outside the limitations will require Owner/Engineer approval and approval of a limited warranty against defects in such work prior to implementation. Perform the warranty work in accordance with Materials Procedure (MP) 402-01, Warranty Requirements for Asphalt Top Course. Unless specified elsewhere in this specification or contract documents, these seasonal limits do not apply for any other asphalt course placement.
- B. Grade Control: Establish and maintain required lines and elevations.
- C. In no instance shall the materials and thicknesses of pavement and subbase courses replaced be less than that removed, unless approved by the Engineer.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate the placement of asphalt concrete pavement with the completion of underground work by other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. General: Asphalt concrete and all related items shall meet the requirements of NYSDOT Section 400.
- B. Binder Course:
 - 1. NYSDOT 404.258901 specify other – See NYSDOT Standard Specifications.
- C. Top Course:
 - 1. NYSDOT 404.128301 specify other – See NYSDOT Standard Specifications.
- D. Tack Coat:
 - 1. Emulsified asphalt, ASTM D977 NYSDOT Table 702-8.
- E. Joint Adhesive:
 - 1. Hot-applied modified asphalt product conforming to NYSDOT Specification 705.19.
 - 2. The-joint adhesive materials shall be on the NYSDOT approved materials list.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

- A. General: Remove loose material from compacted subbase surface immediately before commencing paving operations.
- B. Proof-roll prepared subbase surface with a 10-ton static, steel-wheel roller to check for unstable areas and areas requiring additional compaction, witnessed by the Engineer at least 48 hours prior to scheduled paving operations.
- C. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.
- D. Sawcut edges of existing pavement to achieve straight line transitions between old and new pavement. Make a second sawcut through the top course of existing pavement, 18 inches from the first cut to provide a staggered joint.
- E. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.03 to 0.07 gallons per square yard of surface. Tack coat shall be applied between each layer of the pavement section.
 - 1. Allow to dry until at proper condition to receive paving.

- F. Joint Adhesive:
1. Apply joint adhesive to all pavement edges in accordance with NYSDOT Section 418 Asphalt Pavement Joint Adhesive prior to placing the asphalt mixture in order to provide bonding with the newly laid pavement. The application of joint adhesive is for Top Course only.
 2. Apply the joint adhesive when surface temperature is 40 DEGF and rising. Use an applicator wand fitted with a sealing shoe to strike-off the adhesive. Strike-off the joint adhesive to provide a 1/4 inch to 3/8 inch thick band. The finished bands are to be approved by the Engineer.
 - a. Wedge Joints:
 - 1) Apply the joint adhesive to the entire vertical face and the upper 2 inches of the wedge joint.
 - b. Butt Joints:
 - 1) Apply the joint adhesive to the entire vertical face of the butt joint.
 3. The joint adhesive will be considered cured when construction and/or vehicular traffic does not track or pick up the material. Reapply joint adhesive to any areas damaged by construction and/or vehicular traffic prior to placing the adjacent asphalt pavement.
- G. Exercise care in applying bituminous materials to avoid smearing of adjoining surfaces. Remove and clean damaged surfaces.

3.2 PLACING AND COMPACTING MIX

- A. General: Place and compact asphalt pavement courses in accordance with NYSDOT Section 404-3 unless otherwise specified.
- B. Place inaccessible and small areas by hand and compact with hot hand tampers or vibrating plate compactors.
- C. Chamfer edges of walks at 45-degree angle where walks do not abut curb.
- D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.
- E. Place tack coat between successive courses if more than 48 hours have elapsed after placing the preceding course. Apply tack coat at a rate of 0.03 to 0.07 gallons per square yard of surface.
- F. Remove and patch areas of any asphalt concrete course deemed unsatisfactory by the Engineer, at the Contractor's expense. Remove hardened or set asphalt by saw cutting.
- G. Adhere to NYSDOT compaction requirements. This, however, shall not relieve the Contractor of his responsibility to provide a well densified pavement. It shall be the Contractor's obligation to recognize difficulties in compacting the mix, and to make appropriate corrections.
- H. Roll and compact the asphalt concrete course until the finished surface is free from depressions, waves or other defects that would prevent proper drainage. The finished surface shall be uniform in texture and appearance.
- I. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

- J. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.
- K. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T168.
 - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample will be taken for every 1000 square yard (836 square meter) or less of installed pavement with no fewer than 3 cores taken.
- L. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.
 - 1. Replace and compact asphalt where core tests were taken.
 - 2. Remove and replace or install additional asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.3 FIELD QUALITY CONTROL

- A. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Engineer.
- B. Thickness: In-place compacted thickness tested in accordance with ASTM D3549 will not be acceptable if exceeding following allowable variations:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Binder and Surface Course: Plus or minus 1/4 inch.
 - 3. Cumulative Thickness Tolerances: Plus or minus 1/4 inch for nominal cumulative thicknesses less than or equal to 4 inches. Plus or minus 1/2 inch for nominal cumulative thicknesses greater than 4 inches.
- C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
 - 1. Base and Binder Course Surfaces: 1/4 inch.
 - 2. Wearing Course Surface: 3/16 inch.
- D. Check surface areas at intervals as directed by Engineer.

END OF SECTION

SECTION 321630 – CONCRETE SIDEWALKS

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the installation of concrete sidewalk as shown on the Drawings, or as specified herein.
- B. The materials and methods specified herein are directly intended for placement of “new” concrete sidewalk. Where existing sidewalk is removed and replaced during construction, modifications to these specifications to match existing conditions shall be made as directed by the Engineer.

1.2

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable.
 - a. Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.
 - b. American Society of Testing and Materials (ASTM).
 - c. American Concrete Institute (ACI).
- B. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications, if at any time during the Work, materials appear unsuitable in the opinion of the Engineer.

1.3 SUBMITTALS

- A. Concrete:
 - 1. The Contractor shall furnish the name and location of the concrete supplier.
 - 2. Submit the design mix for each class of concrete prior to use in the Work.
- B. Product Data:
 - 1. Submit manufacturer’s catalog cuts, specifications, and installation instructions.
- C. Test Results:
 - 1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Concrete:
 - 1. All cast-in-place concrete shall be ready mixed concrete meeting the following criteria:
 - a. 28-day compressive strength-5000 psi.
 - b. Air entrainment-4% to 8%.
 - c. Slump-2" to 4".

- B. Premoulded Expansion Joint Filler:
 - 1. Concrete curbing shall be provided with a 1/2 inch premoulded expansion joint filler conforming to ASTM D1751.
 - 2. The premoulded expansion joint filler shall be “pre-cut” to match the concrete sidewalk cross-sectioned dimensions as detailed on the Drawings.
- C. Fabric Reinforcement:
 - 1. Flat sheets of 6 x 6 - W 2.9 x W 2.9, ASTM A1064, welded wire reinforcement.
- D. Sealants:
 - 1. Joint Sealers: ASTM C920.
- E. Forms:
 - 1. Sidewalk forms shall be of wood or steel, straight of sufficient strength to resist springing during depositing and consolidating concrete, and of a height equal to the full depth of the finished sidewalk.
 - 2. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet, with a minimum of three stakes per form, at maximum spacing of 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness.
 - 3. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Form ends shall be interlocked and self-aligning. Forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Forms shall have a nominal length of 10 feet, with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips, designed for use with steel forms.

PART 3 – EXECUTION

3.1 INSPECTION

- A. The Contractor shall notify the Engineer 24 hours before placing concrete in order to give the Engineer an opportunity to inspect the formwork, reinforcing and related items prior to placement of the concrete.
- B. Delivery tickets shall show the amount of cement, brand, and amount of all admixtures, in addition to information required by ASTM C94, Section 14. Water added on the job shall be approved and the amount noted on the delivery ticket and initialed by the Contractor.

3.2 SUBBASE PREPARATION

- A. Concrete sidewalk shall be constructed on a compacted granular subbase as shown on the Drawings.
- B. The completed subbase shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.
- C. The subbase shall be maintained in a smooth, compacted condition in conformity with the required section and established grade, until the concrete is placed.

- D. The subbase shall be in a moist condition when concrete is placed.
- E. The subbase shall be prepared and protected so as to produce a subbase free from frost when the concrete is deposited.

3.3 FORMWORK

- A. Earth cuts may not be used as forms for vertical surfaces.
- B. All forms shall be built mortar tight and of materials sufficient in strength to hold concrete without bulging between supports. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the forms. Concrete, misshapen by bulges or deformations caused by inadequate forms, shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the Contractor's expense.
- C. All surfaces of wooden forms that will be in contact with exposed concrete shall be thoroughly treated with an approved lacquer in the procedure recommended by the manufacturer. Forms so treated shall be protected from being damaged or dirtied prior to placing of the concrete.
- D. Metal forms shall be treated with an approved form lacquer or may be treated with an approved form oil. The metal used for forms shall be of sufficient thickness to remain true to shape. All bolt and rivet heads shall be designed to hold the forms rigidly together and to allow removal, without injury to the concrete. Metal forms which do not have smooth surfaces, correct alignment and clean surfaces shall not be used.
- E. Side forms shall not be removed for less than 12 hours after finishing has been completed.

3.4 CONCRETE PLACEMENT AND FINISHING

- A. Preparation:
 - 1. Set forms true to line and grade and anchor rigidly in position.
 - 2. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Longitudinal expansion joints shall be installed between concrete sidewalk and abutting concrete curb, continuously. Transverse expansion joints shall be installed equally at not more than 25 feet on center, unless otherwise directed by the Engineer, or as detailed on the Drawings.
 - 3. Transverse expansion joints shall be filled with 1/2-inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.
 - 4. Expansion joints shall be formed about structures and features that project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. The filler shall be installed in such manner as to form a complete, uniform separation between the structure and sidewalk pavement.
- B. Placement of Fabric Reinforcement:
 - 1. Prior to placement, clean reinforcement thoroughly of mill and rust scale and of coatings which could destroy or reduce bond. Where there is a delay in depositing concrete after the positioning of reinforcement, reclean reinforcement, if necessary.
 - 2. Place reinforcement midway between top and bottom of the slab and secure against displacement.

3. Lap edges and ends of adjoining sheets of fabric reinforcement at least half the mesh width. Offset end laps in adjacent sheets to prevent continuous joints at ends. Interrupt reinforcement at expansion joints, stopping 2 inches from edges.

C. Concrete Placement:

1. Concrete shall be placed in the forms in one layer of such thickness that when compacted and finished the sidewalk will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted.
2. The concrete shall be tamped and consolidated with a suitable wood or metal tamping bar, and the surface shall be finished to grade with a wood float. Finished surface of the walk shall not vary more than 3/16 inch from the testing edge of a 20-foot straightedge. Irregularities exceeding the above shall be satisfactorily corrected. The surface shall be divided into rectangular areas by means of contraction joints spaced at intervals shown on the drawings.
3. Place concrete in accordance with ACI 301 unless otherwise specified herein.
4. Cold Weather Concreting: Comply with ACI 306 for placement at temperatures of, or expected to be, below 40°F.
5. Hot Weather Concreting: Comply with ACI 305 for placement at temperature of, or expected to be, above 90°F.

D. Concrete Finishing:

1. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, or as otherwise shown on the drawings.
2. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Corner and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.
3. The completed surface shall be uniform in color and free of surface blemishes and tool marks.

3.5 CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.6 SEALING JOINTS

- A. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Concrete at the joint shall be surface dry, and the atmospheric and pavement temperatures shall be above 50°F, at the time of application of joint sealing materials.
- B. Joints shall be filled flush with the concrete surface in such manner as to minimize spilling on the walk surface. Spilled sealing material shall be removed immediately and the surface of the walk cleaned. Dummy groove joints shall not be sealed.

3.7 BACKFILLING AND RESTORATION

- A. After curing, debris shall be removed, and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.
- B. All lawns, pavements, driveways, shrubs, or other improvements affected by sidewalk placement shall be restored to their original condition.

3.8 PROTECTION

- A. The Contractor shall protect the sidewalk and keep it in "first class" condition until the completion of the Contract. Any sidewalk which is damaged prior to final acceptance of the Work shall be removed and replaced at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: The Contractor will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 DegF and below and when 80 DegF and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C311/C311M.
 - a. Cast and laboratory cure three sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days. The remaining two cylinders will be held in reserve. If the results of the 28-day tests indicate low strength concrete, the engineer will direct the contractor and laboratory to test the remaining two cylinders at a time directed by the Engineer.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Owner within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

END OF SECTION

SECTION 321723 – PAVEMENT MARKING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for removal of existing pavement markings and for new pavement markings on finished surfaces.

1.2 REFERENCES

- A. “Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.”.
- B. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
- C. “Manual of Uniform Traffic Control Devices,” New York State Department of Transportation.
- D. Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities, US Department of Justice.

1.3 SUBMITTALS

- A. Pavement marking plan indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphics symbol.
- B. One (1) manufacturer’s label including product analysis for each paint type and color.

1.4 QUALITY ASSURANCE

- A. Conform to all requirements of regulatory agencies having jurisdiction.

1.5 SITE CONDITIONS

- A. Perform the painting operations after working hours, on weekends or at such time so as not to interfere with the flow of traffic. Provide temporary barriers to prevent vehicles from driving over newly painted areas.
- B. Apply paint on dry, clean pavement surface, when the air temperature is above 40°F.
- C. All pavement markings require glass bead application, except parking stall markings.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate pavement markings with regulatory authorities having jurisdiction.
- B. Schedule pavement markings to follow the completion of paved surfaces.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Marking Paint: NYSDOT Section 685-2.
 - 1. Colors: White, yellow, blue.
- B. All paints and solvent shall conform to Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the US Environmental Protection Agency, and the New York State Department of Environmental Conservation.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

- A. Remove dust, dirt, and other foreign material detrimental to paint adhesion.
- B. Mark layout of pavement markings with chalk or paint prior to final application.

3.2 APPLICATION

- A. Apply pavement markings in accordance with NYSDOT Section 685-3.05, Application for Epoxy Reflectorized Pavement Markings.
- B. Reflective glass spheres are injected into, or dropped onto, the liquid epoxy marking at a minimum rate of 20 lb/gal of epoxy resin.
- C. Use rollers and brushes for miscellaneous markings.
- D. Use templates and guides to provide uniform patterns and straight edges.

END OF SECTION

SECTION 329000 – PLANTING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Trees.
 - 2. Shrubs.
 - 3. Ground covers.
 - 4. Plants including ferns and perennials.
 - 5. Planting accessories.
 - 6. Planting soil mixes.
 - 7. Landscape edging.
 - 8. Mulch.
 - 9. Maintenance and warranty of exterior plants.

1.2 REFERENCES

- A. ANSI Z60: American Standard for Nursery Stock.
- B. ASTM B221: ASTM International Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 DEFINITIONS

- A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.
- B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
- C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.
- F. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

1.4 SUBMITTALS

- A. Before plant material is shipped to the project site, submit the following:
 - 1. A complete itemized list of all plants including the source of supply and nursery certificates.
 - 2. Photographs of plant material.
- B. Product Data: For each type of product indicated.
 - 1. Peat moss (including certification).
 - 2. Fertilizer (including certification).
 - 3. Top mulch.
 - 4. Wrapping
 - 5. Guying and staking material.
 - 6. Weed control barriers.
 - 7. Landscape edging.
 - 8. Antidesiccant (including certification).
 - 9. Tree grates.
- C. Photographs: Submit photographs of plants and mulches prior to Observation, as listed in Quality Assurance below. Photographs shall include a person holding a clearly marked measuring rod next to plants and mulches. Photographs shall exhibit the size, growth habit, and general visual quality of plants. Photographs of dense clusters of plants, in which one plant is not distinguishable from another, are not acceptable. Digital photographs submitted via email are acceptable.
 - 1. At the request of the Owner, the Landscape Architect/Engineer may observe the plant and mulch material at place of growth in lieu of photographs.
- D. Material Test Reports: For existing surface soil and/or imported topsoil as required by Section "Soil Preparation".
- E. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- F. Qualification Data: For Landscape Installer.
- G. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.
- I. Maintenance bond: Contractor shall provide list of items, quantities, and cost to be performed during the maintenance period. Once approved by the owner, the contractor shall submit a formal performance bond.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants on similar projects:
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time, English-speaking, supervisor on Project site when exterior planting and regular maintenance is in progress.
 - 2. Installer must have a minimum of three (3) years experience in this type of landscaping.
 - 3. Installer must have installed previous projects in similar size and scope as this project and provide a listing of projects including name and contact person with phone number or email address.
- B. Provide quality, size, genus, species, and variety of exterior plants indicated on the plans, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
 - 1. Substitutions of plants will not be permitted unless authorized in writing by the Landscape Architect/Engineer prior to purchase for this Project.
- C. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes.
- D. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- E. Observation: Landscape Architect/Engineer may observe trees and shrubs at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect/Engineer retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site. Notify Landscape Architect/Engineer of sources of planting materials seven days in advance of delivery to site.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- G. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- H. Maintenance Instructions: Recommended procedures to be established by owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.
- I. Topsoil Analysis: Furnish soil analysis as required in Section "Soil Preparation".
- J. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to product a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store, irrigate, maintain, and otherwise protect balled and burlapped trees in a manner that prevents mechanical injury and physiological stress between the time of digging and delivery. The trees and shrubs shall be balled with firm, natural balls of soil and wrapped with burlap and tied in accordance with ANSI Z60.1.

- B. All container grown shrubs shall be healthy, vigorous, well rooted, and established in the container in which they are growing. They shall have tops of good quality and be in a healthy growing condition. A container shrub shall be in that container a sufficient time that fibrous roots are formed so the shape will remain and the medium will hold together when removed from the container. All shrubs sold in containers shall meet Contract Documents for both plant size and container size. The plant size shall agree with sizes specified in the American Standard for Nursery Stock.
- C. Groundcovers/perennials shall be supplied in pots or flats; plants shall be 1-year old cuttings (minimum) with well-established root systems.
- D. Deliver exterior plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- E. Do not prune trees and shrubs before delivery, except as approved by Landscape Architect/Engineer. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Irrigate balled and burlapped plants thoroughly immediately prior to transport. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- F. Handle planting stock by root ball. Planting stock with cracked or broken root balls will not be accepted.
- G. Furnish the following with each planting material delivery:
 - 1. An invoice indicating sizes, quantity, genus, species and variety of exterior plant material.
 - 2. All certificates of inspection required by State and Federal agencies.
 - 3. Labels for each plant or bundles of plants indicating name and size.
- H. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
 - 2. Set balled stock on ground and cover ball with woodchip mulch or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
- I. Deliver fertilizer in manufacturer's standard sized bags showing weight, analysis, and manufacturer's name. Store under a waterproof cover or in a dry place as approved by the Landscape Architect/Engineer.

1.7 COORDINATION

- A. Contractor is responsible for verifying plant quantities shown on the planting plan. Contractor is responsible for filling all areas on plans shown to be planted on planting plan. Contractor shall prepare his or her own quantity list from the plan(s). All ground cover, perennial, and annual beds are to be filled at the specified spacing.

- B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion:

Spring:	Deciduous	April 15 to June 15
	Evergreen	April 15 to June 15
Fall:	Deciduous	September 1 to October 31
	Evergreen	Only on approval of the Landscape Architect/Engineer

- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- D. Coordination with Other Work: Coordinate planting with all other work of the project, including site utilities and flatwork.
- E. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect/Engineer. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

- A. Warranty: Warrant all exterior plants covered by this Section, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from abuse by Owner, or incidents that are beyond Contractor's control.
- Warranty Period for Exterior Plants:
 - From date of Installation to Substantial Completion.
 - One (1) year from date of Substantial Completion.
 - Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
 - Replace without cost to Owner, as soon as weather and soil conditions permit, exterior plants that are more than 25 percent dead or in an unhealthy condition as determined by the Landscape Architect/Engineer at end of warranty period.

1.9 MAINTENANCE

- A. Maintenance Period for all exterior plants covered by this Section: Concurrent with Warranty Period and same duration as Warranty Period. Maintenance requirements are itemized in Part 3 of this Section. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.
- B. Owner will assume maintenance following completion of Maintenance Period.
- C. Maintenance Period: 1 year (12 months) from the date of planting completion and acceptance and approval by the Owner.
- D. The contractor shall provide a performance bond for the value of the labor and materials provided during the maintenance period.

PART 2 – PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs in accordance with good horticultural practices under climatic conditions similar to those of the Project for at least two years, unless specifically noted otherwise. Trees and shrubs shall comply with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Trees and shrubs shall exceed American Association of Nurseryman standards for quality by being exceptionally heavy, uniform, so trained or favored in development and appearance as to be superior in form, density and spread of branches, compactness, and symmetry. Determination of quality shall be made by the Landscape Architect/Engineer.
- B. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, leaf spotting, injuries, abrasions, and disfigurement.
- C. Trees shall be planted such that the root flare is 1 inch above adjacent grade unless the Drawings indicate otherwise. Tree planting height shall be dictated by the actual root flare rather than the top of rootball as received from growers or nurseries:
 - 1. Tops of tree rootballs shall be no higher than 2 inches above the tops of main order tree roots.
 - 2. If main order roots are buried greater than 2 inches but less than 4 inches below the top of tree rootballs, Contractor must trim rootballs by carefully removing soil from the top of the rootballs so that main order roots are within 2 inches of the top of rootball.
 - 3. If main order roots are buried greater than 4 inches below the top of rootball, the tree will be rejected, and the Contractor must remove the tree from the job site.
 - 4. The Contractor is responsible for ensuring that trees received on site and planted on site meet the aforementioned specifications regarding tree root flare and rootball. The Contractor is responsible for ensuring that the Landscape Architect/Engineer has an opportunity to review the tree root flares of trees in the grower's field or nursery yard. If tree root flares are obscured (due to trunk wrap or burlap or other obstructions), Landscape Architect/Engineer's acceptance of trees in the grower's yard or nursery shall constitute acceptance of trees WITH THE EXCEPTION of trees whose root flare is buried greater than 4 inches below top of rootball. In the event that Contractor does not allow Landscape Architect/Engineer to visually observe tree root flares during tree selection at grower's yard or nursery, Landscape Architect/Engineer reserves the right to reject any tree delivered to the site if tree's root flare is buried greater than 4 inches below top of rootball, even if Landscape Architect/Engineer previously accepted said trees at the grower's yard or nursery.
- D. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect with a proportionate increase in size of roots or balls.
- E. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.
- F. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- G. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height, branching height, and spread, and number label to assure symmetry in planting.
- H. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader of height and caliper indicated complying with ANSI Z60.1 for type of trees required. Provide balled and burlapped, balled and potted, or container-grown trees. Branching Height: One-third to one-half of tree height. For street trees, branching height shall be one half of tree height.
- B. Small Upright or Spreading Trees: Branched or pruned naturally according to species and type with relationship of caliper, height, and branching according to ANSI Z60.1. Stem form as follows: Stem Form: Multistem, clump, with two or more main stems. Provide balled and burlapped trees.
- C. Multistem Trees: Branched or pruned naturally according to species and type with relationship of caliper, height, and branching according to ANSI Z60.1. Stem form as follows: Stem Form: Clump. Provide balled and burlapped trees.
- D. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.3 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub. Provide balled and burlapped, balled and potted, or container-grown shrubs.
- B. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.4 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens of type, height, spread, and shape required, complying with ANSI Z60.1. Provide balled and burlapped, balled and potted, container-grown, or fabric bag-grown trees.
- B. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.5 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.
- B. Herbs/Ferns: Provide herbs and ferns of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.
- C. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.6 OTHER PLANTS

- A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.
- B. Perennials: Provide healthy, field-grown plants from a commercial nursery of species and variety shown or listed.
- C. Woody Vines: Provide vines of species indicated, and size indicated, complying with requirements of ANSI 13.6.

- D. Fast-Growing Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:
 - 1. Two-year plants with heavy, well-branched tops with not less than three (3) runners 18 inches or more in length and with a vigorous well-developed root system.
 - 2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.
- E. Bulbs: Top Size, including corresponding designation of “Jumbo”, “Giant” or “Extra Large” per ANSI 12.
- F. Comply with the “PLANTING SCHEDULE” as shown on the Drawings.

2.7 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix three (3) parts acceptable topsoil with one (1) part peat moss.

2.8 MULCHES

- A. Shredded hardwood mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs.
 - 1. Color: Brown
 - 2. Size: Range between 3/8 inch to 8”. Fine particles (3/8 inch or less) shall make up to 25% of total volume. Large particles (1 to 1 ½ inch in diameter and 4 to 8 inches in length) shall make up to 20% of total volume. Pieces larger than 8 inches long that are visible on the surface of the mulch after installation shall be removed.

2.9 STAKES AND GUYS

- A. Install Stakes and Guys per methods and locations as shown on the Drawings.
- B. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.
- C. Guy Ties and Guards:
 - 1. Guy and Tie Wire: ASTM A641/A641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.
 - 2. Guy Cable: For large trees: 5-strand, 3/16-inch diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
 - 3. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.
 - 4. Woven Fabric Guy Ties: Flat, woven, non-fraying, polypropylene material, 3/4-inch wide, white. Arbor Tie or approved equivalent.
- D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.10 WEED CONTROL BARRIERS

- A. Non-woven Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a non-woven polypropylene fabric, 4.8 oz./sq. yd.

2.11 LANDSCAPE EDGINGS

- A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B221 (ASTM B221M), alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes:
 - 1. Edging Size: 3/16 inch wide by 5-1/2 inches deep.
 - 2. Stakes: Aluminum, ASTM B221 (ASTM B221M), alloy 6061-T6, approximately 1-1/2 inches wide by 12 inches long.
 - 3. Finish: Black anodized.
 - 4. Paint Color: Black.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aluminum Edging:
 - a. Curve-Rite Aluminum Edgings.
 - b. Permaloc Aluminum Edging.
 - c. Russell, J.D. Company (The).
 - d. Sure-Loc Aluminum Edging Corporation.

2.12 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs, designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Topsoil: Refer to Section "Soil Preparation".
- C. Peat: Finely divided or granular texture, , containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Fertilizer:
 - 1. Bonemeal: Commercial, steamed finely ground material with a minimum of 1.0 percent nitrogen and a minimum of 11 percent phosphoric acid.
 - 2. Commercial Fertilizer (10-6-4): Containing not less than 10 percent nitrogen, 6 percent available phosphoric acid, and 4 percent water soluble potash.
- E. Water: Clean, potable.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify final grades have been established prior to beginning planting operations.
- B. Inspect trees and ground covers for injury, insect infestation, or improper pruning. Do not begin planting until deficiencies have been corrected, or plants replaced.
- C. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Notify Landscape Architect/Engineer, in writing, of any conditions that might prevent satisfactory completion. Proceed with installation only after unsatisfactory conditions have been corrected.

- D. Test drainage of pits and planting beds. Notify Landscape Architect/Engineer of potential poor drainage of tree and shrub pits and planting beds. Recommend a program for correction of poor drainage conditions and submit proposal to Landscape Architect/Engineer. Do not proceed with planting operations in areas of poor drainage until conditions are corrected, or direction is given by the Landscape Architect/Engineer.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- B. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect acceptance of layout before planting. Make minor adjustments as required.
- C. Lay out exterior plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section "Soil Preparation" and Part 2 above.
- B. Place planting Soil: Blend planting soil in place.
- C. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- D. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB PIT/TRENCH EXCAVATION

- A. Pits and Trenches: Excavate circular pits with sides sloped inward, so that top of pit is larger than bottom of pit. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for planting stock.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.
- B. Subsoil removed from excavations may be used as backfill.
- C. Obstructions: Notify Landscape Architect/Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Hardpan Layer: Drill 6-inch-diameter holes into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

- E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

- A. Set balled and burlapped stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:
 - 1. Cut burlap and wire baskets from top half of root balls, but do not remove from under root balls. Discard removed burlap and wire baskets; do not turn down baskets and leave in tree or shrub pits. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
 - 3. Prepare surface of planting bed as shown on the Drawings.
- B. Set balled and potted or container-grown stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:
 - 1. Carefully remove root ball from container without damaging root ball or plant.
 - 2. Make four (4) evenly spaced vertical cuts in the sides of the root ball with a clean, sharp utility knife. Cuts are to be 1-inch deep and are to extend the full height of the rootball.
 - 3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
 - 4. Prepare surface of planting bed as shown on the Drawings.
- C. Set fabric bag-grown stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:
 - 1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
 - 3. Prepare surface of planting bed as shown on drawings.
- D. Mulching: Mulch per planting detail.

3.6 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.
- B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect, do not cut tree

leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.7 GUYING AND STAKING

- A. Guy and Stake trees as indicated on the drawings. Installation of tree support systems shall be completed within 48 hours of planting, utilizing applicable methods as indicated.
- B. Remove tree Guys and Stakes at end of warranty period.

3.8 GROUNDCOVER AND PERENNIAL PLANTING

- A. Set out and space ground cover and plants as indicated.
- B. Dig holes large enough to allow spreading of roots and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated. Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 INITIAL ACCEPTANCE

- A. When all work except maintenance and guarantee program of this contract has been completed, Landscape Architect/Engineer will perform a Substantial Completion inspection. Provide notification at least ten (10) working days before inspection date. If required a "punch list" of items to be completed by an agreed upon date will be issued by the Landscape Architect/Engineer after the Substantial Completion inspection.
- B. Work will be considered Substantially Complete after all "punch list" items are complete. Notify the Landscape Architect/Engineer at least five (5) working days before re-inspection date, to verify completion of the "punch list" items.
- C. Substantial Completion certificate will be issued and dated by the Landscape Architect/Engineer following the "punch list" verification inspection.

3.11 MAINTENANCE

- A. Maintain all exterior plants covered by this Section, as required to establish healthy, viable plantings, including the following maintenance requirements during the maintenance period indicated in Part 1 of this Section:
 - 1. Mowing.
 - 2. Edging.
 - 3. Pruning.
 - 4. Cultivating.

5. Watering including filling tree water bags if used; do not allow plants to wilt at any time.
6. Weeding.
7. Fertilizing.
8. Mulching.
9. Restoring plant saucers for trees.
10. Maintaining trees support systems at correct tension.
11. Resetting plants to proper grade and vertical position.
12. Insect and pest control as required to keep plants free of insects and disease.
13. Removal of trash and debris.
14. Removal of dead or dying plants.

3.12 FINAL ACCEPTANCE

- A. Inspection to determine Final Acceptance of planted areas will be made by the Landscape Architect/Engineer upon Contractor's request at completion of the one-year Warranty Period. Provide notification at least fifteen (15) working days before requested inspection date.
 1. Planted areas will be acceptable provided all requirements, including plant replacements and maintenance, have been complied with and healthy, thriving, and growing plants are established.
 2. Remove all Tree Staking and Guying materials prior to Final Acceptance inspection.
 3. Knock down, regrade, and remulch all tree pit saucers prior to Final Acceptance inspection.

3.13 CLEANUP AND PROTECTION

- A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.14 DISPOSAL

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

END OF SECTION

SECTION 329113 – SOIL PREPARATION

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for the placement of topsoil in conformance with the lines, grades and thicknesses as shown on the Drawings and as herein specified.
- B. Minimum thickness is 6 inches, for all areas disturbed during construction and not receiving other surface treatment.
- C. The Contractor shall furnish all materials and perform all work in accordance with these specifications, drawings, and instructions provided by the Owner.

1.2 SUBMITTALS

- A. Samples: Furnish earth materials to the testing laboratory for analysis and report, as directed by the Engineer or as outlined in the specifications.
- B. Quality Control Submittals:
 - 1. Test Reports: The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer. Indicate quantities of materials necessary to bring topsoil into compliance with textural/gradation requirements. Indicate quantity of lime and quantity and analysis of fertilizer.

1.3 REFERENCES

- A. Comply with the latest edition of the following standards:
 - 1. “Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.”
 - 2. “Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).”
 - 3. ASTM International (ASTM)
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. C602, Standard Specification for Agricultural Liming Materials.
 - 4. U.S. Bureau of Reclamation (USBR)
 - a. 514.4.4, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 4—Particle-Size Analyses.
 - b. 14.8.7, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 8—Soil Chemical Tests

1.4 QUALITY ASSURANCE

- A. Provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.5 PROJECT CONDITIONS

- A. Coordinate the placement of topsoil with the completion of all underground work including that of the other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural, friable, fertile, fine loamy soil possessing the characteristics of representative topsoils in the vicinity which produces a heavy growth; free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than 1 inch in diameter, stumps, roots, trash, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations. Contractor is to verify amount stockpiled and supply any additional as needed:
1. Topsoil shall contain not less than 6% nor more than 12% organic matter as determined by the wet combustion method (chronic acid reduction); topsoil shall have a pH value of not less than 5.5 nor more than 7.0;
 2. Topsoil shall meet the following mechanical analysis:

SIZE OF SCREEN	% OF SOIL RETAINED	% OF SOIL PASSING
1"	0	100
1/4	3	97
No. 100	40-60	40-60

3. Imported topsoil in which more than 60% of the material passing a No. 100 sieve shall be rejected. All percentages are to be based on the dry weight of the samples.
4. Laboratory tests of the topsoil shall be performed by a certified testing laboratory, and shall perform tests for the following:
 - a. Sieve particle size analysis and gradient of mineral content.
 - b. Chemical analysis of the following:
 - 1) pH and buffer pH.
 - 2) Percent of organic content.
 - 3) Nutrient levels of phosphorus, potassium magnesium, manganese, iron, zinc and calcium.
 - 4) Soluble salt.
 - 5) Cation exchange capacity (CEC).
 - c. Recommended fertilizer and rate of application for low and medium level nutrient soils.

2.2 MATERIAL ACCEPTANCE

- A. Topsoil may be acquired from approved sites that are designated on the Drawings. If no sites are designated, material proposed for use as topsoil must be stockpiled, sampled, and tested prior to use.
- B. Topsoil containing foreign material may be rejected on the basis of visual examination by the Engineer, prior to testing.
- C. Acceptance of topsoil shall be based upon test results that are completed within one month of the date of the submittal. Tested topsoil must be approved in writing by the Engineer before any material is used.

2.3 SOIL AMENDMENT

- A. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.

- B. Fertilizer: Shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Store fertilizer in a weatherproof place and in such a manner that it shall be kept dry and its effectiveness shall not be impaired.
 - 1. Percentages of nitrogen, phosphorus and potassium shall be based on laboratory test recommendations. For the purpose of bidding, assume 10% nitrogen, 6% phosphorus and 4% potassium by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen. At least 60% of the phosphorous content shall be derived from super-phosphate containing not less than 18% phosphoric acid or bone meal containing 25% to 30% phosphoric acid and 2% to 3% nitrogen. Potassium shall be derived from muriate of potassium containing 55% to 60% potassium.
 - 2. Grass or sodded areas shall have fertilizer applied according to soil text report or as specified on the drawings.
- C. Organic Matter: Leaf matter and yard waste composted sufficiently to break down all woody fibers, seeds, and leaf structures, and free of toxic and non-organic matter. Organic matter shall be commercially prepared.
- D. Lime: Shall be ground palletized, or pulverized lime manufactured to meet agricultural standards and contain a maximum of 60% oxide.

PART 3 – EXECUTION

3.1 STOCKPILING

- A. Stockpile topsoil from on-site sources or provide from off-site sources and stockpile, if on-site quantities are deficient.
- B. Stockpiles are to contain not less than 200 cubic yards or the minimum required for the project.
- C. Stockpiles are to have a maximum height of 10 feet and be trimmed to uniform surfaces and slopes.
- D. The sites of all stockpiles and adjacent areas, which have been disturbed are to be graded and put into an acceptable condition by seeding, as directed by the Engineer.

3.2 PREPARATION

- A. Preparation - Disk, drag, harrow or hand rake subgrade to a depth of 3 inches to provide bond for topsoil. Topsoil, which must be transported across finished walks, shall be delivered in such a manner that no damage will be done to the walks. The Contractor shall be responsible for the repair of such damage.
- B. Before placing topsoil, rake subsoil surface clear of stones larger than 1.5 inches, debris, and roots. Compact topsoil to form a layer with minimum depth of 4 inches in lawn areas and 12 inches in shrub beds. Topsoil shall be placed so that after final settlement there will be good drainage (and conforming to elevations shown on drawings). Contractor is to maintain surfaces and place any additional topsoil necessary to replace that which may have eroded before acceptance.
- C. Locations containing unsuitable subsoil shall be treated in one of the following manners:
 - 1. Where unsuitability within the construction site is deemed by the Owner to be due to excessive compaction caused by heavy equipment or by the presence of boards, mortar, concrete or other construction materials in subgrade, and where the natural subsoil is other than A.A.S.H.T.O. classification of A6 or 7, the Contractor shall loosen such areas with spikes, discs, or other

means to loosen the soil to a condition acceptable by the Owner. The Contractor shall also remove all debris and objectionable material. Soil should be loosened to a minimal depth of 12 inches with additional loosening as required to obtain adequate drainage. Contractor may introduce peat moss, sand, or organic matter into the subsoil to obtain adequate drainage should he so desire. All such remedial measures shall be considered as incidental to the work and no extra payment shall be made for this part of the work; and

2. Where subgrade is deemed by the Owner to be unsuitable because the natural subsoil falls into an AASHTO classification of A6 or 7 and contains moisture in excess of 30%, then such a condition shall be rendered suitable by installation of a subdrainage system or by other means described elsewhere in these specifications. Where such conditions have not been known or revealed prior to planting time and where they have not been recognized in the preparation of drawings and specifications, then the Owner shall issue a change order to install the proper remedial measures, all of which shall be in addition to the contract sum.

3.3 TOPSOIL PLACEMENT

- A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.
- B. Mix soil amendments, lime, and fertilizer with topsoil before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.
- C. Place 1/2 of total depth of topsoil and work into subgrade soil to create a transition layer. Place remainder of topsoil to depth after compacting to 75% where seeding and planting are scheduled.
- D. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade to ensure positive drainage.
- E. Remove stones exceeding 1 inch, roots, sticks, debris, and foreign matter during and after topsoil placement.
- F. Remove surplus subsoil and topsoil from Site. Grade stockpile area as necessary and place in condition acceptable for planting or seeding.

3.4 CLEANING

- A. Remove all surplus subsoil and topsoil from project site.
- B. Leave the site in clean, satisfactory condition ready to receive subsequent operations.

END OF SECTION

SECTION 329200 – TURF AND GRASSES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the preparation of ground surfaces, fertilization of applicable areas, seeding, mulching of applicable surface areas, and maintenance of turf areas until such time as project is accepted by Owner's Representative. Applicable areas shall include those identified on the Contract Drawings.
- B. Seed shall be sown from April 1 to June 15, or from August 15 to October 15 of given calendar year, unless otherwise approved by Owner's Representative.

1.2 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Certification:
 - a. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials.
 - b. Submit vendor's certified analysis for each grass seed mixture required, stating botanical and common name, percentages by weight, percentages by purity, germination, and weed seed.
- B. Maintenance Instructions: Submit instructions recommending procedures to be implemented for maintenance of landscaped work for one (1) full year. Submit prior to expiration of Contractor's maintenance period.
- C. Submit description of planned mulching techniques and corresponding manufacturer's installation recommendations for approval by Owner's Representative.

1.3 QUALITY ASSURANCE

- A. All turf and grasses work shall be performed by one Contractor, with proven expertise in this type of construction.
- B. Package standard products with the manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
- C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials in containers, showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored on site.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fertilizer:

1. Commercial fertilizer (5-10-5) inorganic, or organic, containing not less than five (5) percent nitrogen, ten (10) percent available phosphoric acid, and five (5) percent water soluble potash.
2. If, as an alternative, the Contractor wishes to substitute for commercial fertilizer 5-10-5, another commercial fertilizer with a 1-2-1 ratio, such as 10-20-10 or 6-12-6, they may do so with the approval of the Owner's Representative and the rate of fertilizer to be used shall be whatever amount is required to furnish the same amount of nitrogen as would be supplied by the 5-10-5.

B. Seed:

1. Seed shall be fresh, clean, new-crop seed mixed in the proportions specified for species and variety, conforming to Federal and State Standards.
2. Use the following standard mixture blue seal classic, unless a special mixture is otherwise indicated or approved by the Owner's Representative.

SPECIES	% BY WEIGHT	% BY PURITY	% BY GERMINATION
Kentucky Bluegrass*	60	85	80
Creeping Red Fescue	20	95	85
Perennial Rye	20	95	85
<i>*Kentucky Bluegrass must consist of a minimum of two varieties.</i>			

3. Weed seed content shall not exceed 0.25%.

C. Mulch:

1. Provide and install a mulch adequate to protect the seeding during its growing period. It shall be the responsibility of the Contractor to determine the appropriate mulching techniques for the particular site conditions and acquire approval of the same from the Owner's Representative.
2. Clean straw for gentle slopes, consisting of stalks of oats, wheat, rye, or other approved crops which are free of noxious weed seeds. Weight shall be based on a fifteen (15) percent moisture content.
3. Mulching blanket for steep slopes and drainage swales: "Curlex Blanket" by American Excelsior, "Ero-Mat" by Contech Construction Products, Inc, or approved equal.
4. Bonded fiber matrix for mulching in areas where slopes are 1.5H:1V or greater, or cut or fill slopes 20 feet (6m) or more in height. Product shall be EcoAegis as manufactured by Canfor, or approved equal meeting U.S. DOT Standard Specification FP-96, Section 713.05(h)
 - a. Package Weight: 50 pound (18.6kg) bags.
 - b. Moisture Content: 12 +/- 3 percent by weight.
 - c. Minimum Water Holding Capacity: Approximately 10 times dry weight.
 - d. Composition:
 - 1) Refined Softwood Fiber: (90% by weight).
 - 2) Blended Hydrocolloid-based Binder: (9% by weight).
 - 3) Mineral Activator: (1% by weight).
 - e. Color: Natural – No Dye Products.

D. Water: Clean and potable.

2.2 ACCESSORIES

- A. Soil Amendments: Soil amendments are not to be made without review and authorization by the Owner's Representative.
 - 1. Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.
 - 2. Aluminum Sulfate: Commercial grade.
 - 3. Peat Humus: FS Q-P-166 and with texture and pH range suitable for intended use.
 - 4. Bonemeal: Commercial, raw, finely ground; 4% nitrogen and 20% phosphoric acid.
 - 5. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
 - 6. Sand: Clean, washed sand, free of toxic materials.
 - 7. Perlite: Conforming to National Bureau of Standards PS 23.
 - 8. Vermiculite: Horticultural grade, free of toxic substances.
 - 9. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil, or toxic substances and with 7.5 pounds (2.8 kg) nitrogen uniformly mixed into each cubic yard of sawdust.
 - 10. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25% by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.
 - 11. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing available plant nutrients.
 - 12. Composted Organic Material: Shall have a minimum organic matter content of 60 percent, as determined by ASTM D-2974, and screened to ¾-inch (1.9 cm).

PART 3 – EXECUTION

3.1 PREPARATION OF TOPSOIL

- A. Clean topsoil of roots, plants, stones, clay lumps and other extraneous materials harmful or toxic to plant growth.
- B. Mix fertilizer into top 2 inches (5 cm) of topsoil at a rate of 10 pounds (3.7 kg) per 1,000 square feet. (92.9 m²)
- C. Mix approved soil amendments into top 2 inches (5cm) of topsoil at necessary rates.
- D. Water dry topsoil to depth of 4 inches (10cm) at least 48 hours prior to seeding to obtain a loose friable seed bed.

3.2 PREPARATION OF UNCHANGED GRADES

- A. Where lawns are to be planted in areas not altered or disturbed by excavating, grading, or stripping, prepare soil for seeding as follows:
 - 1. Till to a depth of not less than 6 inches (15cm).
 - 2. Apply soil amendments and initial fertilizers as specified.
 - 3. Remove high areas and fill in depressions.
 - 4. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
 - a. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such materials off the site; do not turn over into soil being prepared for lawns.

- b. Apply specified commercial fertilizer at rates specified and thoroughly mixed into upper 2 inches (5 cm) of topsoil. Delay application of fertilizer, if lawn planting will not follow within one week.

3.3 SEEDING

- A. Apply seed only when wind velocities are less than five (5) miles per hour (9km/hr).
- B. Sow half the seed with mechanical seeder.
- C. Sow remaining half of the seed at right angles to the direction of the first seeding pattern, using the same method.
- D. Apply seed at the rate of 4 pounds (1.5 kg) per 1,000 square feet (92.9 sq. meters) of disturbed area.
- E. Cover seed to a depth of 1/8-inch (3mm) by raking, harrowing, or cultipacking.
- F. Roll seeded area with roller weighing no more than 150 pounds per foot of roller width.
- G. Water seeded areas to a depth of four (4) inches (10cm) as required during the maintenance period.

3.4 MULCHING

- A. Spread straw uniformly over seeded area with 75% ground coverage and at least 1-1/2 inches loose depth.
 - 1. If, in the opinion of the Owner's Representative, wind will disrupt the mulching, apply asphalt emulsion at a rate of 10 gallons (37.81) per 1,000 square feet (92.9 m²).
- B. Place mulching blanket in accordance with submitted manufacturer's recommendations.
- C. Place bonded fiber matrix mulch material, EcoAegis or approved equal, at a rate of 3,500 to 4,100 pounds per acre, based on manufacturer's recommendations.

3.5 HYDROSEEDING

- A. Mix specified seed, fertilizer, and pulverized mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
- B. Apply slurry uniformly to all areas to be seeded. Rate of application as required to obtain specified seed sowing rate.

3.6 PROTECTION

- A. Immediately after seeding, erect barricades and warning signs as required to protect newly planted areas from pedestrian and vehicular traffic. Maintain barricades throughout maintenance period until grass and/or turf is established.
- B. Repair or replace damaged landscape work as directed by Owner's Representative.

3.7 MAINTENANCE

- A. Begin maintenance immediately after seed placement.

- B. Watering:
 - 1. Keep soil moist during seed germination period.
 - 2. Supplement rainfall to produce a total depth penetration of 2 inches per day after germination.
 - 3. Prevent erosion and displacement of seed.
- C. Mowing:
 - 1. When grass reaches 4 inches in height, mow to 2-½ inches in height.
 - 2. Maintain grass between 1-½ inches and 2-½ inches in height.
 - 3. Do not cut off more than 30% of grass leaf in a single mowing.
 - 4. Remove grass clippings.
- D. Reseed and mulch spots larger than 1 square foot not having uniform coverage.
- E. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.
- F. Maintain and protect all seeded areas until final acceptance of the Contract.

3.8 FINAL ACCEPTANCE

- A. Final acceptance of lawn areas will be granted when a uniform stand of acceptable grass is obtained, with a minimum of 95 percent coverage.
 - 1. Portions of the lawn areas may be accepted at various times at the discretion of the Owner's Representative.
- B. Upon acceptance by the Owner's Representative of a seeded area, the Owner will immediately assume responsibility for maintenance and protection of that portion of the Contract seeding.

END OF SECTION

SECTION 330500 – COMMON WORK RESULTS FOR UTILITIES

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the installation of buried piping.

1.2 REFERENCES

- A. The following references shall be applicable: American Society of Testing and Materials (ASTM).
 - 1. American National Standards Institute (ANSI).
 - 2. American Water Works Association (AWWA).
 - 3. Uni-Bell Plastic Pipe Association.

1.3 SUBMITTALS

- A. Submit for approval a schedule for all proposed testing. Include proposed testing procedures indicating the sequence in which pipe sections will be tested and description of methods and equipment to be used.
- B. Field Test Reports: Submit results of field testing directly to Engineer with copy to Contractor.

1.4 STORAGE, AND HANDLING

- A. Deliver and store materials within the Contract limits as approved by Engineer.
- B. Handle materials carefully with approved handling devices in accordance with manufacturer's recommendations. Special care shall be exercised during delivery and storage to avoid damage to the materials.
- C. Do not drop or roll products off trucks. Products are not to be otherwise dragged, rolled, or skidded.
- D. Materials shall be stored on heavy wood blocking or platforms in accordance with the manufacturer's instructions and recommendations. Materials shall not be in contact with the ground and their interiors shall be maintained free from dirt and other foreign matter.
- E. Products cracked, gouged, chipped, dented, or otherwise damaged will not be approved and are to be removed and replaced at the Contractor's expense, unless the product can be repaired in a manner acceptable to the manufacturer and the Engineer. All repairs shall be at the Contractor's expense.

1.5 COORDINATION

- A. Contractor shall be responsible for coordinating site utility work with other trades to ensure building service connection locations are verified and coordinated prior to commencing site construction.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Conform to individual pipe specification(s).
- B. Pipe transition fittings: Shall be as indicated on the drawings. If not specifically indicated selection shall be based on pressure requirements of the system and types of materials being joined. Product selection shall be approved by the engineer.
- C. Grout:
 - 1. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- D. Flowable Fill:
 - 1. Description: Low-strength-concrete, flowable-slurry mix.
 - a. Cement: ASTM C150, Type I, Portland.
 - b. Density: 115 to 145 pounds/cubic foot.
 - c. Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
 - d. Aggregates: ASTM C33, natural sand, fine.
 - e. Admixture: ASTM C618, fly-ash mineral.
 - f. Water: Comply with ASTM C94/C94M.
 - g. Strength: Greater than 40 psig at 28 days and no more than 150 psig at one year.

PART 3 – EXECUTION

3.1 UTILITY DEMOLITION

- A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.2 BURIED PIPE INSTALLATION

- A. General:
 - 1. Installation of all pipe, fittings, valves, specials, and appurtenances shall be subject to the review and/or approval of the Engineer.
 - 2. Install piping valves and fittings as shown, specified and as recommended by the manufacturer and in conformance with referenced standards, and approved Shop Drawings.

3. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Drawings or Specifications.
4. All piping and appurtenances shall be inspected by the Engineer prior to installation. Engineer's inspection will not relieve Contractor or manufacturer from responsibility for damaged products.
5. Present all conflicts between piping systems and equipment, structures or facilities to Engineer for determination of corrective measures before proceeding.
6. Take field measurements prior to installation to ensure proper fitting of Work. Uncover the existing pipelines sufficiently in advance of the proposed Work in order that the type and location of the existing pipes and joints and other information required to fabricate the proposed piping can be determined. Obtain whatever information is required to complete the connections of the proposed pipelines to the existing pipelines.
7. Carefully examine all piping for cracks, damage, or other defects before installation. Immediately remove defective materials from the site, unless the defective materials can be repaired in a manner acceptable to the manufacturer and Engineer. Remove, replace, or repair at the Contractor's expense piping found to be broken or defective.
8. Inspect interior of all piping and mating surfaces and remove all dirt, gravel, sand, debris, or other foreign material before installation. Maintain the interior of all piping clean until acceptance of the completed Work. Prevent foreign matter from entering joint space.
9. Install buried piping accurately to line and grade shown, specified or directed, unless otherwise approved by the Engineer. Use accurate means of determining and checking the alignment and grade subject to the approval of the Engineer. Remove and relay piping that is incorrectly installed at Contractor's expense.
10. Do not lay piping in water, unless approved by the Engineer. Ensure that the water level in the trench is at least 6 inches below the bottom of piping. Maintain a dry trench until jointing and backfilling are complete, unless otherwise specified in these Specifications or approved by the Engineer.
11. Pipe laying work shall be conducted so that trenching operations are not advanced too far ahead of the pipe laying operation resulting in excessive lengths of open trench. In general, open trench ahead of pipe laying shall not exceed 50 feet.
12. Start laying piping at lowest point and proceed toward the higher elevations, unless otherwise approved by the Engineer. Slope piping uniformly between elevations shown on the Drawings or as otherwise provided by the Engineer.
13. Where pipe crossings occur, the lower pipe shall be laid first and all backfill thoroughly compacted to the level of the higher pipe before the higher pipe is installed. Backfill material under such conditions may be earth, broken stone, or 2500 psi concrete.
14. Install piping so that the barrel of the piping and not the joints receives the bearing pressure from the trench bottom, or other bedding condition.
15. No piping shall be brought into position until the preceding length, valve, fitting, or special has been bedded and secured in place.
16. Whenever pipe laying is not actively in progress, the open ends of the piping shall be closed by a temporary plug or cap to prevent soil, water and other foreign matter from entering the piping.
17. Where required for inserting valves, fittings, special appurtenances, and closures, shall be made with a machine specially designed for cutting piping and in accordance with the manufacturer's instructions for field cutting of pipe. Make cuts carefully, without damage to piping, so as to leave a smooth end at right angles to the axis of the piping. Taper cut ends and file off sharp edges until smooth. Flame cutting will not be permitted. Replace and repair damaged piping.
18. Blocking under piping will not be permitted unless specifically approved by Engineer for special conditions.

19. Touch up protective and linings and coatings prior to installation.
 20. Rotate piping to place outlets in proper position.
- B. Bedding and Backfilling:
1. Bedded and installed piping in conformance with Section “Trenching and Backfilling” and as shown except as otherwise specified.
 2. No piping shall be laid until Engineer approves the bedding condition.
 3. Excavation in excess of that required as shown on the Drawings or specified, which is not authorized by the Engineer, shall be at the Contractor’s expense. Backfilling and compaction of the over-excavated areas shall be at the Contractor’s expense.
 4. Carefully and thoroughly compact all pipe bedding and fill up to the pipe centerline with hand-held pneumatic compactors.
- C. Transitions From One Type of Pipe to Another:
1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
- D. Work Affecting Existing Piping:
1. Location of Existing Piping:
 - a. Locations of existing piping shown shall be considered approximate. Contractor shall perform all necessary subsurface investigation to verify actual locations in the field.
 - b. Determine exact location of existing piping to make connections, relocate, replace or which may be disturbed during earth moving operations, or which may be affected by work in any way.
 - c. Coordinate all excavations with utility companies, Owner and Engineer.
 2. Taking Existing Pipelines Out of Service:
 - a. Do not take pipelines out of service unless specifically approved by Engineer.
 - b. Notify Engineer at least 48 hours prior to taking any pipeline out of service.

3.3 SPECIFIC PIPE INSTALLATION

- A. High Density Polyethylene Gravity Piping (HDPE):
1. Install in accordance with the pipe manufacturer’s specifications.
 2. Completely clean all jointing surfaces and adjacent areas prior to making joints.
 3. Field cut pipe for shorter than standard pipe lengths. Cut ends square and perpendicular to the pipe axis. Remove and smoothly bevel ends.
 4. Assemble all joints in accordance with recommendations of the manufacturer. If a lubricant is required to facilitate assembly, it shall not have a detrimental effect on the gasket or on the pipe when subjected to prolonged exposure.

3.4 FIELD QUALITY CONTROL

- A. General:
1. Notify Engineer at least 48 hours in advance of all testing.
 2. Provide all testing apparatus including pumps, hoses, gauges, fittings, temporary bulkheads, plugs, compressors and miscellaneous other required items.
 3. Provide temporary blocking and bracing or approved thrust and joint restraint to prevent joint separation and pipe movement during testing.
 4. Unless otherwise approved, conduct all tests in the presence of the Engineer and in the presence of local authorities having jurisdiction.

5. Water Source:
 - a. Provide all water for testing, flushing, and other water uses. The source of the water shall be subject to the approval of the Engineer.
 - b. The point of introduction of water for conducting tests shall be subject to the approval of the Engineer.
 6. All costs for tests shall be included in the Contractor's bid.
 7. Locate, and repair or replace, section of piping which fail the test and retest until acceptance.
- B. Required Tests for Storm Sewers:
1. Perform the following tests after the storm drainage pipe has been installed and prior to final acceptance:
 - a. Alignment Test for all pipe.
 2. Based upon visual observations, the Engineer may order additional testing including the following:
 - a. Television Inspection, if required by the Engineer.
 - b. Deflection Test, if required by the Engineer
 - c. Water-tight field test ASTM F1417 if required by the Engineer.
 3. Perform tests prior to placement of pavement, or other construction which may, in the opinion of the Engineer, be detrimentally affected by excavation required for repairs.
 4. Submit details prior to making tests of proposed testing procedures with a description of methods and equipment to the Engineer for approval.
 5. Alignment Test:
 - a. All storm drainage pipe will be subject to a visual inspection in order to identify proper alignment, grade, and excessive deflection.
 - b. The Engineer may choose to perform an alignment test using the hand-lamp method, in which case the full diameter of the pipe shall be visible when viewed between consecutive structures.
 6. Television Inspection:
 - a. The Engineer will notify the Contractor in writing which completed sewers shall be inspected by closed-circuit television.
 - b. The Contractor shall commence the television inspection within 15 days of the Engineer's written notification. The Contractor shall notify the Engineer at least 5 days prior to commencement of television inspection.
 - c. No television inspection shall be performed without the Engineer or his representative present to witness the inspection.
 - d. The Contractor shall provide the Engineer with 3 copies of a report of the televising inspection of each section of completed sewer inspected. Show the exact location and extent of all cracks, loose joints, holes, vertical and horizontal, misalignment, faulty service connections, caved-in pipe, points of infiltration, obstructions, debris and all else detrimental to the proper functioning and service of the completed sewer. The Contractor shall provide the actual television inspection video with the report showing all the above conditions found, at all wyes, tees and laterals and as directed by the Engineer.
 - e. The Engineer will review the report and will instruct the Contractor, to repair any conditions which, in the opinion of the Engineer, are detrimental to the proper function and service of the storm pipe.

END OF SECTION

SECTION 330513 – MANHOLES AND STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Installation of manholes, catch basins, precast concrete structures, frames, grates, covers, steps, and piping connections as shown on the Drawings and as specified herein.
 - 2. Alteration of existing structures as shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. American Society of Testing and Materials (ASTM).
 - 2. American National Standards Institute (ANSI).
 - 3. Occupational Health and Safety Administration (OSHA).

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following for approval:
 - 1. Design and construction details of all precast concrete units.
 - 2. Fabrication, assembly, and installation details for all castings and miscellaneous metal works.
 - 3. Precast concrete structure design calculations verifying the structures have been designed to withstand the burial, submergence and anticipated live and dead loads. Design calculations for uplift forces shall incorporate a minimum factor of safety of 1.15.
- B. Product Data:
 - 1. Manufacturer's catalog cuts, specifications, and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site to prevent interruption of the Work.
- B. All materials shall be inspected by the Contractor upon delivery to the site. The Contractor shall notify the Engineer of any loss or damages. Replace loss or repair damage to new condition at the Contractor's expense.
- C. Store materials to allow easy access for inspection and identification.

PART 2 – PRODUCTS

2.1 DESIGN REQUIREMENTS

- A. Design: In accordance with ASTM C890 – Minimal Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
- B. Loading: AASHTO HS-20 with 30 percent impact and 130 pound/cubic foot equivalent soil pressure.

2.2 PRECAST CONCRETE DRAINAGE STRUCTURES

- A. Drainage manholes shall conform to subpart "Precast Concrete Manholes."
- B. Catch basins with greater than 6 feet sidewall depth shall conform to subpart "Precast Concrete Manholes."
- C. Catch basins with less than or equal 6 feet sidewall depth shall be 2-foot 6-inch by 2-foot 6-inch square I.D.
- D. Precast catch basin units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.
- E. Unless otherwise specified precast concrete units shall conform to ASTM C478.
- F. A precast concrete slab, as necessary for proper frame and grate placement, shall be provided at the top of the catch basin unit. The slab shall be designed for an H-20.

2.3 PRECAST CONCRETE MANHOLES

- A. Precast manhole units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.
- B. Unless otherwise specified, manhole sections shall conform to ASTM C478.
- C. Precast structure bases shall be of the "base unit" type, with an integral base and barrel section. The barrels shall be constructed in increments of 1 foot to provide the indicated height with the fewest joints. Openings for pipe connections will not be permitted closer than 1 foot to the nearest joint. Mark the date of manufacture and name or trademark of manufacturer in the inside of each section.
- D. Manholes barrels, servicing pipes less than 27-inch diameter, shall be 48-inch diameter. Manholes barrels, servicing pipes 27-inch diameter and larger shall be 60-inch diameter. Larger diameter manholes barrels shall be provided as indicated on the Drawings or as specified herein.
- E. Joints shall be rubber and concrete using O-ring gaskets (ASTM C443) or butyl rubber gaskets (ASTM C443), or tongue and groove buttered with 1:2 cement mortar (ASTM C270, Type M). A precast eccentric cone, or precast slab where shown, shall be provided at the top of the manhole barrel to receive the frame and cover. The slab or cover shall be designed for an H-20 loading.

2.4 MANHOLE STEPS

- A. Manhole sections shall contain manhole steps at 12 inches on center for all structures over 3 feet 6 inches in height. The steps shall be embedded in the concrete and accurately positioned both vertically and horizontally.
- B. Steps shall be capable of withstanding a 300-pound concentrated live load without permanent distortion, conforming to the requirements of ANSI A14.3, OSHA, and the details shown on the Drawings.
- C. Manhole rungs shall be steel reinforced copolymer polypropylene plastic. Rungs shall be 14 in. wide, M.A. Industries type PS2-PF, or equal. Copolymer polypropylene shall be type II, grade 16906 meeting ASTM D4101. Steel reinforcing shall be 3/8-inch diameter, Grade 60 conforming to ASTM A615 and shall be continuous throughout the rung. The portion of the legs to be embedded in the precast section shall have fins and be tapered to insure a secure bond.

2.5 FRAMES AND COVERS/GRATES

- A. Frames and covers/grates shall be cast iron, ASTM A48, Class 30, free from flaws or unsightly defects.
- B. Frames and covers shall conform to the details on the Drawings and have "STORM SEWER" cast on every cover.
- C. Frames and covers/grates shall be designed for an H-20 loading and be machined to ensure correct fit and even bearing.
- D. Frames and covers/grates shall be as shown on the on the Drawings. Otherwise, conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable).
- E. Frames and covers shall be as shown on the Drawings. Otherwise, conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable). Access clear width shall be a minimum of 24-inches.

2.6 GRADE ADJUSTMENTS

- A. Grade Rings: Reinforced-concrete rings, 3- to 12-inch total thickness, to match diameter of manhole frame and cover.

2.7 GROUT

- A. Description: ASTM C1107, Grade B. nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.8 DROP INLET

- A. Drop inlets for manholes shall be constructed where shown on the Drawings and shall conform with the details shown on the Drawings.
- B. Pipe and fittings shall be the same type and class as the sewer pipe beings installed.
- C. Concrete for pipe encasement shall be 3,000 psi.

PART 3 – EXECUTION

3.1 EARTHWORK

- A. Earthwork shall be in accordance with Section "Trenching and Backfilling" or Section "Earth Moving."

3.2 PRECAST MANHOLE SECTIONS

- A. Base units shall be placed on a minimum 12-inch foundation of pipe zone bedding material, and be set at the proper elevation, carefully leveled, and aligned.

- B. Barrel units shall be set vertical with steps and sections in proper alignment. All joints shall be sealed with cement mortar inside and out, and troweled smooth to the contour of the wall surface. Joints shall be installed in accordance with manufacturer's recommendations.
- C. Lifting holes shall be sealed tight with a tapered solid rubber plug driven into the hole and the remaining void filled with mortar on the outside only.

3.3 GRADE RINGS

- A. Grade rings placed upon the eccentric cone or slab shall be used for all manholes to provide the potential for future adjustment.
- B. Grade rings shall be placed in a combined thickness of at least 4 inches but not more than 12 inches in order to bring the manhole frame to proper grade.
- C. Consecutive grade ring layers shall be laid on an even mortar bed.

3.4 PIPE CONNECTIONS

- A. Pipe connections to manholes shall be installed true to line and grade as shown on the Drawings. Wall fittings shall be watertight, compatible with the sewer pipe joint. Connections shall conform to the details shown on the Drawings.

3.5 FRAMES

- A. Frames shall be firmly set and bonded at the proper grade to conform with the finished grade shown on the Drawings.
- B. Frames for manholes in unpaved areas shall be set at an elevation higher than finished grade as shown on the Drawings or as directed by the Engineer.

3.6 WATERTIGHTNESS

- A. All manholes shall be free of visible leakage. Each manhole shall be inspected, and all leaks shall be repaired in a manner approved by the Engineer.

3.7 CONNECTION TO EXISTING STRUCTURES

- A. The Contractor shall make connections to existing manholes as shown on the Drawings or as specified herein.
- B. For connections to precast or cast-in-place concrete manholes, the Contractor shall core drill a hole 1 inch larger than the O.D. of the sewer pipe into the existing manhole at the location and elevation shown on the Drawings.
- C. For connections to masonry manholes, the Contractor shall open the sidewall of the existing manhole by removing masonry units no more than necessary to accommodate the sewer pipe.
- D. Connection methods shall be in accordance with the details shown on the Drawings. Any open spaces around the new pipe entry shall be sealed with non-shrink grout to prevent leakage.

- E. The existing bench and channel shall be removed and reconstructed to permit flow through the manhole as it now exists and also for the new sewer pipe. Bench and channel reconstruction shall conform with the details on the Drawings, or as directed by the Engineer.
- F. The Contractor shall be responsible for diverting flow through the manhole in order to allow bench and channel construction.

3.8 CHANGING ELEVATIONS OF EXISTING STRUCTURES

- A. Lower existing frames of manholes by the removal of appropriate masonry courses, to the elevations shown on the Drawings or as directed by the Engineer.
- B. Raise the existing frames of manholes by the addition appropriate grade rings to the elevations shown on the Drawings or as directed by the Engineer.
- C. Where the manhole frames cannot be lowered by removal of masonry courses, such as may be the case with precast concrete manholes, the upper barrel section shall be removed and/or replaced with a section of less depth, to permit the necessary adjustment of the frame.
- D. Frames and covers damaged during the Work shall be replaced at the Contractor's expense.

END OF SECTION

SECTION 334100.20 – HIGH DENSITY POLYETHYLENE STORM UTILITY DRAINAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the installation of polyethylene piping systems as shown on the Drawings and as specified herein.
- B. All piping, fittings, and appurtenances shall be new, clean, and in accordance with material specifications. In no instance shall second- hand or damaged materials be acceptable.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable:
 - a. Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.
 - b. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
 - c. American Society of Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's catalog cuts, specifications, and installation instructions for both pipe and coupling system.
 - 2. Submit manufacturer's certification that product was manufactured, tested, and supplied in accordance with the standards specified herein.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage:
 - 1. Pipe, fittings, specials, appurtenances, and accessories shall be delivered to and stored within the Contractor's work limits as shown on the Drawings.
 - 2. Special care shall be exercised during delivery and storage to avoid damage to the products.
 - 3. Products shall be stored so as to avoid unnecessary handling and in locations where they will not interfere with the Owner's operations or public travel.
- B. Handling:
 - 1. Pipe, fittings, special appurtenances, and accessories shall be handled carefully with approved handling devices in strict conformance with the manufacturer's recommendations.
 - 2. Products shall not be dropped nor shall products be otherwise dragged, rolled, or skidded.
- C. Products cracked, gouged, chipped, dented, or otherwise damaged will not be approved and shall be removed and replaced at the Contractor's expense, unless the product can be repaired in a manner acceptable to the manufacturer and Engineer. All repairs shall be at the Contractor's expense.

PART 2 – PRODUCTS

2.1 MATERIALS

A. HDPE Water Tight Pipe:

1. Pipe shall be ADS N-12 WT IB (per AASHTO) smooth interior with annular exterior corrugations and a Manning's "n" value of 0.012 high-density polyethylene pipe (HDPE) as manufactured by Advanced Drainage Systems (ADS) or approved equal. Pipe shall have an integral water tight gasketed bell and spigot or approved equal.
 - a. 4 inches through 11 inches conforming to AASHTO M252 Type S.
 - b. 12 inches through 60 inches conforming to AASHTO M294 Type S or ASTM F2306.
2. 4 inches through 60 inches (100 to 1500 mm) shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.
3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the water-tight joint performance requirements of ASTM F2306.

B. Flared End Section:

1. Flared end sections shall be 1210 NP or 1810 NP HDPE end sections as manufactured by ADS or equal.
2. End sections shall be fastened to the last corrugation of the pipe length using a high strength nylon cable tie supplied by the manufacturer through pre-drilled holes at the top of the end section collar.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Inspect all pipe and fittings prior to laying in the trench. Remove defective pipe and fittings from the site.
- B. Do not backfill until inspection by the Engineer, unless otherwise approved by the Engineer.

3.2 INSTALLATION AND TESTING

- A. Trenching, backfilling and compaction shall conform to Section "Trenching and Backfilling."
- B. Pipe installation and testing shall conform to Section "Common Work Results for Utilities."

END OF SECTION