PROJECT MANUAL / SPECIFICATIONS FOR

THE STREAM CENTER
SCHOOL OF THE HOLY CHILD

2225 Westchester Avenue, Rye, NY 10580

VOLUME 3: SECTIONS 300000 - 340000

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ISSUE FOR BID: **12 AUGUST 2021**

THE UNDERSIGNED CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE, INFORMATION AND BELIEF, THE PLANS AND SPECIFICATIONS ARE IN ACCORDANCE WITH APPLICABLE REQUIREMENTS OF THE NEW YORK STATE UNIFORM FIRE PREVENTION AND BUILDING CODE, THE STATE ENERGY CONSERVATION CONSTRUCTION CODE, AND BUILDING STANDARDS OF THE EDUCATION DEPARTMENT, AND THAT THE PLANS AND SPECIFICATIONS REQUIRE THAT NO ASBESTOS CONTAINING MATERIAL SHALL BE USED.

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Erik Kaeyer, AIA

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SITE PREPARATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits as indicated on the plans and includes, but is not limited to the following:
   1. Construction, establishment and maintenance of temporary soil erosion, sediment and dust control measures.
   2. Construction layout.
   3. Clearing and grubbing.
   4. Removal of structures, obstructions, debris, utilities and all items and appurtenances that may be shown on the Demolition/Removals Plan and/or necessary for construction.
   5. Protection and support of existing structures and utilities to remain.
   6. Protection of existing trees, landscaping and natural features to remain.
   7. Maintenance and protection of traffic and pedestrians.
   8. Construction entrance(s).
   9. Clean-up and restoration.
   10. Installation of temporary facilities including temporary construction fencing and gates.

B. Related Sections:
   1. Section 01 41 00 "Regulatory Requirements."
   2. Section 02 30 00 "Subsurface Investigation."
   3. Section 31 25 00 “Temporary Soil Erosion, Sediment and Dust Control”

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

A. Locations shown on Drawings not Guaranteed - The structures, utilities, trees, shrubs and other features shown on the Drawings are those known to exist, but their locations are not guaranteed to be exact, nor is it guaranteed that all structures, utilities, trees, shrubs and features are shown. The Contractor shall, however, be responsible for the protection of all items and features which are to remain whether shown on the Drawings or not.

B. Safeguards and Protection - The Contractor shall provide all necessary safeguards including the installation of shoring, structural supports, protective fencing and barriers, etc., as may be required to prevent damage to adjacent property, buildings, or injury to persons. All work shall be done in accordance with the requirements of the local building codes and the rules, regulations and ordinances of all other governing bodies having jurisdiction. The Contractor shall be held responsible for any claim arising from

his failure to provide proper safeguards or for his failure to conduct his operation in a manner consistent with the rules, regulations and ordinances of those governing bodies having jurisdiction.

At the end of each work day, the Contractor shall secure the site to ensure that all safety measures, including fences, barricades, etc., are in place and there are no unprotected hazards on the site or adjacent to the site.

Construction fencing shall be maintained at all times during the construction operations in accordance with the requirements of OSHA and all Authorities having jurisdiction.

C. Replacement of Disturbed Ground Surfaces - The Contractor shall, at his own expense, repair or replace all ground surfaces, pavements, sidewalks, curbs, etc., which are to remain and which may become disturbed or damaged due to his operations. Said repair or replacement shall be satisfactory to the Owner's Field Representative and in accordance with the requirements of the governing body having jurisdiction.

D. Damage - The Contractor, at his own expense, shall make good, repair and/or replace all damage occurring as a direct or indirect result of his operations.

E. Notification of Utility Owners - Under 16 NYCRR 753 “Protection of Underground Facilities”, prior to the start of his work, the Contractor shall be required to notify the One-Call Notification System serving the area of the proposed Work and to contact and notify separately the owners of utilities that do not belong to the One-Call Notification System on file with the Central Registry so that all the various underground utility operators will be able to locate and mark the locations of their own utilities. Notification of operators of utilities must be made at least two (2) days and not more than ten (10) days prior to the start of any construction and as required by State and Local laws. No work by the Contractor shall commence until the operators have notified the Contractor that their utilities have been located. The Contractor shall be held responsible for any claims arising from his failure to make such notification, or for his failure to do the work in accordance with the rules and regulations of the governing Authorities and owners of the utilities involved.

F. Test Pits - Wherever the proposed utilities cross or connect to existing utilities, the Contractor will be required to hand excavate test pits to determine location and elevation of the existing utilities. This work is to be done prior to any trench excavation. In the event of conflict between the existing utility and the proposed utility, the Contractor shall notify the Owner's Field Representative and Architect/Engineer immediately for resolution of the conflict.

3.2 CONSTRUCTION LAYOUT

A. General Requirements - The Contractor shall provide all work required in connection with the layout for construction of the Site Work. The Contractor shall be responsible for establishing property lines, easement lines, base lines, control points and benchmarks which shall be maintained and protected throughout the life of the Contract. The Contractor shall employ a licensed land surveyor, registered in the State of New York, to do the layout work, who shall establish locations, alignments, elevations, reference marks, ties, off-set lines, batter boards, etc., needed by the Contractor during the progress of the Work, and from time to time to verify such marks by instrument or other appropriate means. The Owner will provide a survey of the property and a Layout Plan.

B. Check of Layout Work by Owner's Field Representative and Architect/Engineer - The Owner's Field Representative and Architect/Engineer shall be permitted, at all times, to

check the locations, alignments, elevations, reference marks, batter boards, etc., set by the Contractor, who shall correct any errors in lines, elevations, reference marks, batter boards, etc., that may be disclosed by such check. Such a check shall not be construed to be an approval of the Contractor's work and shall not relieve or diminish in any way the responsibility of the Contractor for the accurate and satisfactory construction and completion of the entire Work.

C. Contractor to Protect and Maintain Control Points - The Contractor shall be responsible for protecting and maintaining the points that he has established and also any control points that may be furnished by the Owner.

D. Contractor's Responsibility - The Contractor shall make, check, and be responsible for all measurements and dimensions necessary for the proper construction and installation of all items of work under the Site Work. The Contractor shall be responsible for the finished Work in conformance with the lines, grades and locations called for on the Drawings, and he shall correct all errors caused by improper layout of the Work or due to errors by his personnel at no additional cost to the Owner.

3.3 CLEARING AND GRUBBING

A. General Requirements - Except for the existing trees which are to remain, the site shall be cleared of trees, logs, stumps, brush, vegetation, rubbish and other perishable or objectionable materials, as directed by the Owner's Field Representative.

All stumps and roots shall be removed in their entirety.

B. Before any tree removal takes place, the Contractor must coordinate with the Owner's Field Representative and any Authority having jurisdiction, to ensure only authorized trees are removed.

C. Disposal - All material obtained from clearing and grubbing shall become the property of the Contractor and shall be legally disposed of off-site.

3.4 REMOVAL OF STRUCTURES, UTILITIES AND OBSTRUCTIONS

A. General Requirements - The Contractor shall remove and dispose of those existing structures, utilities, debris, obstructions, etc., which are shown on the plan to be removed, interfere with the proposed construction, or as directed by the Owner's Field Representative.

The Contractor shall remove only those items and structures that he has been authorized to remove, either by specific directions given on the Drawings or by written instructions given before or during the progress of the Work by the Owner's Field Representative.

The Contractor shall be held responsible for any claim arising from his removal of any existing item or structure without the required authorization specified herein.

B. Discontinuance of Utilities - Before any structure or building with utilities thereon is disposed of, the utilities shall be disconnected and abandoned or completely removed as directed. The Contractor shall perform the work of discontinuing the utilities in accordance with the requirements and directions of the Authorities having jurisdiction over the utilities involved.

C. Existing Services to be Maintained - In removing utilities such as water, storm drainage, sanitary sewers, or utility structures, all existing live systems shall be rebuilt and properly reconnected or bypass provided, and services shall be maintained during such construction operations.

D. Disposal of Material - All waste material obtained from the removal of utilities, structures and obstructions shall be legally disposed of off-site.

3.5 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. General Requirements - The Contractor shall be responsible throughout the course of the Work for protecting from injury or damage all existing structures and utilities which are to remain.

All existing gas and water lines, telephone, electric and light poles, wires, conduits, sewers, drains, culverts, hydrants and all other utilities and structures which are to remain shall be carefully supported, maintained in operation and protected by the Contractor from injury or damage, whether or not stated on the plans.

The Contractor shall sling, support, shore up and secure in place all pipe, conduits or structures without damage thereto. The Contractor shall provide for and maintain, by means of suitable temporary channels or pipe, the flow of drainage and watercourses, whether on the surface or underground, which may be interrupted during and by progress of the Work. All works of drainage intercepted or disconnected shall be restored and made good or taken down and rebuilt to the extent made necessary by the new Work, and all temporary material required for such construction shall immediately be removed therefrom when no longer required.

B. The Contractor shall be held responsible for any claim arising from damage to existing structures or utilities to remain.

C. Dead-End Pipe and/or Conduit to be Sealed - When pipe, conduits, sewers or drains are removed from trenches, leaving dead-ends in the ground, the Contractor shall carefully plug and bulkhead such ends in a manner satisfactory to the Owner's Field Representative and the utility owner.

3.6 PROTECTION OF EXISTING TREES, LANDSCAPING AND NATURAL FEATURES

A. General Requirements - The Contractor shall protect, throughout the course of construction, all trees to remain. The Contractor shall also protect throughout the course of construction all landscaping, vegetation and natural features on public and private property. The Contractor shall use every precaution to prevent injury, damage, pollution, erosion or destruction of existing landscaping, vegetation and natural features, including watercourses, drainageways, ponds, lakes, swamps, woods and fields.

B. Protection for Trees - The Contractor shall install and maintain a properly supported protective fencing around each tree or group of trees that is to be saved. The fence shall be installed at the drip line of the tree(s) or as required by the Owner's Field Representative. Where locations of trees are such that a protective fencing is impractical, as determined by the Owner's Field Representative, the Contractor shall install an approved armor type protection around the trunk of the tree(s) as shown in detail on the Drawings and/or as directed by the Owner's Field Representative. All protection for trees shall be subject to the approval of the Owner's Field Representative.

C. Grading and/or Filling Around Trees - Grading and/or filling operations within the protective fencing or adjacent to armor protected trees shall be carried on with extreme care as approved by the Owner's Field Representative. If the soil over the root area of the trees has been compacted, it shall be restored by the Contractor by proper cultivation to permit entrance of water and proper aeration of roots.

D. Cutting of Tree Roots and Limbs - Roots and limbs of trees are not to be cut unless authorized by the Owner's Field Representative or designated on the plans. Should it become necessary to do so, the Contractor shall treat the remaining exposed portion of roots and/or limbs to prevent damage, loss or injury to the tree. All work shall be done in accordance with accepted horticultural practice and by personnel experienced in that field of work.

E. Interfering branches of trees scheduled to remain may be removed when acceptable to the Landscape Architect.

F. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the Landscape Architect or Owner's Representative. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

G. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the Landscape Architect, or Owner's Representative, with trees of similar size and species. Cost for tree replacement shall be determined in accordance with the Tree Evaluation Formula as described in "A Guide to the Professional Evaluation of Landscape Trees, Specimen Shrubs, and Evergreens", published by the International Society of Arboriculture.

H. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at Contractor's expense.

3.7 MAINTENANCE AND PROTECTION OF TRAFFIC AND PEDESTRIANS

A. The Contractor shall maintain traffic and protect pedestrians as required during the course of construction in such a manner satisfactory to the Owner's Field Representative and Authorities having jurisdiction. The Contractor shall comply with all rules and regulations of those governing bodies having jurisdiction within the site and on adjacent roadways, and he shall obtain all required permits and pay all fees, deposits and charges in connection with same.

B. The Contractor shall regulate and maintain pedestrian and vehicular traffic, post construction signs, install temporary walkways, fencing and lighting, and do such work as necessary and required for the proper safeguarding and handling of all traffic and protection of the public, in accordance with the Plans and Specifications and as shown, specified or ordered by the Owner's Field Representative and all Authorities having jurisdiction.

C. The Contractor shall be required to submit to the Owner's Field Representative for approval, in conjunction with his construction schedule, the method by which he plans to maintain traffic and protect pedestrians, as outlined herein. If, at any time before or during the progress of the Work, the Owner's Field Representative deems it necessary to revise the schedule relative to maintenance and protection of traffic and pedestrians in order to expedite the Work, he may do so, and said revisions shall not be made the basis of any claim by the Contractor.

D. The Contractor shall, at all times, conduct his operations in a manner that will ensure protection of the public, businesses and Owner from injury to persons or damage to property. Disruption and inconvenience to the public, businesses and Owner shall be kept to a minimum during all phases of the construction, and work shall be performed and completed as expeditiously as possible.

E. Before construction is started and during the progress of the work, the Contractor shall prepare and erect, remove and reinstall and relocate approved construction signs to

properly direct vehicular and pedestrian traffic at such points as may be directed by the Owner's Field Representative and the governing authority having jurisdiction.

F. The Contractor shall supply and maintain all lights, flashers, fences, barricades, steel plates, trained personnel to guide traffic, and/or other protection devices necessary to adequately protect traffic and pedestrians during construction.

G. The Contractor shall not obstruct or interfere with the maintenance and operation of public or private utilities such as water, sewer, storm drains, fire alarm, street lights, traffic, electric, gas and telephone. Proper access shall, at all times, be maintained to manholes, catch basins, hydrants, valves, splice boxes, fire alarm boxes and traffic control units.

H. The Contractor shall keep the traveled ways, both within and adjacent to the job site, free of construction material and debris such as spilled earth, stone or other objectionable material which may have fallen from transporting vehicles. Any material deposited on traveled ways as a result of the Contractor's operations shall be removed immediately by the Contractor to the satisfaction of the Owner's Field Representative and the governing body.

I. All traveled ways both pedestrian and vehicular, within the job site shall be properly maintained by the Contractor. Traveled ways shall be kept free of potholes, bumps, depressions or any other irregularities which occur as a result of the Contractor's operations and which disrupt the movement of traffic or pedestrians, as determined by the Owner's Field Representative. Refer to the plans and/or Construction Management Plan for phasing requirements, as applicable.

J. Before leaving the job site at the end of each work day, the Contractor shall provide for adequate and safe means of egress and ingress for vehicular and pedestrian traffic during non-working hours.

K. Special attention shall be given to providing satisfactory and safe travel ways for vehicular and pedestrian traffic over weekends and holidays.

L. Failure by the Contractor to properly maintain traffic and protect the public during construction will be reason for the Owner to suspend work until such time as proper measures are taken by the Contractor to correct unsatisfactory conditions, and such suspension of work shall not be made the basis of any claim by the Contractor.

M. The Contractor shall comply with all rules and regulations of those governing bodies having jurisdiction on the adjacent roadways, and he shall obtain all required permits and pay all fees, deposits and charges in connection with same. Unless stated otherwise, should police officers be required as determined by the Authority having jurisdiction, they shall be at the Contractor's expense.

3.8 CONSTRUCTION ENTRANCE(S)

A. General Requirements - The Contractor shall install and maintain stabilized construction entrance(s) at the construction area(s) to prevent the tracking or flowing of sediment into the adjacent area and Public Right-of-Way. The stabilized construction entrance shall consist of a minimum six (6) inch thickness of 1-1/2 to 2 inch size crushed stone placed over filter fabric to prevent pumping of the subsoil. Minimum dimensions of the stabilized construction entrance shall be fifty (50) feet in length and fifteen (15) feet in width unless otherwise shown or specified on the Drawings. The Contractor will be required to periodically top dress the construction entrance with additional clean stone or additional length as conditions warrant, as determined by the Owner's Field Representative and at no additional cost to the

Owner. All sediment spilled, dropped, or tracked into the adjacent area and Public Right-of-Way shall be removed by the Contractor immediately and the areas cleaned.

B. Should the stabilized construction entrance(s) be inadequate as a stand-alone practice as determined by the Owner's Field Representative, additional sediment and erosion control measures shall be utilized at no additional cost to the Owner (i.e. vehicle washdown areas).

C. Maintenance - The Contractor shall be responsible for the installation and maintenance of temporary facilities such as steel plates, ramps, etc., to insure safe, adequate and uninterrupted means of traffic flow over this access road. Work shall also include dust control and snow removal.

3.9 CLEAN UP

A. Clean Up - The Contractor shall clean up and remove all refuse, rubbish, scrap materials, unsuitable materials and debris caused by his operations so that, at all times, the site of the Work shall present a neat, orderly and workmanlike appearance. Materials from the Contractor's operations shall not be allowed to accumulate and cause hazardous or unsightly conditions.

B. Restoration - Where and as directed by the Owner's Field Representative, the Contractor shall replace all surfaces disturbed and shall restore paving, curbing, sidewalks, driveways, gutters, shrubbery, fences, grassed areas, sod and other surfaces disturbed to a condition equal to or better than that which existed before the Work began, furnishing all labor, material, and equipment necessary thereto.

C. The Contractor shall, at said Contractor's own expense and to the satisfaction of the Owner's Field Representative, clean up and correct unsightliness, inconvenience, hazard or damage caused by water, mud, stones, dust, rubbish, construction debris, traffic, workmen or the general operations. Wheel tracks, paths, puddles, damaged growth, ragged edges, undesirable spoil from excavation and rough slopes are to be removed, obliterated, corrected, graded, leveled, patched or smoothed. All adjacent areas that have been damaged or that require regrading shall be smoothed and worked to make the Project area blend into existing conditions.

D. Unsightliness extending onto adjacent private or public property shall be corrected to the satisfaction of both the owner of the adjacent property and the Owner's Field Representative, and no private agreements allowing a waiver of clean up will be recognized.

END OF SECTION

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. Work Included: The Work of this Section is for work to the limits as indicated on the plans and includes, but is not limited to the following:
   1. As applicable, complying with the requirements of the Geotechnical Report and/or Geotechnical Engineer, which may include special subgrade preparation work and soil/rock handling.
   2. Stripping and stockpiling of topsoil and re-spreading stockpiled topsoil on lawn and landscaped areas after establishment of grade/subgrade.
   3. Excavation and/or filling, compaction and grading to subgrade surface elevations.
   4. Removal and disposal and/or reuse of rock.
   5. Removal and disposal of unsuitable and/or surplus excavated material.
   6. Formation and compaction of swales, fill sections, embankments and subgrades, using suitable on-site excavated material and/or imported borrow material as required.
   7. Grading and regrading, including proof-rolling of subgrade surfaces and fine grading.
   8. Sheeting, shoring and bracing as necessary and required.
   9. Dewatering as necessary and required.

B. Related Sections:
   1. Section 02 30 00 “Subsurface Investigation.”
   2. Section 31 10 00 “Site Preparation.”
   3. Section 31 23 33 “Trenching and Backfilling.”
   4. Section 31 25 00 “Temporary Soil Erosion, Sediment and Dust Control.”

1.3 QUALITY ASSURANCE

A. Topographic information as shown on the Drawings was taken from a completed topographical survey. It shall be the obligation of the Bidder to satisfy himself by personal examination of the site that the existing topography shown is accurate. No claim for extra compensation for inaccuracies of existing topography will be allowed after Bids are submitted.

B. Existing Subsurface Data - At this time, subsurface geotechnical investigations have not been made at the site. Should a report become available, the information relative to these subsurface investigations will be detailed in the Geotechnical Report which would not be part of the specification but would be provided to the Contractor/Bidder for information purposes only. Refer to Section 02 30 00 "Subsurface Investigation."

C. Contractor/Bidder to Accept Actual Site Conditions - Submission of a Proposal binds the party thereto to accept the actual site conditions and to provide a completed condition at no additional cost to the Owner except as specifically provided herein.

D. The Owner will provide a survey of the property and a Layout Plan.

E. The Contractor shall provide adequate personnel and equipment to complete the Site Work as specified herein and within the agreed upon Project Construction Schedule. The Contractor shall employ a qualified English -speaking supervisor who shall provide adequate and efficient coordination of the Site Work. The supervisor shall be present on the site on a continuous full-time basis and shall have the authority to act on behalf of the Contractor.

F. The Contractor shall provide adequate survey control to locate building lines, parking areas, driveways, walls, top of slopes, toe of slopes, etc. within the horizontal dimensions shown on the Contract Drawings. He shall also provide adequate vertical control to establish site grades as shown on the Contract Drawings, within the tolerances as specified hereinafter.

G. Prior to the beginning of any site grading, the Contractor shall make sufficient checks on the topographic conditions to satisfy himself that the existing elevations are as shown by the topographic survey and on the Contract Drawings. Should any discrepancies be found they shall be reported to the Owner's Field Representative and Architect/Engineer in writing prior to commencement of any work. The Contractor shall also check the plan utility elevations to insure they are in the same datum.

H. The Contractor is responsible for reporting to the Owner's Field Representative and the Architect/Engineer any conditions encountered during construction which materially differ from those shown on the Drawings or indicated in the Specifications. These conditions shall be reported prior to continuing the related construction work.

I. The Contractor shall review all Drawings, Specifications and all other information included in Contract Documents and shall determine the quantities of the work to be completed and be responsible for the assumptions made in determining the cost of the Work.

J. The Contractor shall coordinate and complete his work in such a manner as to interfere as little as possible with all other contractors and/or subcontractors working on the site.

K. The Contractor shall locate existing underground utilities in the area of the Work before starting earthwork operations. Where utilities are to remain in place the Contractor shall provide adequate means of protection during earthwork operations. The Contractor shall notify all utility owners and all Authorities having jurisdiction within seventy-two (72) hours prior to the start of his operation.

L. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, the Contractor shall: immediately notify the Owner's Field Representative and Architect/Engineer and consult with the utility owner(s) for directions; cooperate with the owner(s) in keeping their respective services and facilities in operation; and repair any damaged utilities to the satisfaction of the utility owner(s). The Contractor shall not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner's Field Representative and only after acceptable temporary utility services have been provided.

M. The Contractor shall demolish and completely remove from the site underground utilities indicated to be abandoned on the Drawings and coordinate with local utility companies for shut-off of services if lines are active.

N. Earthwork operations to the limits as indicated on the plans, may be observed and documented by the Geotechnical Engineer. If present, the Geotechnical Engineer will have technical personnel on the site during the earthwork operations, who will conduct tests as specified herein and observe and document rock, subsoil conditions, and fill placement for suitable moisture, density, compaction and lift thickness. The Contractor shall abide by the results of such tests and the recommendations of the Geotechnical Engineer provided to the Owner and design team in the full conduct of the Work and in the correction of conditions which are unsatisfactory and not in accordance with the Drawings and Specifications. The Work will not be accepted by the Owner until documented by the Geotechnical Engineer to be in compliance with the Drawings and Specifications.

PART 2 PRODUCTS

2.1 FILL

A. Borrow fill will not be brought to this project unless it is has been tested in accordance with Muncipal requirements and certified by the contractor to be clean, natural, inorganic soil or crushed stone, and approved by the Geotechnical Engineer, as applicable.

B. Ordinary Fill - Material excavated from the site for use as general fill and backfill in landscaped areas should be friable inorganic soil essentially free of trash, ice, snow, tree stumps, roots and organic materials. Ordinary fill shall contain no stone or rubble exceeding two-thirds of the specified loose lift thickness for material placement. It shall have physical properties such that it can be readily spread and compacted during filling.

C. New Structural Fill - New fill required to achieve the planned subgrade elevations shall consist of either engineer-approved on-site soil or imported sand and gravel. Imported sand and gravel shall contain less than 20% by weight passing a No. 200 sieve. In the event that imported structural fill will be required during construction, the imported fill shall meet the following specified gradation requirements:

US Standard Sieve Size	Percent Finer by Weight
3-inch	100
No. 4	30-80
No. 40	10-50
No. 200	0-20

D. Freely Draining Fill - Material imported to the site or suitable material excavated from the site to be used as backfill, other than to satisfy topsoil specifications, shall consist of well-graded, inorganic granular material with a maximum size of 2 inches and less than 5% by weight passing the number 200 sieve.

E. Crushed Stone - Crushed stone shall be natural broken stone (i.e., not recycled material) and shall consist of well-graded, inorganic granular material with a maximum size of 3/4 inches and less than 1% by weight passing the number 200 sieve.

F. Wall Drainage Backfill - shall consist of freely draining aggregate material meeting the requirements of AASHTO No. 57 or 67 aggregate.

G. MSE Wall Reinforced Soil Zone (as applicable) - Fill material used to construct reinforced soil zone of MSE walls shall consist of either GP, GW, SW, SP or SM USCS designation. The fill material must also meet the gradations listed in the MSE wall specifications (GT-403). Gradation requirements vary for different walls.

The material passing the No. 200 sieve must be either non-plastic or of low plasticity. The maximum particle size shall be limited to 1.5 inches. Materials outside of these criteria, including on-site soils, require approval of the wall design engineer.

H. Dense Graded Aggregate - Dense graded aggregate (DGA) shall meet the following gradation requirements or as directed by the Geotechnical Engineer:

US Standard Sieve Size	Percent Finer by Weight
1-1/2"	100%
3/4"	55 - 90%
No. 4	25-50%
No. 50	5 - 20%
No. 200	3-10%

I. As applicable, all fill shall meet with the approval of the Geotechnical Engineer.

Fifty (50) pound bag samples of each material to be used as fill shall be submitted to the Geotechnical Engineer ten (10) days prior to commencing filling operations. The Geotechnical Engineer shall also have the opportunity to visit and inspect the proposed borrow area prior to its use. Prior to bringing any material on site, the Contractor must submit in writing, certification from an independent testing agency that the materials are clean and free of chemical contamination or recycled materials that would preclude the use on the site, and comply with the material requirements.

Final acceptance of fill material shall rest with the Geotechnical Engineer, whose decision shall be final and binding upon the Contractor. The acceptance of any sample material by the Geotechnical Engineer shall not relieve the Contractor of the responsibility to have all fill material used conform to the approved samples. This material must be tested for contaminants and requires papers and chain of custody.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. If required, subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer and/or Structural Engineer. If a Geotechnical Report is available, the most stringent geotechnical requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to be the Contractor.

B. The Contractor shall remove all soil, rock and other material, and utilize or legally dispose of these materials off-site as shown on the Drawings and as specified herein.

C. The Contractor shall carry out excavation and fill to the subgrade surface elevations which conform with the finished grades as shown on the Drawings, as determined by the thickness of pavements, depths of topsoil required, etc. In building areas, work shall be carried to subgrade floor elevations as determined by thickness of floor slabs and granular base course (where specified or directed).

D. The Contractor shall be responsible, at all times, for carrying out all excavation, fill and embankment operations in a safe and prudent manner so that all persons and property

will be protected from hazard. The Contractor shall comply with all applicable safety and protection laws, rules and regulations of all Federal, State, County and Local Authorities having jurisdiction.

E. Where building code requirements conflict with the Contract Documents, the more stringent requirement shall be adhered to by the Contractor.

F. The Contractor shall prepare and submit his construction schedule for stripping, excavation, embankment, and fill operations to the Owner's Field Representative for approval. This shall include the sequence of the Work and provide for the construction of permanent erosion control work at the earliest possible time.

3.2 DRAINAGE DURING CONSTRUCTION

A. During grading operations, pits, cuts, excavation areas and/or embankments and subgrades shall be shaped, sloped and maintained to facilitate drainage of surface water. Existing drainage routes shall not be choked or obstructed until new ones are available. Temporary culverts, swales, sumps, pumps or other equipment shall be used to facilitate drainage during construction.

B. Where steep slopes or abrupt grade changes occur, temporary berms or dikes shall be installed at the top to direct the flow of water to control point(s) to be transported downslope by slopes drain(s). Slope drains shall be constructed with an apron at the top to direct the water and rubble stone at the bottom to prevent scouring the soil.

C. Adequate site drainage should be implemented early in the construction schedule to avoid an overly wet subgrade, which must be dried before resuming construction activity.

3.3 TOPSOIL

A. General - Topsoil, where present on the site, except as modified by the Geotechnical Engineer, shall be stripped by the Contractor and a sufficient quantity stockpiled to insure compliance with the Drawings and Specifications.

Topsoil shall be defined as the existing surface layer of organic material which is suitable for re-use in seeding, sodding and planting. Topsoil shall contain no admixture of refuse or substances harmful to plant growth and shall be free from subsoil, stumps, roots, brush, stones, clay lumps or any other undesirable material.

Topsoil shall not be used for fill or embankment.

B. Stripping of Topsoil - Topsoil where present, shall be stripped for its full depth within the entire limits of earthwork.

Topsoil shall not be stripped beneath the spread of the branches of trees designated "To Be Saved" or "To Remain" unless directed otherwise by the Owner's Field Representative.

Topsoil stripping shall be completed prior to the start of general excavation in the area.

C. Stockpiling of Topsoil - Topsoil suitable for reuse shall be kept separate from other material, stored and stockpiled on the site in locations approved by the Owner's Field Representative and/or the Geotechnical Engineer. The Contractor shall cover the stockpile with tarps or plastic sheeting and place a silt fence or other acceptable erosion control device around stockpiles.

1. Stockpiled topsoil shall be free from trash, brush, stones over 3" diameter, and other extraneous matter.

2. Screen topsoil. Screened topsoil shall be free from stones over 1/2” diameter. Maintain separate stockpile for screened topsoil.

D. Deficiency of Topsoil - If there is not a sufficient quantity of topsoil present on the site the Contractor shall supply from off-site source(s), the necessary quantity of topsoil to complete the topsoil operations as specified herein and on the Drawings. Specifications for topsoil furnished from off-site source(s) shall be as specified under the Section of these Specifications relating to seeding and grass establishment or as required by the Landscape Architect. All such topsoil shall be furnished under the Contract Sum.

E. Excess of Topsoil - If there is an excess of topsoil, it shall be legally disposed of off-site by the Contractor or stored on site if directed. The Contractor shall verify with the Owner's Field Representative the quantity of topsoil he estimates is to be stockpiled on the site for reuse and the quantity of topsoil which is to be disposed of. Should the Contractor dispose of too much topsoil, any deficiencies shall be replaced by the Contractor at his own expense.

F. Spreading of Topsoil - Topsoil shall be spread over the specified areas as soon as grading operations have been completed. The Contractor shall place topsoil to a minimum depth of six (6) inches on all slopes, planting areas, areas to be seeded, etc., first scarifying the subgrade to a depth of two (2) inches for the bonding of the topsoil with the subsoil. Topsoil shall be raked to an even surface and cleared of all debris, roots, stones and other unsatisfactory material.

Immediately upon completion of topsoil operations, slopes and all other areas to be seeded shall be seeded in accordance with the Section of these Specifications relating to seeding and grass establishment, or as required by the Landscape Architect.

3.4 EXCAVATION

A. General Requirements - The Contractor shall be responsible for compliance with the Geotechnical Report if available, the Geotechnical Engineer and/or Structural Engineer, and all excavation of whatever material encountered, and there will be no extra compensation for any excavation, regardless of the character of the existing unsuitable fill and subsoil. All excavation under this Contract shall be considered as "Unclassified Excavation" as hereinafter described.

The existing fill, any unsuitable materials, and surface materials (i.e. asphalt, curbing, topsoil, surface vegetation, etc.) must be completely removed from the planned building areas extending at least ten (10) feet beyond the construction limits, where feasible.

B. Existing Fill - Existing fill throughout the site may be variable. If existing fill is present, it must be screened and processed in order to be suitable for reuse as new compacted fill on the site. Contractor must export fill that cannot be used.

C. Stripping/Excavation - The Contractor shall strip the area to be excavated of all undesirable material, as identified by the Authority having jurisdiction, and the Contractor shall legally dispose of the stripped material off-site. Over-excavation of certain areas may be required down to the virgin soil or underlying bedrock.

The Contractor must completely remove all existing fill if present in the building area and other areas where directed (down to virgin soil or underlying bedrock), as directed by the Geotechnical Engineer or the Authority having jurisdiction.

D. Excavation in "Cut" Areas - After approval of the stripping operation in a "cut" area, excavation shall be made of the existing material to the lines and grades shown on the Contract Drawings. Material encountered during excavation which is not suitable for the proposed construction shall be excavated to the depths identified by the Geotechnical Engineer or Owner's Field Representative. Material suitable for use in fills or backfills, and in quantities sufficient for those purposes shall be stockpiled and protected at on-site locations approved by the Owner's Field Representative and/or Geotechnical Engineer.

E. Classification - All material excavated shall be classified as "Unclassified Excavation", and this material shall be further classified as "Suitable Material" or "Unsuitable Material" as follows:
   1. Unclassified Excavation - Unclassified excavation shall be defined as removal of all material of any nature whatsoever, including but not limited to topsoil, pavements, rock and earth.
   2. During the removal of unsuitable material, the Contractor must segregate potentially re-usable existing fill material from the non-reusable fill (i.e. debris and topsoil).
   3. Suitable Material - Suitable material shall be defined as material whose composition is satisfactory for use in fill, embankment or foundation construction. In general, any mineral (inorganic) soil, including their mixtures with crushed, blasted or broken rock, and meet the gradation requirements for Ordinary Fill or Controlled Fill and similar materials of natural or man-made origin, shall be considered as suitable materials. If allowed, all backfill imported to the site shall be analytically tested and certified in accordance with all applicable laws and regulations, and documented to be clean prior to delivery to the site. Analytical results must be provided to the Geotechnical Engineer or Owner's Field Representative for approval prior to importing.
   4. Unsuitable Material - Unsuitable material shall be defined by the Geotechnical Engineer or Owner's Field Representative and shall include but not limited to any material containing vegetation or organic matter, such as muck, peat, organic silt, topsoil or sod, that is not satisfactory for use in fill, embankment construction or for support of permanent structures. Certain man-made deposits such as landfill may also be determined to be unsuitable material.
      Identification of the depth of unsuitable material to be excavated below structures will be made either visually or by laboratory testing by the Geotechnical Engineer or the Owner's Field Representative. The Contractor may elect to dig exploratory tests pits to be observed to pre-determine excavation levels prior to the start of excavation in a given area.
      Should the Contractor encounter unusual material, he shall immediately notify the Geotechnical Engineer or Owner's Field Representative, who will examine the material, recommend testing if necessary, classify it, and advise the Contractor as to the method of handling. Unauthorized removal of material before it has been tested and classified is done at the Contractor's risk.

F. Stockpiling and Use of Suitable Material - The Contractor shall be responsible for the proper scheduling of the Work and stockpiling suitable excavated material as necessary and required for use in the embankment, slope, and/or subgrade fill areas. Material which is stockpiled shall be properly protected by the Contractor so that its use as fill, embankment, slope construction, and/or subgrade will not be impaired. The

Contractor shall place tarps or plastic sheeting over stockpile and provide a silt fence or other acceptable erosion control device around stockpiles.

If material leaves the site and stored off-site it cannot be brought back on-site without soil testing and analysis, and chain of custody paperwork.

G. Environmentally Impaired Material - The Contractor shall be responsible for the proper segregation and handling of suspected or confirmed environmentally impaired soil in accordance with all requirements and Authorities having jurisdiction.

H. Disposal of Surplus Material - The Contractor shall be responsible for the legal off-site disposal of all debris and surplus excavated material. Prior to commencement of excavation, the Contractor shall verify with the Owner's Field Representative and/or the Geotechnical Engineer the quantity of surplus material that he estimates is to be disposed of off-site.

In the event that the Contractor disposes of too much suitable excavated material, he shall replace this material as necessary and required, at his own cost and expense. Material to be replaced shall meet the requirements for fill material as specified herein and shall be subject to the approval of the Geotechnical Engineer or Owner's Field Representative.

I. Deficiency of Suitable Excavated Material - Should there be a deficiency of suitable material obtained from excavation of the site, as determined by the Owner's Field Representative and/or the Geotechnical Engineer, such additional fill material which is necessary and required shall be furnished from an off-site source and tested for conformance to the requirements of Section 2. In the event that such deficiency of suitable material is the result of the Contractor's failure to properly schedule the Work, stockpile the proper amount of suitable excavated material, properly protect stockpiled material, or if the Contractor in any way, causes suitable material to become unsuitable for use as fill material because of his operations, such deficiency shall be corrected by the Contractor at his own expense at no additional cost to the Owner.

J. Slopes - Unless indicated otherwise, slopes shall not be steeper than 3 horizontal to 1 vertical in both cut and fill. Storm water shall not be drained over the slopes.

K. Moisture Content of Excavated Soil - When the soil being excavated is such that an increase in moisture content will have a detrimental effect on its use as fill material, the soil shall be stockpiled, graded, and protected in a manner which will minimize the infiltration of rain water or surface runoff water.

L. Drainage - Soil excavation areas are to be kept sloped to drain. They are to be sealed by rolling each night. All dewatering measures must discharge to temporary sediment tank(s).

3.5 ROCK EXCAVATION

A. General Requirements - The Contractor shall excavate, remove and dispose of rock within the limits specified and in accordance with the Drawings and Specifications and/or as ordered by the Geotechnical Engineer or Owner's Field Representative.

B. Unless otherwise specified or directed, rock excavation shall be carried to a level directed by the Geotechnical Engineer or Owner's Field Representative. The subgrade shall then be brought to a smooth subgrade surface with suitable, approved material and compacted to the specified density.

C. Unless otherwise specified or directed the contractor is responsible for over excavation of rock material and subsequent backfill material required to accommodate the installation of the specified plant material. Landscaped areas consisting of trees and

shrubs shall be over excavated to provide a minimum of 36 inches of approved backfill suitable for planting. Landscaped areas consisting of only shrubs shall be over excavated to provide a minimum of 24 inches of approved backfill suitable for planting. All other landscaped areas including lawn areas shall be over excavated to provide a minimum of 12 inches of approved backfill suitable for planting. All backfill material shall be approved by Geotechnical Engineer or Owner's Field Representative. The subgrade shall then be brought to a smooth subgrade surface with suitable, approved material and compacted to the specified density.

D. Rock as Fill Material - Excavated rock may be used as fill material provided that the material conforms to the required gradation, is well graded, and has been approved prior to use by the Geotechnical Engineer or Owner's Field Representative.

Unless Directed Otherwise, Rock Fill Gradation Limitations:

Location	Maximum Particle Size
Building Area within 2' of finished floor	3 inches
Building Area more than 2' below finished floor	6 inches
Building Area more than 6' below finished floor	12 inches
Outside Building Area within 18" of finished grade (i.e. pavement & sidewalk areas)	3 inches
Outside Building Area more than 18" below finished grade (i.e. pavement & sidewalk areas)	6 inches
Outside Building Area more than 3' below finished grade (i.e. pavement & sidewalk areas)	12 inches

E. Blasting - When drilling and blasting are permitted, the blasting Contractor must provide a Blasting Management Plan in accordance with Municipal and State regulations and the Explosive Materials Code, NFPA No. 495, National Fire Prevention Association. Additionally, all blasting should adhere to the provisions of 29 CFR Ch. XVII Section 1910.109 for explosives and blasting agents. The blasting Contractor must employ licensed personnel, and adhere to all Local, County, State and OSHA Regulations regarding the use and storage of explosives, and he shall acquire all necessary insurance, permits and licenses. The Contractor shall be responsible for all damages due either directly or indirectly to such operations.

The Contractor should not assume that blasting will be allowed. The Contractor may be required to remove rock utilizing heavy excavating equipment in lieu of blasting.

Each blast will be monitored independently to insure that this criterion is not exceeded. The monitoring results shall be provided to the blasting contractor as soon as possible so that the blasting program can be modified if necessary.

F. The blasting contactor should avoid over-blasting the rock. Over-blasting will disturb the deeper intact rock that will be used as bearing material for the proposed structures. Any material that is over-blasted will have to be removed and replaced with new structural fill under the full-time inspection of the Geotechnical Engineer. The Geotechnical Engineer will be responsible for determining what material is to be removed and will direct the contractor during the excavation.

G. Rock excavation and handling shall be included in the Contract Sum.

3.6 BEDROCK SPECIAL CONSTRUCTION PROCEDURES

A. Special construction procedures may be required as directed by the Geotechnical Engineer or Owner's Field Representative, where both soil and rock are encountered within the foundation excavations.

3.7 SUBGRADE UNDERCUTTING

A. General Requirements - Geotechnical Engineer, shall observe the subgrade surfaces to determine if any undercut excavation is required and the extent of such undercutting to remove existing fill, topsoil, or subsoil. The Contractor shall, upon written authorization of the Owner's Field Representative and/or Geotechnical Engineer, excavate, remove and dispose of any such unsuitable material and replace same with compacted Controlled Fill or with material directed by the Geotechnical Engineer, in accordance with these Specifications to proper grade as called for on the Drawings.

B. Wet Subgrade - If the building subgrade is wet, the Contractor must prepare the subgrade to stabilize with geotextile fabric (Mirafi 500 X or equal) over 3/4" crushed stone prior to placing new compacted fill, or as directed by the Geotechnical Engineer.

C. Refer to Section 02 30 00 "Subsurface Investigation" and the Geotechnical Report (as applicable) for additional information.

D. All such undercut excavation and replacement with suitable material as directed, shall be included in the Contract Sum.

3.8 MINIMUM COMPACTION REQUIREMENTS

A. Unless otherwise directed or stated in the Geotechnical Report, the minimum compaction requirements for the various areas of the site are as follows:

Minimum Compaction Requirements

Area	Maximum Modified Dry Density (ASTM D1557)
Building Area (below foundations)	95%
Building Area (above foundations)	92%
Adjacent to Foundation Walls	92%
Slope Areas	95%
Retaining Wall Subgrade	95%
Retaining Wall Backfill	92%
Pavement Areas	92%
Exterior Slabs and Sidewalks	92%
Utility Trenches	92%
Landscape Areas	90%

3.9 EMBANKMENT / FILL

A. General Requirements - Suitable material on-site or removed from the excavation, as determined by the Geotechnical Engineer or Owner's Field Representative, shall be used as recommended in the formation of slopes, fill sections, embankment, subgrade, etc.

The Geotechnical Engineer or Owner's Field Representative may recommend based on visual classification and/or laboratory testing that excavated material from certain areas or certain strata does not comply with the specifications for use under paved areas but that such material may be suitable for deposit in deep fills or embankment areas outside of the paved areas and building areas.

The Geotechnical Engineer or Owner's Field Representative may recommend based on visual classification and/or laboratory testing that excavated material from certain areas or certain strata is unsuitable for use on any portion of the site, and such unsuitable material shall be legally disposed of off-site as herein specified under the Contract Sum.

B. Compaction of Fill - Prior to commencing fill operations, the Contractor shall supply data on the compaction equipment to the Geotechnical Engineer or Owner's Field Representative.

C. New structural fill and engineer-approved on-site soil required to achieve planned subgrade elevations shall be placed in layers not exceeding one (1) foot in thickness, and each layer shall be compacted to at least 95% of its Maximum Modified Dry Density (ASTM D1557). Each layer must be compacted, tested, and approved by the Geotechnical Engineer or Owner's Field Representative prior to placing subsequent layers.

D. Prior to placing fill, the Contractor shall proof compact the exposed embankment subgrade with at least four passes of a large self-propelled vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width. The cost of all such work shall be included in the Contract Sum.

E. Embankment Fill shall be placed and compacted to the required elevations (adjusted to subgrade) indicated on the Drawings. Fill shall be compacted with a large self-propelled vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width. Embankment sections shall be constructed using Ordinary Fill placed in loose lifts not to exceed 10 inches and compacted to at least 95% of the maximum dry density according to ASTM D1557. When fill is to be placed on existing slopes steeper than 4 horizontal to 1 vertical, the existing slope shall be benched in accordance with the details shown on the Drawings and/or as directed by the Geotechnical Engineer or Owner's Field Representative. All methods employed in the placing of fill on existing slopes shall be subject to the approval of the Geotechnical Engineer or Owner's Field Representative.

F. Construction of Slope - The Contractor's attention is directed to the Geotechnical Report (as applicable), for requirements relating to slope construction.

G. Frost - No fill shall be placed when the fill material, the embankment foundation or the previous lift on which fill is to be placed is frozen. In the event that any fill which has already been placed or the foundation shall become frozen before the next lift is placed, it shall be scarified and recompacted or removed prior to placement of the next lift of non-frozen controlled fill. If the free water in the fill to be placed or prepared surface freezes prior to or while placing fill, the site shall be protected by the Contractor until conditions more favorable to fill placement exist.

H. Moisture - If in the opinion of the Geotechnical Engineer or Owner's Field Representative, fill material becomes too wet or too dry for the required compaction, the Geotechnical Engineer or Owner's Field Representative will notify the Contractor and it will be the Contractor’s responsibility to dry the fill or to add water to the fill until optimum moisture contents and required compaction can be achieved.

I. Protection of Fill - Protection of all compacted lifts shall be the responsibility of the Contractor. Damage to any compacted lift, including those lifts previously tested and approved by the the Geotechnical Engineer or Owner's Field Representative, occurring at any time during the course of construction, caused by equipment, from moisture entering the footing subgrade, or from any other cause whatsoever, shall be fully repaired by the Contractor prior to placement of overlaying materials, at his own expense and to the complete satisfaction of the Geotechnical Engineer or Owner's Field Representative.

In the event of heavy rains, the Contractor shall suspend fill operations immediately and shall take all necessary steps to keep the site as well drained as possible. Fill operations shall not be resumed until the moisture content of the fill is such as to permit compliance with these Specifications.

All corrective work or operations necessary to maintain proper moisture control of the fill material shall be at the expense of the Contractor.

3.10 FOUNDATIONS

A. General Requirements - Suitable material removed from the excavation, as determined by the Geotechnical Engineer or Owner's Field Representative, may be used as recommended.

The Geotechnical Engineer or Owner's Field Representative may recommend based on visual classification and/or laboratory testing that excavated material from certain areas or certain strata does not comply with the specifications for use under paved areas but that such material may be suitable for deposit in deep fills or embankment areas outside of the paved areas.

The Geotechnical Engineer or Owner's Field Representative may recommend based on visual classification and/or laboratory testing that excavated material from certain areas or certain strata is unsuitable for use on any portion of the site, and such unsuitable material shall be legally disposed of off-site as herein specified under the Contract Sum.

B. Prior to placing fill, the Contractor shall proof compact the exposed subgrade with at least four passes of a large self-propelled vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width. Protect foundation subgrades after proofrolling with the placement and compaction of 3 to 6 inches of ¾ inch crushed stone or as directed by the Geotechnical Engineer or Owner's Field Representative. The cost of all such work shall be included in the Contract Sum.

Placing of Fill - Fill shall be placed and compacted to the required elevations (adjusted to subgrade) indicated on the Drawings. Fill shall be compacted with a large self-propelled vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width. Fill sections shall be constructed using Controlled Fill placed in lifts not to exceed 10 inches in loose lift and compacted to the required maximum dry density according to ASTM D1557 with a vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width.

When fill is to be placed in existing paved areas, the Contractor shall scarify, break and remove the pavement prior to placing the fill as approved by the Geotechnical Engineer or Owner's Field Representative or Owner's Field Representative.

Unless indicated otherwise, soil slopes shall be 3 horizontal to 1 vertical or flatter. Should new buildings be constructed adjacent to steeper slopes, the new footings must be revised to adhere to the appropriate section of the NYS Building Code; (i.e.

the building foundations may require additional embedment). When fill is to be placed on existing slopes steeper than 4 horizontal to 1 vertical the existing slope shall be benched in accordance with the Geotechnical Engineer or Owner's Field Representative.

All methods employed in the placing of fill on existing slopes shall be subject to the approval of the Geotechnical Engineer or Owner's Field Representative.

Embankments shall be pitched to provide drainage at the close of each day's operations. Unless otherwise specified or directed, in no case shall the slope of fill construction exceed a ratio of 3 horizontal to 1 vertical.

C. Compaction of Fill - Prior to commencing fill operations, the Contractor shall supply data on the compaction equipment to the Geotechnical Engineer or Owner's Field Representative.

Prior to compaction, each layer shall be leveled off by use of blade graders or bulldozers with adequate power for the work involved. The entire area of each layer shall be compacted by making no less than four (4) passes over the area with a large self-propelled roller as specified for proof rolling. Compaction shall be continued until each layer is thoroughly consolidated to the required degree of compaction for its full width.

Construction and hauling equipment shall be routed evenly over the area in order to avoid the creation of ridges, hollows and zones of non-uniform density.

Compaction requirements shall be in accordance with these specification and plans and/or as directed by the Geotechnical Engineer or Owner's Field Representative.

D. Frost - No fill shall be placed when the fill material, the foundation or the previous lift on which fill is to be placed is frozen. In the event that any fill which has already been placed or the foundation shall become frozen before the next lift is placed, it shall be removed prior to placement of the next lift of non-frozen controlled fill. If the free water in the fill to be placed or prepared surface freezes prior to or while placing fill, the site shall be protected by the Contractor until conditions more favorable to fill placement exist.

E. Moisture - If fill material becomes too wet or too dry for the required compaction, the Geotechnical Engineer or Owner's Field Representative will notify the Contractor and it will be the Contractor’s responsibility to dry the fill or to add water to the fill until optimum moisture contents and required compaction can be achieved.

F. Protection of Fill - Protection of all compacted lifts shall be the responsibility of the Contractor. Damage to any compacted lift, including those lifts previously tested and approved by the Geotechnical Engineer or Owner's Field Representative, occurring at any time during the course of construction, caused by equipment, from moisture entering the footing subgrade, or from any other cause whatsoever, shall be fully repaired by the Contractor prior to placement of overlaying materials, at his own expense and to the complete satisfaction of the Geotechnical Engineer or Owner's Field Representative.

In the event of heavy rains, the Contractor shall suspend fill operations immediately and shall take all necessary steps to keep the site as well drained as possible. Fill operations shall not be resumed until the moisture content of the fill is such as to permit compliance with these Specifications.

All corrective work or operations necessary to maintain proper moisture control of the fill material shall be at the expense of the Contractor.

3.11 GRADING TOLERANCE

A. All subgrade surfaces prior to fine grading for pavement and building construction shall be graded to within ± one tenth (0.1) foot of the required subgrade surface elevations. This ± one tenth (0.1) foot tolerance shall balance, so that the surface can later be fine graded without adding or removing material.

B. Uniform levels and slopes shall be provided between elevations shown on the Drawings and between proposed elevations and existing elevations shown to be maintained. Abrupt changes in slopes shall be rounded in accordance with the directions of the Geotechnical Engineer or Owner's Field Representative.

3.12 PROOF-ROLLING OF SUBGRADE SURFACES

A. General Requirements - Unless otherwise indicated, all subgrade surfaces shall be proof-rolled by means of a large self-propelled roller vibratory roller with 5,000 to 8,000 pounds of force per foot of drum width, making at least four (4) passes covering the entire graded area to locate and permit timely correction of subgrade deficiencies which are likely to adversely affect the performance of the pavement structure.

B. Cut Sections - In cut sections, proof-rolling of the subgrade surface shall be done to determine the location and extent of areas below the subgrade surface that may require subgrade undercutting. Should any portion of the cut subgrade surface fail to provide satisfactory support for the proof-rolling operation excavate these areas and replace with compacted Controlled Fill. Such corrective work shall be as specified elsewhere in this Section under "Subgrade Undercutting".

C. Embankment Sections - In embankment sections, proof-rolling of the subgrade surface shall be done to determine the uniformity of the compaction below the subgrade surface and to locate subgrade deficiencies requiring corrective work. Any deficiencies discovered during proof-rolling operations shall be excavated and replaced with compacted Controlled Fill. Corrective work shall not be considered complete and acceptable until the subgrade shows satisfactory and uniform response to the proof-rolling operations. All work necessary and required to correct subgrade deficiencies in embankment sections shall be at the Contractor's expense.

3.13 DUST CONTROL

A. General Requirement - The Contractor shall provide all necessary measures to control dust through the use of water, calcium chloride or other material in accordance with the directions of the Owner's Field Representative, at such locations and during such periods as he may direct, or as may be required by local ordinance or Authorities having jurisdiction.

B. Spreading Calcium Chloride - Calcium Chloride shall be spread in pellet or flake form by approved devices so that uniform distribution is attained over the entire area being treated.

C. Applying Water - Watering equipment shall consist of pipelines, tanks, tank trucks or other approved devices capable of applying a uniform spread of water over the surface. A suitable device for regulating the flow and positive shutoff of water shall be provided for positive control by the operator.

D. Authority of Owner's Field Representative - The Owner's Field Representative will advise the Contractor of any unsatisfactory procedures for dust control. If the unsatisfactory procedures are not corrected promptly, the Owner's Field Representative may suspend the performance of any or all construction until the condition has been corrected, and such suspension of construction shall not be used

as the basis of any claim by the Contractor for additional compensation or an extension of the Contract time.

3.14 SHEETING, SHORING AND BRACING

A. General Requirements - At his own expense, the Contractor shall design, furnish, install and maintain such sheeting, shoring, bracing and cofferdamming, etc., as may be needed to support the sides and roofs of excavations and to prevent any earth or rock movements which might in any way diminish or affect the necessary width of the excavation, endanger the safety of persons, injure or delay the Work, or jeopardize the safety of adjacent pavements, property, buildings or other structures. The work of sheeting, shoring and bracing shall, at all times, be in accordance with the requirements of all Authorities having jurisdiction, including OSHA and designed by a licensed professional engineer in the State of New York.

B. Contractor to be Solely Responsible - The Contractor shall be entirely and solely responsible for the adequacy and sufficiency of all supports and of all sheeting, bracing, shoring, cofferdamming, etc. The Contractor shall assume entire and sole liability for damages on account of injury to persons, adjacent pavements, and public and private property including, but not limited to, the work under construction, buildings and other structures, which injury shall result directly or indirectly from the Contractor's failure to install or to leave in place adequate and sufficient supports, sheeting, bracing, shoring, cofferdamming, etc.

3.15 DEWATERING AND DISPOSAL OF WATER

A. Unless directed otherwise, all dewatering measures must discharge to the stormwater basin and/or temporary sediment tank(s) as directed.

B. Any surface water or precipitation should be diverted away from excavation areas. If water is encountered, the Contractor may attempt to control groundwater levels with open pumping using a system of ditches and sumps. Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation or slopes, will not cause erosion problems, and will not undermine or cause instability or damage to existing structures.

Off-Site discharge shall adhere to all Local, State and Federal regulations.

C. Open pumping with ditches and sumps, if it results in boils, loss of fines, softening of the ground, or instability of slopes, will not be permitted. If wells or well points are to be used, they shall be installed with suitable screens and filters so that continuous pumping of fines does not occur. The treatment system shall be set up in a manner to allow for the collection of pre- and post-treatment samples by the Geotechnical Engineer or Owner's Field Representative. The discharge shall be arranged to facilitate collection of samples by the Geotechnical Engineer or Owner's Field Representative. Whatever method of groundwater control is used, the groundwater level shall be maintained at least two (2) feet below the bottom of the excavation. The Geotechnical Engineer or Owner's Field Representative will be present for excavation operations to determine if sufficient control of ground water levels is being maintained.

D. Method of Disposal - The water from the excavations shall be disposed of in such a manner as will not cause injury or damage to the public health, public or private property, nearby water courses, drainage ways, water impoundment areas, the work contemplated or in progress, surfaces of the streets, nor cause any interference with the use of the same. The disposal of this water shall be done in a manner satisfactory to the Owner's Field Representative and Authorities having jurisdiction.

3.16 COORDINATION OF OPERATIONS

A. The Contractor is advised that during the course of work under this Section work may be progressing on other phases of the Project, including work on separate contracts with the Owner for building construction, utilities, etc. It shall be the responsibility of the Contractor to coordinate his operations and those of any of his subcontractors with the operations of these other contractors, through the Owner's Field Representative.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section is for work to the limits as indicated on the plans and includes, but is not limited to the following:
   1. As applicable, complying with requirements of the Geotechnical Engineer, which may include special subgrade preparation work and soil/rock handling.
   2. All necessary excavation, including disposal off-site of unsuitable and/or surplus excavated material.
   3. All necessary bedding, backfill and compaction, including furnishing approved bedding material and additional suitable backfill material as required.
   4. Sheeting, shoring and bracing as necessary and required.
   5. Dewatering of trenches and excavations as necessary and required.

B. Related Sections:
   1. Section 02 30 00 "Subsurface Investigation."
   2. Section 31 10 00 "Site Preparation."
   3. Section 31 23 00 "Excavation and Fill."
   4. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control."

1.3 QUALITY ASSURANCE

A. General:
   1. Trench excavation shall be carried out by the Contractor to conform with the line and grade of the various utilities and the bottom of the foundations and/or footings for subsurface structures as shown on the Drawings and as specified herein.
   2. All excavations shall be kept free from water, snow and ice during construction.
   3. The Contractor shall be responsible, at all times, for conducting all operations in a safe and prudent manner so that all workmen and the public will be protected from hazard. The Contractor shall observe all applicable Local, County, State and Federal requirements, and he shall obtain all necessary permits and pay all fees, deposits and charges required for acquiring said permits.
   4. In fill areas, all embankments shall be constructed to a minimum of 2 feet above the outside top (at the bell) of the pipes prior to beginning any trench excavation.
   5. If available, the Contractor is referred to the Geotechnical Engineer's report. The most stringent requirements stated in the report, or required by the Owner's Field Representative, Geotechnical Engineer, Structural Engineer or MEP Engineer, or any other place in the Contract Documents shall be adhered to by the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Owner's Field Representative, Geotechnical Engineer, Structural Engineer, and/or MEP Engineer. The most stringent geotechnical requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to by the Contractor.

B. General Requirements - The Contractor shall be responsible for the excavation of all materials encountered, and with the exception of "Additional Trench Excavation in Rock" and "Additional Trench Excavation in Earth" as hereinafter described, there will be no extra compensation for any excavation, regardless of the character or type of soils or materials encountered.

C. Method of Trenching - Trench excavation shall be done with excavating machinery, except in such places where work performed in this manner will injure trees, buildings or existing utilities or structures, or where the use of machinery is specifically forbidden, in which case hand methods shall be employed.

D. Preparation of Bottom of Trench - The trench bottoms shall be prepared to conform to the details on the Drawings, the Geotechnical Report, and as specified herein. Special precautions shall be exercised to insure that pipe and conduit, when installed, will not rest on rock, masonry or any other materials which would present a non-uniform foundation. For bell and spigot pipe, bell holes shall be provided at each pipe joint to prevent bearing on the bell of the pipe. Where two or more pipes or conduits are to be laid in the same trench, the Contractor shall excavate the trench so that all pipe and conduit are laid on undisturbed or approved properly compacted material.

   New Utilities may bear in densified existing fill, virgin soils, weathered bedrock, or new compacted fill, as directed by the Geotechnical Engineer or Owner's Field Representative.

E. Unsuitable Material at Bottom of Trench - When the material at the bottom of a trench is unsuitable, as determined by the Geotechnical Engineer or Owner's Field Representative, it shall be removed to such depth as the Geotechnical Engineer or Owner's Field Representative may direct, and backfilled with suitable and properly compacted granular material obtained from the Project excavation, or from borrow material if it is not available within the Project, consisting of 3/4-inch clean crushed stone to provide firm pipe support. Compaction of this replacement material in grassed areas shall be not less than 90%, and under pavements, sidewalks and utilities, shall be not less than 92% Maximum Modified Density (ASTM Designation D-1557).

   All such removable and replacement with suitable compacted granular material as directed, is included in the Contract Sum.

F. Excavation Below Required Grade - Excavation below the grade of pipe, conduit or subsurface structures shown on the Drawings, necessitated by changes in grades in accordance with the directions of the Site Engineer and/or Owner's Field Representative, will be paid for under "Additional Trench Excavation in Earth" or "Additional Trench Excavation in Rock," as hereinafter defined. However, if removal of unsuitable material and replacement with suitable material is required as a result of the

Contractor's operations or negligence, it shall be the Contractors responsibility to correct the condition at his own cost and expense, and no additional payment shall be made to the Contractor by the Owner for removal and replacement of such material. Removal and replacement of material without written authorization, is performed at the Contractor's expense.

Excavation carried below the required level without the authorization of the Owner's Field Representative shall be backfilled by the Contractor at his expense with suitable compacted granular material as directed by the Owner's Field Representative. Compaction of backfill material shall be as specified under Paragraph 3.5.

G. Excavation in Paved Areas - When excavations are to be made in paved surfaces, the paved surfaces shall be line cut on each side of the trench and ahead of the excavation by means of saw cutting or other approved tools to provide a clean, uniform edge, with minimum disturbance of the remaining pavement. The pavement so removed shall not be used for trench backfill, but shall be disposed of off-site according to all regulations.

H. Unsuitable Excavated Material - Unsuitable excavated material shall be disposed of by the Contractor off-site according to all regulations.

I. Environmentally Impaired Material - The Contractor shall be responsible for the proper segregation and handling of suspected or confirmed environmentally impaired soil in accordance with all requirements and Authorities having jurisdiction.

J. Surplus Excavated Material - Excavated material which is not required for trench backfill shall be legally disposed of off-site by the Contractor. In general, suitable surplus excavated material may be used as fill material.

3.2 TRENCH EXCAVATION IN ROCK

A. Refer to Section 31 23 00 for additional information pertaining to rock removal.

B. General Requirements - If rock is encountered in trench, the Contractor shall excavate, remove and dispose of rock in trench within the limits specified and in accordance with the Drawings and Specifications and/or as approved by the Owner's Field Representative.

Trench excavation in rock shall be defined as removal of boulders larger than one (1) cubic yard in volume and removal of ledge rock, concrete or masonry structures which cannot be ripped with a one and one-half (1-1/2) cubic yard backhoe or equivalent and requires drilling, blasting, or other special methods for removal. Removal of concrete pavement or foundations of any kind over trench is not considered trench excavation in rock.

For pipe and conduit installation, rock excavation shall be carried to a level at least six (6) inches below the bottom of the pipe or conduit. The trench shall then be brought to proper grade for laying of the pipe or conduit by the placing of Select Bedding as directed by the Owner's Field Representative.

C. Shattered Rock - If, in the course of rock excavation, the rock below grade is shattered due to over-drilling or over-blasting, and the Owner's Field Representative and/or Geotechnical Engineer considers such shattered rock to be unfit for support of pipe, conduit or structures, the shattered rock shall be removed and the excavation backfilled with concrete, gravel or crushed stone, as the Owner's Field Representative and/or Geotechnical Engineer directs. All such removal, backfilling and corrective work shall be done by and at the expense of the Contractor.

D. Blasting - When drilling and blasting are permitted, the Contractor must employ licensed personnel, and adhere to all Local, County, State and OSHA Regulations regarding the use and storage of explosives, and he shall acquire all necessary insurance, permits and licenses. The Contractor shall be responsible for all damages due either directly or indirectly to such operations.

   Blasting, when permitted, shall be done only at such times as the Owner and those Authorities having jurisdiction shall approve and under such conditions and restrictions as they may impose.

E. No additional payment will be made for trench excavation in rock; compensation shall be considered as included in the Contract Sum, except that in the event the Contractor is ordered to excavate below the grade of the pipe, conduit or subsurface structure shown on the Drawings and in accordance with the directions of the Site Engineer and/or Owner's Field Representative, payment for rock encountered and removed below the grade shown on the Drawings will be made to the Contractor under the price that may be set forth in the Contract for "Additional Trench Excavation in Rock", as applicable.

3.3 ADDITIONAL TRENCH EXCAVATION

A. Authorized Changes and/or Alterations - The Site Engineer and/or Owner's Field Representative may, as a result of unforeseen conditions arising during the progress of the Work, order the grade of any pipe or structure changed from that established on the Drawings, or may order the raising, lowering or alteration of any existing pipeline or structure.

B. Additional Payment to Contractor - Should such changes or alterations result in an addition to the quantity of trench excavation, this additional excavation shall be considered as Extra Work and payment for same shall be made to the Contractor on the basis of the price that may be in the Contract for "Additional Trench Excavation in Earth" or "Additional Trench Excavation in Rock," whichever may be appropriate, as determined by the Owner's Field Representative.

C. Credit to Owner - Should such changes or alterations result in a reduction in the quantity of excavation, then the unit price in the Contract for "Additional Trench Excavation in Earth" or "Additional Trench Excavation in Rock," whichever may be appropriate, as determined by the Owner's Field Representative, shall be applied to the quantity of reduced excavation to determine a credit to the Owner for the reduction in the amount of excavation occasioned by such change.

D. Method of Measurement - The quantity of "Additional Trench Excavation in Earth" or "Additional Trench Excavation in Rock" measured for payment to the Contractor or reduction of trench excavation measured for credit to the Owner shall be determined by plotting the profile of the bottom of the trench for pipe and/or structures, as indicated on the Drawings and the profile of the bottom of the trench for pipe and/or structures(s) in their final location and computing the difference in trench volume. The volume of additional trench excavation (in the case of additional payment to the Contractor) or reduced trench excavation (in the case of credit to the Owner) shall be measured using a constant width of trench equal to the outside pipe diameter plus two (2) feet for pipe and one (1) foot outside of walls for structure(s). The depth of the excavation shall be measured from subgrade elevation in cut areas and from two (2) feet above the outside top of pipe in embankment areas.

3.4 BEDDING

A. General Requirements - Bedding in trench for pipe and conduit shall be as shown in detail on the Drawings and as specified herein. Requirements for bedding shall be as follows:

Refer to the Geotechnical Report and/or Owner's Field Representative for bedding requirements for utilities under the following conditions:

1. Utilities underlain by peat/organic silt.
2. Utilities in rock, boulder and debris fill.
3. Utilities in existing soil fill and virgin soil.

B. Standard Bedding - shall consist of bedding the pipe or conduit on a properly prepared foundation of natural undisturbed earth for trench excavation in cut areas and properly compacted earth for trench excavation in fill areas as shown in detail on the Drawings. The bed shall have recesses to receive the bell of bell and spigot pipe.

C. Select Bedding - shall consist of a bed of properly compacted granular bedding material (sand or crushed stone as specified) having a compacted thickness of at least six (6) inches below the bottom of the pipe or conduit and extending around the pipe or conduit for at least 30% of its diameter or rise. The layer of bedding material shall be shaped to fit the pipe or conduit for at least 15% of the outside diameter or rise of the pipe or conduit and shall have recesses shaped to receive the bell of bell and spigot pipe. Sand bedding shall be clean, well-graded sand consisting of hard, durable particles free from lumps of clay, loam and all other deleterious substances. Crushed stone bedding shall be well-graded crushed stone conforming to ASTM Designation C-33, size No. 67. When Select Bedding is specified, the Contractor shall furnish, place and compact all necessary and required select bedding material at no additional cost to the Owner.

Select Bedding shall be used for polyethylene and polyvinyl chloride pipe and conduit installation. Except for polyethylene and polyvinyl chloride pipe and conduit installation, and unless otherwise shown on the details of the Drawings, specified or directed by the Owner's Field Representative, Standard Bedding may be used.

3.5 BACKFILLING

A. General Requirements - Upon approval by the Owner's Field Representative of bedding and pipe installation, and after proper inspection and tests have been made, excavations shall be backfilled by the Contractor with the type of backfill material specified. Excavations shall be backfilled and compacted as specified herein and in accordance with the details of the Drawings using the following materials:

1. Standard Backfill - shall consist of suitable on-site material approved by the Owner's Field Representative and/or Geotechnical Engineer. Should there be a deficiency of proper on-site material for backfilling, the Contractor shall furnish, place and compact additional proper backfill material, at no additional cost to the Owner.
2. Select Backfill - shall consist of granular material (sand or crushed stone as specified) as approved by the Owner's Field Representative and/or Geotechnical Engineer. Sand shall consist of clean, well graded, hard, durable particles, free of lumps of clay, loam and all other deleterious substances. Crushed stone shall consist of well graded crushed stone conforming to ASTM Designation C-33, Size No. 67.

3. Controlled Density Backfill Material - shall be flowable fill equal to K-Krete, between 30 psi minimum and 50 psi maximum or as required by the Authority having jurisdiction.

When Select Backfill is specified, the Contractor shall furnish, place and compact all necessary and required select backfill and/or controlled density backfill material at no additional cost to the Owner.

B. Refer to the Geotechnical Report and/or Owner's Field Representative for backfilling requirements for utilities under the following conditions:
   1. Utilities underlain by peat/organic silt.
   2. Utilities in rock, boulder and debris fill.
   3. Utilities in existing soil fill and virgin soil.

   All backfill material shall be free from large stones, clods, topsoil, sod, frozen earth, wood or any other objectionable material as determined by the Owner's Field Representative and/or Geotechnical Engineer.

   For all polyethylene and polyvinyl chloride pipe and conduit installation, Select Backfill shall be used to backfill the trench until there is a minimum of six (6) inches of cover over the pipe or conduit. Above this level, and unless specified otherwise or directed by the Owner's Field Representative, Standard Backfill may be used.

   Except for polyethylene and polyvinyl chloride pipe and conduit installation and unless otherwise shown on the details of the Drawings, specified, or directed by the Owner's Field Representative, Standard Backfill may be used.

   Where use of Standard Backfill is permitted, the material used to backfill the trench up to a level two (2) feet above the top of the pipe shall be approved clean earth and shall contain no stone or broken rock greater than one (1) inch in size. Above a level two (2) feet higher than the top of pipe, the material used for backfill shall be approved material, which may contain not more than fifteen (15) percent stone or broken rock with no stone or piece thereof exceeding four (4) inches in size. Such stone or broken rock shall be thoroughly mixed with the earth so that there will be no voids in the backfill.

C. Placement and Compaction - Backfill for pipe and conduit shall be placed evenly and carefully around and over the pipe or conduit in six (6) inch maximum layers. Each layer shall be thoroughly and carefully compacted until twelve (12) inches of cover exists over the pipe or conduit. The remainder of the backfill may then be placed and compacted in maximum twelve (12) inch layers. Each layer shall be compacted by approved mechanical tamping machines.

   Backfill shall be compacted to not less than 92% Maximum Modified Density for utilities and under pavements and sidewalks, and 90% in grassed areas, in accordance with ASTM Designation D-1557 in the manner herein described.

   Backfill shall proceed up to the lines and grades as shown on the Drawings and/or as directed by the Owner's Field Representative. Backfill areas which settle shall be corrected by the Contractor to the satisfaction of the Owner's Field Representative at the Contractor's expense.

D. Removal of Sheeting - During backfill operations, no sheeting which is to be removed shall, at any time, extend into the backfill which is being compacted. The sheeting shall be withdrawn so as to always be above the backfill.

Any voids created while removing sheeting shall be immediately corrected by filling with select backfill material and compacting to the required density by the Contractor to the satisfaction of the Owner's Field Representative.

E. Protection - The Contractor shall be responsible for safeguarding all pipes, conduits and structures being backfilled, and any damage occurring to same either during the backfilling operations or after the backfilling operations have been completed shall be corrected by the Contractor to the satisfaction of the Owner's Field Representative at the Contractor's expense.

3.6 SHEETING, SHORING AND BRACING

A. General Requirements - At his own expense, the Contractor shall design, furnish, install and maintain such sheeting, shoring, bracing and cofferdamming, etc., as may be needed to support the sides and roofs of excavations and to prevent any earth or rock movements which might in any way diminish or affect the necessary width of the excavation, endanger the safety of persons, injure or delay the Work, or jeopardize the safety of adjacent pavements, property, buildings or other structures. The work of sheeting, shoring and bracing shall, at all times, be in accordance with the requirements of all Authorities having jurisdiction, including OSHA, and must be designed by a licensed New York State Professional Engineer.

B. Contractor to be Solely Responsible - The Contractor shall be entirely and solely responsible for the adequacy and sufficiency of all supports and of all sheeting, bracing, shoring, cofferdamming, etc. The Contractor shall assume entire and sole liability for damages on account of injury to persons, adjacent pavements, and public and private property including, but not limited to, the work under construction, buildings and other structures, which injury shall result directly or indirectly from the Contractor's failure to install or to leave in place adequate and sufficient supports, sheeting, bracing, shoring, cofferdamming, etc.

3.7 DEWATERING AND DISPOSAL OF WATER

A. Unless directed otherwise, all dewatering measures must discharge to stormwater basin and/or temporary sediment tank(s) as directed.

B. The Contractor shall remove, by pumping or other means approved by the Owner's Field Representative, any surface or groundwater which may accumulate in excavations, and he shall at all times keep excavations dry while work is being done in them.

The water table shall be lowered to at least two (2) feet below the bottom of the proposed excavation prior to making excavations extending below the water table. Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation or slopes, will not cause erosion problems, and will not undermine or cause instability or damage to existing structures. Any soil disturbed and which becomes unstable for support of pipes, foundations, structures, etc., shall be replaced by the Contractor as directed by the Owner's Field Representative and/or Geotechnical Engineer with an approved aggregate at the Contractor's expense.

C. Grading of Adjacent Areas - Areas adjacent to any excavation shall be graded so as to prevent water from running into the excavations.

D. Method of Disposal - The water from the excavations shall be disposed of in such a manner as will not cause injury or damage to the public health, public or private property, nearby streams, ditches, channels, rivers, water impoundment areas, the

work contemplated or in progress, surfaces of the streets, nor cause any interference with the use of the same. The Contractor shall utilize suitable screens and filters so that pumping of fines does not occur. The disposal of this water shall be done in a manner satisfactory to the Owner's Field Representative and/or Geotechnical Engineer and Authorities having jurisdiction.

Off-Site discharge shall adhere to all Local, State and Federal regulations.

E. Erosion Control - The Contractor is advised that all operations must conform to the Article of these Specifications entitled "Temporary Soil Erosion, Sediment and Dust Control".

F. Protection of Masonry and Concrete - Newly laid masonry and concrete shall be protected from damage resulting from dewatering operations by the use of canvas or other methods as may be approved. No water shall be allowed to run through newly laid masonry, concrete or pipes except with the approval of the Owner's Field Representative.

END OF SECTION

SECTION 31 25 00

TEMPORARY SOIL EROSION, SEDIMENT AND DUST CONTROL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits as indicated on the plans and includes, but is not limited to the following:
   1. The Contractor shall provide all temporary control measures as shown on the Drawings or as ordered by the Owner's Field Representative and/or Authorities having jurisdiction during the life of the Contract to control soil erosion, sediment and dust.
   2. Work may include, but may not be limited to, the installation and maintenance of staging areas, stabilized construction entrance(s), concrete wash-outs, berms, stone and block inlet protection, curb gutter inlet protection structure, excavated drop inlet protection, ditches, fiber mats, straw netting, gravel, silt fences, mulches, hay bales, grasses, silt traps, silt sacks, soil stockpiles, swales, sediment basins, temporary riser and anti-vortex device, sediment tanks, stone check dams, and other approved erosion control devices or methods and the removal of such temporary erosion control devices when no longer needed, as determined by the Owner's Field Representative and/or Authorities having jurisdiction.
   3. The work shall also include, but not be limited to, furnishing and applying water, calcium chloride or other approved materials for dust control.
   4. The temporary control provisions contained herein shall be coordinated with the permanent erosion control features specified elsewhere in the Contract Documents to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post construction period.
   5. The Contractor shall comply with the requirements of the permits and all applicable Federal, State, County, and Local statutes and ordinances relating to the prevention and abatement of soil erosion, sediment and dust.
   6. In the event of conflict between the requirements of these Specifications and the pollution control laws, rules and regulations of Federal, State, County, Local or other Authorities having jurisdiction, the more restrictive laws, rules and regulations shall govern.
   7. Soil erosion, dust and water pollution control measures shall, at all times, be satisfactory to the Owner's Field Representative and Authorities having jurisdiction. When these measures are not corrected promptly, the Owner's Field Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected, and such suspension shall not be the basis of any claim by the Contractor for additional compensation from the Owner nor for an extension of time to complete the Work

B. Related Sections:

1. Section 01 41 00 “Regulatory Requirements,” includes Stormwater Pollution Prevention Plan (SWPPP) requirements.
2. Section 31 10 00 “Site Preparation."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

A. As applicable, the Contractor's attention is directed to the Geotechnical Engineering Report for special construction requirements related to soil erosion, sediment and dust control, and dewatering.

B. General Requirements - The Contractor shall conduct his operations to minimize erosion of soils and to prevent silting and muddying adjacent rivers, streams, impoundments (lakes, reservoirs, etc.) and lands adjacent to or affected by the Work. Construction of drainage facilities and performance of the Contract Work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with the earthwork operations or as soon thereafter as practicable. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum.

C. Contractor to Submit Erosion Control Schedule - Prior to the start of construction, the Contractor shall submit to the Owner's Field Representative his program and schedule for installation of temporary and permanent erosion control work applicable during all stages of construction, and his plan for disposal of waste materials. Adequate site drainage should be implemented early in the construction schedule to avoid an overly wet subgrade which must be dried before resuming construction activity. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled so that grading operations and permanent erosion control features can follow immediately thereafter, if the Project conditions permit, otherwise temporary erosion control measures may be required between successive construction stages. No work shall be started until the Erosion Control Schedule and methods of operations have been accepted by the Owner's Field Representative and Site Engineer.

D. Exposed Earth - Exposed slopes and all graded areas shall be seeded with the following grass mix immediately upon completion of its construction, at a rate of six (6) pounds per 1,000 sf in the following proportion:

Creeping red fescue	30%
Perennial rye grass	70%

E. Temporary Erosion Control Measures - 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 which are not associated with permanent control features on the Project. Additional temporary erosion control measures that may be required due to Contractor's failure to maintain erosion control devices or due to Contractor's construction procedures, staging, etc. shall be done by the Contractor at his own expense for the life of the Contract.

When temporary measures are converted to permanent measures, all cleaning and preparation of the area must be performed at no additional cost and as directed.

F. No additional payment will be made to the Contractor regardless of the number of times sediment and erosion control practices are installed, replaced, removed,

reinstalled, or relocated, or new practices are implemented during various stages of construction.

G. Permanent Erosion Control Measures - The Contractor shall incorporate all permanent control features into the Project at the earliest practical time as outlined in his Schedule.

H. Live streams - If live streams are located on or adjacent to the site, frequent fording of the live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing by the Owner's Field Representative, mechanized equipment shall not be operated in live streams. When work areas are located in or adjacent to live streams, such areas shall be separated from the main stream by a dike or other barrier to keep sediment from entering the flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the muddying of the stream.

I. Watercourses and Drainageways - All watercourses and drainageways shall be cleared as soon as practicable of formwork, sheeting, debris or other obstructions placed during construction operations and which are not a part of the finished work. Ditches which are filled or partly inoperative shall be cleaned and made operative before the Contractor stops work for any day and, for the duration of the Work, they shall be maintained in a condition satisfactory to the Owner's Field Representative.

J. Sediment - Water from operations containing sediment or construction particulates shall be treated by filtration, sediment basins or other approved means sufficient to eliminate sediment content before discharge to the stream or drainage system into which it is discharged.

K. Pollutants - Pollutants such as wash water from concrete mixing operations, fuels, oils, lubricants, and other harmful materials shall not be discharged into rivers, streams, ponds, water impoundment areas, watercourses, drainageways, channels, drainage ditches, catch basins or drainage or sewer systems.

L. Dust Control - Throughout all operations covered by this Contract, the Contractor shall provide all necessary measures to control dust through the use of water, calcium chloride, or other approved material in accordance with the directions of the Owner's Field Representative, at such locations and during such periods as he may direct, or as may be required by local ordinance or Authorities. Special consideration must be given to control fugitive dust from affecting the adjacent businesses and residences surrounding the site. Control of dust shall include but not limited to street sweeping and vehicle wash down areas as determined by the Owner’s Field Representative, and at no additional cost to the Owner.

M. Authority of Owner's Field Representative - The Owner's Field Representative shall have the authority to increase or decrease the surface area of erodible earth material exposed by clearing and grubbing, and/or excavation and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment.

N. Limit of Area of Work - In general, the limit of the area of clearing and grubbing and/or excavation and fill 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. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Field Representative, temporary erosion control measures shall be taken immediately by the Contractor.

END OF SECTION

SECTION 31 37 00

RIP RAP APRON/ENERGY DISSIPATOR

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. The Work of this Section includes, but is not limited to the installation of rip-rap apron/energy dissipator at the pipe end section and within the stormwater planter.

B. Related Sections:
   1. Section 31 23 00 "Excavation and Fill"
   2. Section 31 23 33 "Trenching and Backfilling"
   3. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control"

PART 2 - PRODUCTS

2.1 STONES

A. The stones for the rip-rap shall be as required and directed for the application, and be hard and angular in shape, resistant to weathering and reasonably free from soil, shale and organic materials. The type and gradation of the materials furnished for use in rip-rap shall be approved by the Owner's Field Representative.

   Refer to the plan detail(s) for the median stone diameter required (d50) or as directed by the Site Engineer.

2.2 BEDDING

A. Mirafi filter fabric FW404 or approved equal shall be placed prior to placing rip rap. If directed, a six (6) inch layer of bedding material shall also be installed. Refer to the detail(s) on the plans.

PART 3 - EXECUTION

3.1 PREPARTION

A. Clear proposed riprap area of brush, trees and stumps, and grade to a smooth surface. Compact fill areas in accordance with Section 31 23 00 and Section 31 23 33.

3.2 INSTALLATION

A. The ground surface on which the rip-rap is to be placed shall be dressed and graded to a smooth surface. All soft and spongy materials shall be removed to the depths shown on the Drawings or as directed by the Owner's Field Representative and replaced with approved material.

   Rip rap shall be installed to the configuration and depth indicated on the plans.

B. Rip-rap shall be placed on a bedding of compacted sand or gravel if shown in detail on the Drawings. Prevent mixing of bedding material with subgrade. Install filter fabric in accordance with manufacture's instructions.

C. Filled areas shall be compacted in accordance with the applicable provisions of these Specifications. The stones shall then be placed on the bedding material so that the dimension approximately equal to the layer thickness is perpendicular to the ground surface and the weight of the stone is carried by the underlying material.

D. The rip-rap shall be properly aligned and placed so as to eliminate void spaces between the adjacent stones, and graded in accordance with the detail on the plans.

END OF SECTION

SECTION 32 01 16

FLEXIBLE PAVING REHABILITATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The Work of this Section includes, but is not limited to:
   1. Mill and overlay existing asphalt concrete pavements.
   2. All finishing, curing, and testing necessary and required.

B. Coordinate work of this Section with construction and other underground utilities, and with trades responsible for their installation.

1.2 REFERENCE STANDARDS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section, as well as all applicable construction, fabrication and safety standards.

B. Comply with all industry standards and requirements of all Authorities having jurisdiction. If requirements specified conflicts with the requirements of Authorities having jurisdiction, the requirements of the Authority having jurisdiction applies. (NYSDOT: New York State Department of Transportation.)

1.3 SUBMITTALS

A. Shop Drawings: Provide catalog cuts. Include details of fabrications and materials as applicable, including accessory items, for all items and appurtenances.

1.4 QUALITY ASSURANCE

A. Provide a detailed installation and termination schedule for all items of work included in this Section. Notify the Site Engineer prior to the work taking place, so that that the Site Engineer may be present during installation.

PART 2 PRODUCTS

2.1 PAVING OVER MILLED ASPHALT CONCRETE PAVEMENTS

A. Refer to Section 32 12 00 "Flexible Paving."

B. Materials and Construction Details - Materials and construction details shall conform to the applicable requirements of the New York State Department of Transportation (NYSDOT) Specifications as follows:
   1. NYSDOT 490, 1 through 3.04 - Milling Asphalt Pavement.
   2. Asphalt Concrete Top Course - Type 6F NYSDOT Item 403.1701 or as indicated on the plans and details.
   3. Tack Coat - NYSDOT Item 407.0101 and/or Uniform Straight Tack Coat - NYSDOT Item 407.0103.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Traffic Control - The Contractor shall conduct his work in such a manner as to interfere as little as possible with the use of the active areas under construction. The Contractor shall provide for through traffic as necessary or as directed by the Authority having jurisdiction, and access for emergency vehicles at all times. All necessary traffic control devices shall be constructed, maintained, and located in accordance with the current version of the New York State Manual of Uniform Traffic Control Devices (NYSMUTCD).

B. Adjust Castings and Gate Valves to Grade - All casting and/or valve box adjustments shall be conducted at no additional cost.

3.2 MILLING AND PAVING

A. General - Milling work shall include the milling of asphalt pavements to produce a uniform section and smooth riding surface, and shall include the removal and disposal of all milling/grinding residue and the sweeping and cleaning of the existing and milled surfaces and all other work as may be necessary to properly complete the pavement profiling work in accordance with the Plans and Specifications. Depth of milling shall be as indicated on the plans or as directed by the Authority having jurisdiction. If depth not indicated, depth of milling and asphaltic concrete paving shall be two (2) inches.

B. Equipment and Execution - All equipment shall be maintained in good repair and shall meet the approval of the Engineer. Water for the milling and cleaning operation must be supplied by the Contractor.
   1. Milling Machine - The milling machine shall be a self-propelled machine specifically designed to fully or partially remove existing pavement to the desired depth, profile, cross slope and surface texture. The machine shall have a control system to automatically control the elevation and transverse slope of the milling head. The machine shall be equipped with a conveyor capable of loading the milled material directly from the roadway to a truck. The machine shall be equipped with a minimum 15-foot long skid or rolling straightedge and grade control sensors to automatically maintain proper grade and alignment.
   2. Brooms - The Contractor will be required to have a mechanical broom of the revolving type and be so constructed that the revolutions may be adjusted to its progression. Brooms used for finish sweeping shall be of the "pick-up" or vacuum type wherein material from the road surface 1s removed by the machine for subsequent disposal at a different location.
   3. Diamond Grinding Machine - Grinding and texturing shall be completed utilizing diamond blades, mounted on a self propelled machine, designed for grinding and texturing of pavements. The equipment shall not cause strain or damage to the underlying surface of the pavement. Grinding and texturing equipment that causes excessive ravels, aggregate fractures, spalling, or disturbance of the joints shall not be permitted.
   4. Surface Preparation - The existing pavement surface shall be cleaned of deleterious material prior to any milling or grinding operation.
   5. Milling Full Width - The milled surface shall be free from transverse and longitudinal irregularities in excess of 4 inch when measured with a 10- foot straightedge. Special care shall be taken along the face of the curb section to remove all asphalt, seal material, or other debris from the exposed face of the curb and gutter section. Milling shall proceed from curb to curb at a width and depth designated by the Engineer.
   6. Edge Milling - The pavement edge shall be milled from the face of the gutter section to approximately 10 feet out from the edge of the gutter section; that point being at a distance where the milling shall "daylight" out or that the transition in depth shall be non-discernible. Special care shall be taken along the face of the gutter section to remove all asphalt, seal material, or other debris from the exposed face of the curb and gutter section. Milling depth along the curb shall generally be from 1" to 1 1/2" in depth or as designated by the Authority having jurisdiction.
   7. Milling Around Castings - Where the existing pavement cannot be removed with the milling machine, the Contractor shall carefully "hand-remove" the pavement without damage to the castings.

8. Disposal of Milled Asphalt Material -All milled asphalt material shall be disposed of off-site, unless directed otherwise by the Owner's Field Representative.
9. Cleaning of the Milled Space - The milled pavement surface shall be cleaned by sweeping during and immediately after the milling operation. The Contractor shall make every effort to keep the dust to a minimum and to ensure that the milled debris is not spread onto the adjacent boulevards and sidewalks. Any debris inadvertently spilled on sidewalks or boulevards shall be promptly removed to the satisfaction of the Engineer.
10. Diamond Grinding - Grinding shall be performed in the longitudinal direction so grinding begins and ends at lines normal to the pavement centerline. The allowable overlap between passes shall be 0 to 2 inches and the maximum allowable depth variance between adjacent passes shall be 1/8 inch. The grinding shall be feathered out as directed by the Engineer.

    The surface of the ground pavement shall have a texture consisting of grooves between .090 and .130 inches wide. The peaks of the ridges shall be approximately 1/32 inch higher than the bottom of the grooves.

    The pavement shall be left in a clean condition. The removal of all slurry or residue resulting from the grinding operation shall be continuous. The grinding operation should be controlled so the residue from the operation does not flow across lanes utilized by traffic.

3.3 ASPHALT CONCRETE OVERLAY (OVER MILLED OR EXISTING SURFACES)

A. General Requirements - The Contractor shall place an asphalt concrete overlay over existing pavement or milled pavement, on a properly prepared surface, in conformity with the lines, grades, compacted thicknesses and typical sections shown on the Drawings and as specified herein.

B. Cleaning Pavement - The pavement shall be cleaned by the use of hand brooms or mechanical sweepers of approved type in a manner satisfactory to the Owner's Field Representative until the surface is free of all material which might interfere with the bond between the old and new surfaces. All loose material removed from the pavement surface shall be disposed of off-site in accordance with all authorities having jurisdiction.

C. Depressions in Existing Pavement - All ruts and depressions in the existing pavement shall be swept clean by use of hand brooms until all loose material has been removed.

    If pavement base failure is present, such as in the case of alligator cracking and pot-holes, and as determined by the Owner's Field Representative, pavement shall be replaced prior to the overlay resurfacing to its original depth in accordance with the requirements specified for pavement replacement in existing asphalt concrete pavements.

D. Castings - Castings located within the area to be paved with asphalt concrete shall be set to proper grade as applicable, to accommodate the new pavement installation in accordance with the requirements specified herein for preparation for pavement installation.

E. Tack coat - The milled pavement surface shall be treated with an application of asphalt material to satisfactorily bond the old and new surfaces. When feathered edges are permitted, at the discretion of the Owner's Field Representative, care shall be exercised to assure that the tack coat, in the areas where the new asphalt concrete surface is being feathered to meet the adjoining surface, has been coated evenly and uniformly. Material and method of application shall be in accordance with the applicable State Specifications.

3.4 TEMPORARY PAVEMENT

A. Refer to Section 32 12 00 of these Specifications.

General Requirements - Unless directed otherwise, the Contractor shall install and maintain temporary pavement in areas where existing pavement has been milled and castings are protruding, and where necessary to accommodate pedestrians and vehicles.

Unless otherwise specified, the construction of the temporary pavement shall consist of compacted measure of hot-mix asphalt concrete, and shall be removed prior to paving operations.

3.5 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance, the paved areas shall be subjected to a final inspection in the presence of the Site Engineer and/or Owner's Field Representative. The work shall not be considered complete until all requirements for line, grade, cleanliness, tests and workmanship have been met.

END OF SECTION

SECTION 32 05 23

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits as indicated on the plans and may include, but may not be limited to the following:
   1. Utility structures
   2. Curbs
   3. Encasements
   4. Thrust and anchor blocks
   5. Pads/slabs/footings/utility foundations
   6. Vehicle guide rails
   7. Fencing

B. Related Sections:
   1. Section 31 23 00 “Excavation and Fill”
   2. Section 31 23 33 “Trenching and Backfilling”
   3. Section 32 16 00 "Curbs"
   4. Section 32 17 23 "Pavement Markings and Signs"
   5. Section 32 31 00 "Fencing"
   6. Section 33 00 00 "Miscellaneous Utilities"
   7. Section 33 10 00 “Water Utilities”
   8. Section 33 30 00 “Sanitary Sewerage”
   9. Section 33 40 00 “Storm Drainage Utilities”
   10. Section 34 71 13 "Vehicle Guide Rails"

PART 2 PRODUCTS

2.1 CLASS “A” CONCRETE

A. Class "A" Concrete shall be air-entrained, ready-mixed concrete, 4000 psi twenty-eight (28) day compressive strength and shall conform to AASHTO designation M-85.
   1. Cement - shall be Portland cement, Type I or II, conforming to AASHTO Designation M-85. Cement shall be by an American manufacturer.
   2. Provide white portland cement for integrally colored concrete.
   3. Fine Aggregate (sand) - shall conform to AASHTO Designation M-6 having clear, hard, durable, uncoated grains, free from deleterious substances and shall range in size from fine to coarse within the following percentages by weight:

Passing 3/8" Sieve	100%
Passing No. 4 Sieve	95 - 100%
Passing No. 16 Sieve	45 - 85%
Passing No. 50 Sieve	10 - 30%

Passing No. 100 Sieve	2 - 10%

4. Coarse Aggregate - shall conform to AASHTO Designation M-80 and shall be free of deleterious matter or coatings. Gradation must be within the following percentages by weight:

Passing 1-1/2" Sieve	100%
Passing 1" Sieve	95 - 100%
Passing 1/2" Sieve	25 - 60%
Passing No. 4 Sieve	0 - 10%

5. Water - shall be clean and fresh, free from salt, grease, acids, alkalis, organic materials or other deleterious materials. When possible, water shall be from a municipal system.
6. Reinforcement - as detailed on the plans, or shall be new deformed billet steel bars free of loose rust, conforming to ASTM Designation A-615, Grade 60, with minimum yield of 60,000 psi. Wire fabric shall conform to the "Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" ASTM Designation A-185.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure is subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer, Structural Engineer and/or MEP Engineer.

B. General Requirements - Site concrete shall be Class "A" concrete having a twenty-eight (28) day compressive strength of 4000 psi.

There shall be no less than six (6) sacks of cement per cubic yard. The concrete shall contain no more than six (6) gallons of water per sack of cement, and shall produce a slump of not more than four (4) inches. Air content shall be 7% (+1%).

The use of accelerators shall not be used unless prior approval is received from the Owner's Field Representative.

Where concrete surfaces are exposed and visible in the finished work, such as in the construction of curbs and sidewalks, the cement used shall be of the same brand and from a single source, so that the item of construction will be uniform in color.

If any requirements specified herein for concrete construction conflicts with the requirements of Authorities having jurisdiction, the requirements of Authority having jurisdiction shall apply.

C. Forms - shall be acceptable steel or lumber, straight and free from warp or other irregularities that will adversely affect the installation. Forms shall be carefully set to the proper shape, lines and dimensions as shown on the Drawings and/or as directed by the Owner's Field Representative and shall be sufficiently tight, thoroughly braced and secured in place so that there will be no leakage of mortar or displacement of forms during placing of the concrete.

Prior to placing the concrete, the contact surfaces of the forms shall be given a light coating of form oil that will not discolor the concrete.

Forms shall remain in place until concrete has hardened and acquired sufficient strength to safely support dead and live loads. Form removal shall be carried out in such a manner to ensure complete safety and integrity of the structure.

D. Reinforcement - shall be accurately cut, placed and rigidly held in position by means of bar supports, spacers, ties or other acceptable means in such manner that the reinforcing will not displace when the concrete is poured. When reinforcing bars must be spliced, there shall be sufficient lap to develop the strength of the bar by bond.

E. Concrete Protection for Reinforcement - The steel reinforcement shall be protected by the thickness of concrete as indicated on the details of the Drawings. Where not otherwise specified or directed, the thickness of concrete over the reinforcement (clear dimensions) shall be as follows:
   1. For concrete deposited against ground without the use of forms - not less than three (3) inches.
   2. For concrete exposed to the weather or exposed to the ground but placed in forms - not less than two (2) inches.
   3. For concrete placed in slabs and walls not exposed to the ground or to the weather - not less than one and one half (1-1/2) inches.
   4. In all cases, the thickness of concrete over reinforcement shall be at least equal to the diameter of the reinforcing bars.

F. Construction joints and expansion joints - shall be provided where and as shown in detail on the Drawings. Construction joints and expansion joints not indicated on the Drawings shall be as approved by the Owner's Field Representative and/or Site Engineer.

G. Placement - Unless specified otherwise, concrete three (3) or more inches thick shall be placed and consolidated with mechanical vibrators used in the concrete by skilled workman, properly supervised. Vibrators shall not be moved laterally or used to transport concrete. Vibrators shall be used to merge successive layers and prevent cold joints. Concrete shall be consolidated to maximum density, free of honeycombing and trapped air. Hand spading shall be used in corners and angles of forms while concrete is plastic. During placement operations, concrete shall be thoroughly consolidated and worked well around and into thorough contact with the steel being careful not to disturb the location of the reinforcing. Over-working and over-vibration which may cause segregation shall be avoided.

   When concrete is to be placed on the ground surface, the subgrade shall be moistened prior to placing the concrete, except during cold weather periods when freezing is likely to occur. Concrete shall be placed in the form as near to its final position as practicable. Concrete shall be placed in layers to prevent honeycombing. Proper chutes, troughs and other approved devices shall be used to minimize free fall of concrete and to convey concrete to the proper locations. In no case shall concrete be deposited from a height that will separate the aggregates.

   Concrete shall be deposited within thirty (30) minutes after mixing, as nearly as practicable, in its final position to avoid segregation due to rehandling or flowing.

H. Cold Weather Requirements - Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing and near-freezing weather. No frozen materials or materials containing ice shall be used.

   All concrete materials and all reinforcement, forms, fillers and ground in which the concrete is to come in contact, shall be free from frost. Whenever the temperature of the surrounding air is below 40 degrees F. all concrete placed in the forms shall have a

temperature between 70 degrees F. and 80 degrees F., and adequate means shall be provided for maintaining a temperature of not less than 70 degrees F. for three (3) days or 50 degrees F. for five (5) days except when high early strength concrete is authorized for use, in which case, the temperature shall be maintained at not less than 70 degrees F. for two (2) days or 50 degrees F. for three (3) days or for as much more time as is necessary to insure proper curing of the concrete. The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing.

I. Finishing - As soon as the face forms are removed, all fins and other projections shall be removed carefully and offsets leveled and rubbed with carborundum where necessary. Pointing and filling voids shall be done only under the direction of the Owner's Field Representative. Finished concrete surfaces shall be clean, smooth, free of honeycombing, spauling, ragged edges and laitance. Finishing of concrete shall be done only by experienced concrete finishers.

J. Curing - Concrete shall be protected from the sun and kept moist for at least seven (7) days. During this period, concrete shall be maintained above 70 degrees F. for at least three (3) days or above 50 degrees F. for at least five (5) days. Exposed concrete shall be kept thoroughly wetted during the first week, and covered with polyethylene or heavy paper. Liquid membrane curing meeting the requirements of AASHTO Designation M-148 may be used upon approval of the Owner's Field Representative.

K. Protection - Every precaution shall be taken by the Contractor to protect finished surfaces from stains, abrasions or damage of any kind. Adequate protection shall be provided against injurious action by sun, wind or freezing temperatures. Fresh concrete shall be thoroughly protected from damage due to heavy rain, flowing water, freezing temperatures and mechanical injury.

3.2 DEFECTIVE CONCRETE

A. Concrete work that is not formed as indicated or is not true to alignment, or is not plumb or level, or is not true to grades or levels, is frozen, or has voids or rock pockets, or has saw dust, wood or debris embedded in it, or does not fully conform to the Contract Documents, shall be considered as defective and shall be removed and replaced by the Contractor at no additional cost to the Owner with work that conforms to the Contract Documents.

END OF SECTION

SECTION 32 12 00

FLEXIBLE PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits as indicated on the plan and includes, but is not limited to the following:
   1. Installation of all asphalt pavements consisting of subbase course (where specified), base course, asphalt concrete binder and/or intermediate courses, surface course, including all associated items and operations necessary and required to complete the pavement installation.
   2. Pavement replacement over trenches and excavations.
   3. As applicable, complying with the requirements of the Geotechnical Engineer, which may include special subgrade preparation work.
   4. Preparation of subgrade to also include fine grading, compaction and proof-rolling.
   5. All necessary and required line cutting of existing pavements.
   6. All formwork, finishing, curing and testing necessary and required for the installation of pavements.
   7. Work under this Section shall also include the installation of temporary asphalt concrete pavements over trenches and/or excavations in existing paved areas and the permanent replacement of pavement over these trenches and/or excavations.

B. Related Sections:
   1. Section 02 30 00 "Subsurface Investigation."
   2. Section 31 23 00 “Excavation and Fill.”
   3. Section 31 23 33 "Trenching and Backfilling."
   4. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control."
   5. Section 32 01 16 "Flexible Paving Rehabilitation"

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE PAVEMENTS

A. General Requirements - The Contractor shall construct asphalt concrete pavements upon a properly prepared subgrade, in conformity with the lines, grades, compacted thicknesses and typical sections and details shown on the Drawings and as specified herein.

B. Materials and Construction Details - Materials and construction details shall conform to the applicable requirements of the New York State Department of Transportation (NYSDOT) Specifications and municipal requirements, as shown on the plans and/or directed by the Authority having jurisdiction as follows:
   1. Asphalt Concrete Top Course - Type 6F NYSDOT Item 403.1701.

2. Asphalt Concrete Binder Course - Type 3 NYSDOT Item 403.13.
3. Asphalt Concrete Base Course - Type 1 NYSDOT Item 403.11 (as applicable).
4. Subbase Course (DGA) - Type 1 NYSDOT Item 304.11 (as applicable).
5. Tack coat - NYSDOT Item 407.0101 and/or Item 407.0103.

C. For pavement replacement within the right-of-way, the Contractor's attention is referred the the detail on the plans for the type of pavement and cut-back requirements. K-Krete backfill may be required in certain excavations as detailed on the Plan or as directed.

D. New Fill - Where new fill is required to achieve final grades, it shall consist of either suitable on-site soil or imported sand and gravel. Imported sand and gravel shall less than 20% by weight passing a No. 200 sieve.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer or Owner's Field Representative.

The construction methods and requirements for the preparation of the subgrade and pavement installation indicated below may be supplemented/amended by more stringent requirements stated in the Geotechnical Report (if available), and/or the Section of these specifications titled "Excavation and Fill." The most stringent requirements must be followed.

B. The Contractor shall install all pavements as specified in the locations and to the grades as shown on the Drawings and/or as directed by the Owner's Field Representative. Materials, methods of construction, and type and thickness of pavement courses shall be as shown on the Drawings and as specified herein.

C. Materials and methods for construction of asphalt concrete pavements, bases and subbases shall conform to the New York State Department of Transportation Specifications and/or Municipal Specifications, depending on the Authority having jurisdiction.

D. Prior to starting any paving, the Contractor shall coordinate a pre-paving meeting with all Authorities having jurisdiction.

E. The Contractor shall be responsible for laying out and installing all pavements in the correct locations and to the proper cross sections and in accordance with the lines and grades as specified herein and on the Drawings and/or in accordance with the directions of the Owner's Field Representative and/or Site Engineer. Pavements which are not constructed to the proper section, grade and/or alignment shall be corrected by repair or replacement by the Contractor in accordance with the directions of the Owner's Field Representative and/or Site Engineer and at no additional cost to the Owner.

F. The installation of all pavements within Public Rights-of-Way shall be in accordance with the rules and requirements of the Municipality. Work shall include all items and operations necessary and required to complete the pavement installation to the satisfaction of the Municipality, including maintenance and protection of traffic and pedestrians.

3.2 PREPARATION OF SUBGRADE

A. General Requirements - Prior to the start of paving operations, the subgrade surface shall be prepared by filling in wheel ruts, erosions and all other ground disturbances, regardless of cause, and the ground surface shall be fine graded so that after compaction the subgrade surface will be at the proper elevation (+.05') to accommodate the pavement structure.

   Refer to Section 31 23 00 "Excavation and Fill" for additional requirements for subgrade preparation.

B. Existing Fill - As directed by the Geotechnical Engineer or Owner's Field Representative, the densified existing fill, virgin soil, weathered bedrock, and new compacted fill may be used to support the pavement. Areas where existing fill is encountered shall be compacted in place. If the Geotechnical Engineer and/or the Owner's Field Representative determines that the existing fill is unsuitable, portions of this fill may have to be removed and replaced with new compacted fill , at no additional cost to the Owner.

C. New fill - New fill shall be placed in layers not exceeding 12 inches in loose thickness and each layer shall be compacted at least 92% of its Maximum Modified Dry Density (ASTM D1557). After the subgrade has been proofrolled and new compacted fill has been placed as required, the new pavement subbase may be placed on the densified site soils, weathered bedrock, and new compacted fill.

D. Fine Grading - Fine grading of the subgrade shall be performed in sections, working the equipment perpendicular to the contours and constructing the respective valleys and ridges in accordance with the Drawings. Particular care shall be exercised with the grades of the valleys which lead to drain inlets and catch basins. Fine grading shall not be done when the ground is excessively wet or frozen.

E. Compaction - Fine grading of the subgrade shall be accompanied by proper compaction to the extent that the upper twelve (12) inches of subgrade shall have a density not less than that as specified under the Section of these Specifications entitled "Excavation and Fill" (minimum CBR=10). Compaction shall be done by means of a roller weighing not less than ten (10) tons or other compaction equipment satisfactory to the Owner's Field Representative and/or the Geotechnical Engineer.

F. Proof-rolling - Immediately prior to the start of paving operations, the Contractor shall proof-roll the subgrade with a large vibratory drum roller (i.e. Dynapac 250 or equivalent) to densify underlying soils in the presence of the Geotechnical Engineer or Owner's Field Representative. If the subgrade is not suitable for support of the pavement structure as determined by the Geotechnical Engineer or Owner's Field Representative, measures shall be taken by the Contractor (i.e. remove the soft and/or unsuitable soil and replace with new compacted fill), to correct the subgrade deficiencies to the satisfaction of the Geotechnical Engineer or Owner's Field Representative at no additional cost to the Owner.

G. Subgrade Approval - The Geotechnical Engineer or Owner's Field Representative must approve the subgrade prior to placement of the initial pavement course. Installation of all or any portion of the pavement without subgrade approval by the Geotechnical Engineer or Owner's Field Representative is done at the Contractor's risk.

H. Protection of Approved Subgrade - Approval of the subgrade by the Geotechnical Engineer or Owner's Field Representative shall not relieve the Contractor of his

responsibility to protect the subgrade from damage caused from excessive moisture, rutting from trucks or heavy equipment or from any other cause, and any damage occurring to the subgrade either before or during the paving operations shall be corrected by the Contractor at his own expense to the satisfaction of the Owner's Field Representative and/or the Geotechnical Engineer.

3.3 PREPARATION FOR PAVEMENT INSTALLATION

A. The Contractor shall have a water truck during paving activities and shall wet and cool pavement as necessary, and as directed by the pavement testing technician.

B. Utility Structures and Appurtenances - After the subgrade and/or existing pavement surfaces have been prepared as specified herein, the Contractor shall check all frames, covers, grates, water valve boxes and all other miscellaneous castings that are located in the proposed pavement areas to ensure that all such items have been accurately positioned and set to the proper slope and elevation. All covers and grates are to be set flush with the required finished pavement surface. No depressions or mounds will be permitted in the pavement to accommodate inaccuracies in the setting of these appurtenances. All corrective work as may be necessary as determined by the Owner's Field Representative and/or Site Engineer shall be done by the Contractor at his own expense.

C. Meeting Existing Pavement - Where new pavements are to meet existing pavements, the Contractor shall line cut the existing pavement with an approved saw cutting machine as directed so that there will be a vertical butting surface between the old and new pavements. Line cutting of existing pavements shall be done along neat, straight and even lines and in such a manner so as not to damage the adjacent pavement which is to remain. The Owner's Field Representative shall decide as to the acceptability of the line cutting device and the method of operation, and his decision shall be final.

D. Pavement Replacement in Existing Asphalt Concrete Pavements - The existing pavement shall be line cut and cut back as specified herein above under "Meeting Existing Pavement". Minimum width of cut back shall be twelve (12) inches unless otherwise specified or shown on the Drawings. Line cutting for pavement replacement over trenches shall be parallel to the centerline of the trench; line cutting for pavement replacement at manholes, drain inlets, catch basins or other underground structures, test holes, etc., shall be in a square or rectangular configuration as directed. For all types of pavement replacement the line cutting shall encompass the disturbed area and include the required undisturbed pavement shelf area as specified herein or as directed.

E. Tack Coat - All surfaces (vertical and horizontal) of curbs, structures, gutters and existing pavement in contact with new asphalt concrete mixtures and between all superpave courses, shall be painted with a uniform coating of an approved asphalt emulsion or priming material (tack coat). Extreme care shall be exercised in the application of this material to prevent splattering or staining of surfaces that are to be exposed. Surfaces that are stained as a result of the Contractor's operation shall be repaired and/or replaced to the satisfaction of the Owner's Field Representative at the Contractor's expense.

F. Delay in Surface Course Installation - When there is a planned or unplanned delay in the installation of the surface course after the binder and/or intermediate course is placed, as specified or as may be directed by the Owner's Field Representative, which requires that traffic be maintained or parking provided on the binder and/or

intermediate course for a period in excess of four (4) weeks, then just prior to placement of the surface course the Contractor will be required to thoroughly clean, repair and tack coat the binder and/or intermediate surface. This requirement shall also apply when such delay is caused by the Contractor. Compensation for this work shall be considered as included in the Contract Sum.

3.4 TEMPORARY PAVEMENT

A. General Requirements - Unless directed otherwise by the Owner's Field Representative, the Contractor shall install temporary pavement in areas where existing pavement has been disturbed due to his operations. This pavement shall be constructed after the excavation has been backfilled and properly compacted.

Unless otherwise specified, the construction of the temporary pavement shall consist of a minimum of three (3) inches compacted measure of hot-mix asphalt concrete on four (4) inches base course, or approved equal or as required by the Authority having jurisdiction. Approved milled salvaged pavement material may be used as base course for temporary pavement.

B. Spreading and Rolling - Before the material is spread, all surfaces of curbs, edgings, manholes and other structures which will come into contact with the new pavement shall be well painted with an asphalt emulsion or priming material acceptable to the Owner's Field Representative. Care shall be taken to prevent staining, smearing or defacing the exposed faces of the curbs and other structures during the spreading and rolling of the material.

After spreading, the material shall be rolled by means of a roller weighing not less than ten (10) tons. In all places not accessible to the roller, the material shall be compacted thoroughly by approved mechanical tampers.

The finished surface of the temporary pavement shall be flush with the adjacent pavement surface.

C. Maintenance - The temporary pavement shall be maintained by the Contractor until such time that the final settlement of the trench shall have taken place in the opinion of the Owner's Field Representative or the temporary pavement is no longer needed. Any settlement taking place shall be maintained by the Contractor at his expense by furnishing, spreading and rolling additional material over that previously laid. The Contractor shall continue this maintenance until such time that the Owner's Field Representative considers that final settlement of the trench has occurred and that the trench is in readiness for the replacement of the permanent surface.

D. Public Rights-of-Way - In Public Rights-of-Way the Contractor shall comply with the requirements of the Authority having jurisdiction.

3.5 PERMANENT PAVEMENT REPLACEMENT

A. General Requirements - The Contractor shall replace disturbed pavement to the lines and grades shown on the Drawings or specified herein. The existing pavement shall be saw cut as shown on the Drawings, specified herein, and/or directed by the Owner's Field Representative.

B. Replacement of temporary pavements - In areas where a temporary pavement has been placed, the contractor shall remove the temporary pavement to the subgrade line shown on the drawings or as specified and disposed of off-site. He shall then fine grade the subgrade to the proper elevation and compact it as described herein under "Preparation of Subgrade".

Where shown on the Drawings or as specified by the Owner's Field Representative, the Contractor shall excavate a shelf to provide a bearing area on all sides for the new pavement. The width of said shelf shall be as shown on the Drawings or as directed by the Owner's Field Representative.

C. Public Rights-of-Way - In Public Rights-of-Way the Contractor shall comply with the requirements of the Authority having jurisdiction.

3.6 GUARANTEE AND MAINTENANCE

A. The Contractor shall guarantee all pavement installations, including materials and workmanship, for a period of one year from the date of completion and initial acceptance of the Work (as specified in writing to the Owner). The Contractor shall make interim repairs as necessary to maintain all paved areas in good, usable condition. The Contractor shall receive no additional compensation for pavement maintenance and restoration during this guarantee period. Payment shall be considered as included in the Contract Sum.

END OF SECTION

SECTION 32 14 33
TURF SURFACED ROADWAYS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SECTION INCLUDES

A. Water-permeable, stabilized turf surfaced system in accordance with the details on the plans.

B. Related Sections
   1. Section 31 23 00 “Excavation and Fill.”
   2. Section 31 25 00 “Temporary Soil Erosion, Sediment and Dust Control.”

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's printed product literature on all products specified in this section; include installation instructions.
   1. Samples: Two full sized pieces of individual turf reinforcement units, or minimum 1 foot square piece of roll reinforcement, whichever is applicable.
   2. Certificates: Certify that products of this section meet or exceed specified requirements.
   3. Maintenance Data: Manufacturer's precautions for maintenance of turf and turf reinforcement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.5 WARRANTY

A. Manufacturer's 10 year warranty against defects in material and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Turf Reinforcement: Invisible Structures, Inc.
   1. Invisible Structures, Inc.; Grasspave 2: www.invisiblestructures.com, or approved equal.

2.2 MATERIALS

A. Composition:
   1. Manufactured in the USA.
   2. High density polyethylene (HDPE): 100 percent recycled materials.
   3. Color: black
   4. Color Uniformity: Uniform color throughout all units rolls.
   5. Carbon Black for ultraviolet light stabilization.
   6. Hydrogrow soil amendment and fertilizer, provided by manufacturer with Grasspave2.
   7. Performance Properties:

a. Maximum Loading Capability: 15,940 psi (2.29 million psf) when filled with sand.
b. Wheelchair Access testing for ADA Compliance: Passing ASTM F 1951-08.
c. Wheelchair Access testing for ADA Compliance: Passing Rotational Penetrometer testing.
d. Size: 20 Tensile strength, pull-apart testing: 458 lbf/in from ASTM D638 Modified by 40 inches, nominal.
e. System Permeability (Grasspave2, sand, base course): 2.63 to 38.55 inches of water per hour.
f. Effective Imperviousness (E.I.): 10%.

8. Dimensions (individual units are assembled and distributed into rolls):
   a. Roll area: From 108 sq ft to 538 sq ft; in 108 sq ft increments
   b. Roll Widths: From 3.3 ft to 8.2 ft; in 1.6 ft increments.
   c. Roll Lengths: From 32.8 ft to 65.6 ft; in 3.3 ft increments.
   d. Roll Weights: From 41 lbs to 205 lbs; in 41 lbs increments.
   e. Unit Nominal Width by Length: 20 inches by 20 inches or 40 inches by 40 inches.
   f. Nominal Depth: 1 inch - for rolls and individual units.
   g. Unit Weight: 18 oz or 5 lbs.
   h. Volume Solid: 8 percent.

2.3 SYSTEM MATERIALS

A. Base Course: 12” thick sandy gravel material from local sources commonly used for road base construction (recycled materials such as crushed concrete or crushed asphalt are NOT acceptable).
   1. Conforming to the following sieve analysis and requirements:
      a. 100 percent passing sieve size 1 inch.
      b. 90-100 percent passing sieve size 3/4 inch.
      c. 70-80 percent passing sieve size 3/8 inch.
      d. 55-70 percent passing sieve size #4.
      e. 45-55 percent passing sieve size #10.
      f. 25-35 percent passing sieve size #40.
      g. 3-8 percent passing sieve size #200.
         1) Provide a base course material nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.
            (a) Material may be either "pit run" or "crusher run." Avoid using clay based crusher run/pit run. Crusher run material will generally require coarse, well-draining sand conforming to AASHTO M6 or ASTM C 33 to be added to mixture (20 to 30 percent by volume) to ensure long-term porosity.
               (1) Alternative materials such as crushed shell, limerock, or crushed lava may be used for base course use, provided they are mixed with sharp sand (20 to 30 percent) to ensure long-term porosity, and are brought to proper compaction. Without added sand, crushed shell and limerock set up like concrete and become impervious.
               (2) Alternative size and/or composition of base course materials should be submitted to Invisible Structures, Inc. (Manufacturer) for approval.
         2) Fill for Rings and Spaces Between Rings:

(a) United States Golf Association (USGA) greens, section - sand mix "The Root Zone Mixture:" 80% sharp concrete sand, 20% nutrient grade compost. (Refer to United States Golf Association recommendations for a method of putting green construction, 2004 revision).

B. The sand used in a USGA root zone mix shall be selected so that the particle size distribution of the final root zone mixture is as described in Table 3.

Particle Size Distribution of USGA Root Zone Mix		
Name	Particle Diameter	Recommendation (by weight)
Fine Gravel	2.0 - 3.4mm	Not more than 10% of the total particles in this range, including a maximum of 3% fine gravel (preferably none)
Very Coarse Sand	1.0 - 2.0mm	
Coarse Sand	0.5 -1.0mm	Minimum of 60% of the particles must fall in this range
Medium Sand	0.25 - 0.50 mm	
Fine Sand	0.15 - 0.25mm	Not more than 20% of the particles may fall within this range
Very Fine Sand	0.05 - 0.15 mm	Not more than 5%
Silt	0.002 - 0.05mm	Not more than 5%
Clay	less than 0.002mm	Not more than 3%
Total Fines	very fine sand +silt+ clay	Less than or equal to 10%

1. Soil Selection:

C. If soil is used in the root zone mix, it shall have a minimum sand content of 60%, and a clay content of 5% to 20%. The final particle size distribution of the sand/soil/peat mix shall conform to that outlined in these recommendations, and meet the physical properties described herein.

D. Organic Matter Selection:

E. Peats -The most commonly used organic component is a peat. If selected, it shall have a minimum organic matter content of 85% by weight as determined by loss on ignition (AS1M D 2974 Method D).

F. Physical Properties of the Root Zone Mix:

G. The root zone mix shall have the properties summarized below, as tested by USGA protocol (proposed ASTM Standards).

Physical Properties of the Root Zone Mix	
Physical Property	Recommended Range
Total Porosity	35%- 55%
Air-filled Porosity	15%- 30%
Capillary Porosity	15%- 25%
Saturated Hydraulic Conductivity	Minimum of 6 inches/hr

H. IT IS ABSOLUTELY ESSENTIAL TO MIX ALL ROOT ZONE COMPONENTS OFF-SITE. No valid justification can be made for on-site mixing, since a homogeneous mixture is essential for success.

I. A QUALITY CONTROL PROGRAM DURING CONSTRUCTION IS STRONGLY RECOMMENDED. Documents describing quality control programs in detail can be found on the USGA's Web site at www.usga.org/green/coned. Arrangements should be made with a competent laboratory to routinely check gravel and root zone mixtures during production and blending. It is imperative that these materials conform to the recommendations approved by the laboratory in all respects.

J. Care should be taken to avoid overshredding the peat, since it may influence performance of the mix in the field. Peat should be moist during the mixing stage to ensure uniform mixing and to minimize peat and sand separation.
   1. Turf Conditioner:
      a. Hydrogrow a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grasspave2.
      b. No substitutions are permitted.
         1) Grass
            (a) Seed: Use approved seed materials, of the preferred species for local environmental and projected traffic conditions, from certified sources. Seed shall be provided in containers clearly labeled to show seed name, lot number, net weight, % weed seed content, and guaranteed % of purity and germination. Pure Live Seed types and amount shall be as shown on plans and to match existing.
               (1) Topsoil - Obtain specified topsoil for a 2” depth above rings filled with sand for seeding germination.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade has been prepared correctly, is smooth, and is at the proper grade and level.

B. Do not begin work until subgrade is correct.

3.2 INSTALLATION

A. Subgrade Preparation:
   1. Prepare subgrade as specified in Section 31 23 00. Verify subgrade in accordance with porous paving system manufacturer's instructions.
   2. Proper subgrade preparation will enable the Grasspave2 rolls/units to connect properly and remain level and stationary after installation.
   3. Excavate area allowing for unit thickness, the engineered base depth (where required), and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).
   4. Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
   5. Ensure in-place soil is relatively dry and free from standing water.
   6. Uniformly grade base.
   7. Level and clear base of large objects, such as rocks and pieces of wood.
      a. Base Preparation:

1) Install Base as specified in Section 31 23 00. Verify engineered base (if required) is installed in accordance with porous paving system manufacturer's instructions.
   (a) Coordinate base installation and preparation with subdrains.
   (b) If required, place a geotextile separation layer between the natural ground and the 'engineered base'.
   (c) If required, install the specified sub-drain and outlet according to construction drawings.
   (d) Coordinate base installation and preparation with irrigation and drip irrigation lines, as applicable.
   (e) Place engineered base in lifts not to exceed 6 inches, compacting each lift separately to 95 percent Modified Proctor.
   (f) Leave 1 inch of depth below final grade for porous paver unit and sand fill and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).

3.3 HYDROGROW INSTALLATION

A. Spread all Hydrogrow mix provided (spreader rate = 10 lbs per 1076 ft2) evenly below the rings, over the surface of the base course with a hand-held, or wheeled, rotary spreader.

B. The Hydrogrow mix should be placed immediately before installing the Grasspave2.

3.4 GRASSPAVE2 INSTALLATION

A. Install the Grasspave2 units by placing units with rings facing up, and using snap-fit connectors, pegs and holes, provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer, as required to secure units in place. Tops of rings shall be between 0.25" to 0.5" below the surface of adjacent hard-surface pavements.

B. Install sand in rings as they are laid in sections by "back-dumping" directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving over rings already filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of rings and no more than 0.25" above top of rings.

3.5 INSTALLATION OF GRASS

A. Grass coverage on the sand-filled rings must be completed within one week. Sand must be re-installed and leveled and Grasspave2 checked for integrity if rings become exposed due to wind, rain, traffic, or other factors. The grass installation shall be as directed by the Owner's Representative.
   1. Install grass seed at rates per grass type. A 2" thick commercial topsoil mix, will be placed above the rings and seed mix to aid germination rates. Seeded areas must be fertilized and kept moist during development of the turf plants). DO NOT DRIVE ON SYSTEM: Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 6 to 8 weeks, or until the root system has penetrated and established well below the Grasspave2 units.
      a. Adequately water sod or grass seed to assure germination of seed and growth of root system.

3.6 PROTECTION

A. Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 4 to 8 weeks, or until the grass is mature to handle traffic.

3.7 FIELD QUALITY CONTROL

A. Remove and replace segments of Grasspave2 units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.

B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

3.8 MAINTENANCE

A. Maintain grass in accordance with manufacturer's instructions and as specified in the appropriate Section of these specifications.

B. Lawn Care: Normal turf care procedures should be followed, including de-thatching.

C. DO NOT AERATE. Aerator will damage the Grasspave2 units. Aeration in not necessary in a sand root zone.

D. When snow removal is required, keep a metal edged plow blade a minimum of ¾ inch (17 mm) above the surface during plowing operations to avoid causing damage to the Grasspave2 units, or
   1. Use a plow blade with a flexible rubber edge, or
   2. Use a plow blade with skids on the lower outside corners set so the plow blade does not come in contact with the units.

END OF SECTION

SECTION 32 14 40
MASONRY PAVERS AND COPINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions included in the Contract Documents.

B. Related Work Specified Elsewhere

1.	Site Preparation	Section 31 10 00
2.	Excavation and Fill	Section 31 23 00
3.	Trenching and Backfilling	Section 31 23 33
4.	Cement and Concrete for Exterior Improvements	Section 32 05 23
5.	Unit Masonry Walls	Section 32 32 20

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials, tools, equipment, and services necessary for and reasonably incidental to complete the installation of Bluestone Pavement, treads, and coping and applications as shown on the drawings, or specified including, but not limited to the following:

1. Bluestone pavement over a mortar setting bed with a concrete base. .

2. Bluestone Coping at top of stone veneer wall.

3. Joint fillers.

1.3 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:

1. National Concrete Masonry Association (NCMA)

2. American Society of Testing and Material (ASTM)

3. American Association of State and Highway Transportation Officials (AASHTO)

B. Installation performed only by a skilled workman with satisfactory record of performance, minimum of five years experience on at least three installations similar in type, size, and quality to that of this project.

C. Sample Panel Installation:

1. Prior to starting installation of pavers and wall coping provide sample panels of each pavement type and application using materials, patterns, anchors, joint treatments **indicated on the drawings**, including special features of expansion joints and contiguous work. The panel can be a part of the actual paving. Build sample panels at the project site of full thickness and approximately 6' x 6', unless otherwise indicated. Provide the range of color, texture and workmanship to be expected in the completed work.

2. Correct and rebuild sample panels until Landscape Architect's acceptance of work. Retain accepted panels during the entire construction as a standard for completed pavement. Do not remove or destroy panel until construction is complete.

3. Build panel and apply sealant primers and sealant compounds in sufficient time to allow for final test for staining or other deleterious effects from such applications.

1.4 SUBMITTALS

A. Manufacturer's Data:

1. Submit manufacturer's specifications and other technical data for each proprietary material, including certification that each complies with the specified requirements. Include instructions for storage, installation, and protection. Indicate that installer has received a copy of each instruction.

B. Samples:

1. Submit a minimum of 3 full size samples of each paver and coping required. Include in each set the full range of color and texture to be expected in the completed work. Landscape Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Submit material certificate for base and bedding materials.

D. Maintenance Instructions: Submit recommended cleaning and maintenance instructions for the pavers being provided.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site in undamaged condition.

B. Protect pavers during storage and construction against wetting, soiling, staining, and damage.

C. Handle pavers to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of pavers with wood or other rigid materials. Lift with wide belt-type slings wherever possible; do not use wire rope or rope containing tar or other substances that might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

D. Store pavers on wood skids or pallets, covered with non-staining waterproof membrane. Place and stack skids and pavers to distribute weight evenly and to prevent breakage or cracking of units. Protect stored pavers from weather with waterproof, non-staining covers or closures, but allow air to circulate around pavers.

E. Deliver, store and handle masonry accessories to prevent weather damage and deterioration.

1.6 PROJECT CONDITIONS

A. Protection of Existing Structures:

1. When working in the area and around the site, special attention shall be given during demolition of existing pavement adjacent to the building and during new pavement installation.

B. Review installation procedures and coordinate paving work with other work affected by the paver work.

C. Weather limitations:

1. Protect pavement from freezing when ambient temperature is 40 degrees F and falling. Heat materials and provide temporary protection of completed portions of pavement work. Comply with requirements of International Masonry All-Weather Council's "Guide Specification for Cold Weather Masonry Construction", Section 04200, Article 3.

2. Do not build on frozen work or wet, saturated or muddy subgrade. Remove and replace paving damaged by frost or freezing.

3. Do not use frozen materials or, materials mixed with or coated with ice or frost.

4. During all seasons, protect partially completed pavement against weather

when work is not in progress. Cover pavement with strong waterproof, non-staining membrane extending at least 2' on all sides and anchor securely in place.

5. Apply mortar setting bed when ambient temperature is above 50 degrees F and when temperature is not below 35 degrees F for twelve hours immediately prior to application.

D. Protect adjacent work from damage, soiling, or staining during paving operations.

E. Provide temporary barricades and warning lights as required for protection of project work and public safety.

PART 2 PRODUCTS

2.1 AGGREGATE SUBBASE

A. ¾ " Crushed stone over compact subgrade. Conform to Section 32 05 23 Cement and Concrete for Exterior Improvements. Depth as indicated on drawings.

2.2 BASE MATERIAL

A. Concrete Base: Conform to Section 32 05 23 Cement and Concrete for Exterior Improvements. Depth as indicated on drawings.

B. Stone Base: ¾" crushed stone gravel free of clay, organic material, or other deleterious matter. Depth as indicated on the drawings.

2.3 SETTING BED MATERIAL

A. Mortar: Type M Portland mortar.

B. Portland Cement: ASTM C150, except complying with the staining requirements of ASTM C91 for not more than 0.03% water soluble alkali. Provide Type I, except Type III may be used for setting stonework during cold weather. Color as required for grout.

C. Hydrated Lime: ASTM C207, Type S.

D. Sand: ASTM C144, except graded with 100% passing the No. 16 sieve for 1/4" and narrower joints.

E. Water: Clean and free of deleterious materials that would impair the work.

2.4 JOINT FILLER

A. One part portland cement, ASTM C150 to two parts sand, ASTM C476-02. (wet mix)

2.5 BLUESTONE PAVEMENT AND COPING

A. Provide only sound units free of defects that would interfere with proper placing of pavers or impair strength or permanence of construction.

B. Do not change source of pavers during the course of work to ensure consistent color range and textures.

C. General: Bluestone Pavers for paving conditions shall be $1^{1/2}$" thick. For wall coping, use 2" thick bluestone units as shown on drawings. All bluestone shall be natural cleft finish and as noted on drawings. Match color and source of existing bluestone used on campus.

D. Bluestone pavers to be random rectangular. Size and pattern to match existing bluestone terraces on campus. Finish to be natural cleft.

E. Bluestone coping to match bluestone copings on existing walls on campus. Provide an eased edge.

2.7 EXPANSION JOINTS

A. Conform to Section 32 05 23 Cement and Concrete for Exterior Improvements. Provide cleavage membrane as noted on drawings.

2.8 JOINT SEALANT

A. Polyurethane elastomeric type complying with FS TT-S-00227, self-leveling, designed for foot traffic.

2.9 SEALANT BACKER ROD

A. Compressible rod stock of polyethylene foam, butyl rubber foam, neoprene foam, or other flexible permanent, non-staining, non-absorbable material or approved bond breaker tape.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine substrate and installation conditions of related trades and verify that all such work is complete and satisfactory. In the event of a discrepancy, notify the Landscape Architect. Do not start pavement work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Clean pavers before setting by scrubbing with fiber brushes followed by a thorough drenching with clean water. Use only mild cleaning compounds that do not contain caustic or harsh fillers or abrasives in accordance with fabricator's instructions.

3.3 INSTALLATION OF BASE MATERIALS FOR MORTAR SETTING BED

A. Aggregate Subbase:

1. Install aggregate subbase as per Section 32 05 23 Cement and Concrete for Exterior Improvements.

B. Concrete Base:

1. Obtain the Landscape Architect’s inspection and acceptance of subgrade surface before placing of subgrade materials.

2. Install concrete base as per Section 32 05 23 Cement and Concrete for Exterior Improvements.

3.4 INSTALLATION OF MORTAR SETTING BED

A. Cement Setting Bed:

1. Install setting bed of thickness indicated unless otherwise indicated on the drawings.

2. Spread and screed to uniform thickness to permit tamping of units to accurate level and grades required. Provide setting button as required to prevent extrusion of mortar.

B. Joints:

1. Butter vertical joints for full width before setting and set units in full bed of mortar, unless otherwise shown or specified.

2. Point out joints with grout of color selected by the Landscape Architect except at expansions and control joints. Finish grout flush with surface of pavers before mortar is set to allow for sealant installation as shown.

3. Cure grout for at least 72 hours.

4. Construction and Expansion Joints: Locate and install all joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure.

5. Seal joints as shown. All exposed vertical and horizontal joints shall be sealed.

6. After installation of the surface shall be true to grade and shall not vary by more than 1/4" when tested with a 10'-0" straight edge at any location on the surface. Remove and reinstall any pavement that does not meet finished grades on the drawings.

7. Do not permit traffic on or pavement during setting, or for at least 24 hours after grouting.

3.5 INSTALLATION OF PAVERS

A. Set pavers in patterns indicated on the drawings, utilizing full range of pavers with level surface and uniform joints of widths indicated, or as pattern requires. If not indicated, as directed by the Landscape Architect.

B. Cut pavers when necessary with motor-driven saw equipped with a diamond blade designed to cut masonry with clean, sharp unchipped edges. Cut pavers as required to provide pattern shown on the drawings and to fit adjoining work neatly. Use full pavers without cutting wherever possible. Where cutting is required, use the largest size paver as possible. Avoid the use of small pieces of pavers or large joint spaces.

C. Set pavers in random rectangular pattern to match other outdoor terraces on campus.

D. Fill gaps at the edge of the paved surface with standard pieces or with pavers cut to fit with a motor-driven saw. Provide cut units with straight cut surfaces, free from cracks or chips.

E. FOR MORTAR SETTING BED

1. Install continuous expansion joint where paving abuts building structure or concrete curb. Install joint filler full width and depth of joints. Provide top edge flush with finished grade.

2. Placing Pavers:

   a. Place pavers carefully by hand in straight courses maintaining accurate alignment and uniform top surface. Protect newly laid pavers with panels of plywood on which workers stand. Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment, to avoid creating depressions or disrupting alignment of pavers.

3. After the work has started, do not change the source of expansion joints, sand or other materials that will affect the appearance of the finished work.

4. Tolerances: Do not exceed 1/16" unit to unit offset from flush, and a tolerance of 1/8" in 2'-0" and 1/4" in 10'-0" from level or slope as indicated for finished surfaces of paving. Remove and reinstall any brick pavers that do not meet tolerances indicated above.

5. Remove and re-install any pavement that does not meet finish grade tolerances indicated above.

6. Immediately after the installation of pavers, install joint filler.

3.6 PROTECTION

A. Restrict traffic from pavement surfaces during setting of pavers and until completion of installation.

B. Installer shall advise General Contractor of proper procedures required to protect pavers from collapse, deterioration, discoloration or damage during construction.

C. Protect pavers from damage until final acceptance.

3.7 REPAIR AND CLEANING

A. Remove and replace pavers that are broken, chipped, stained or otherwise damaged. Provide new matching pavers; install as specified and point-up joints to eliminate evidence of replacement.

B. Cleaning:

1. Remove excess sand from exposed pavement surfaces, wash and scrub clean.

2. Perform cleaning during installation of work and upon completion of work using clean water and stiff bristle brushes. Do not use wire brushes, acid type agents or other cleaning compounds with caustic or harsh fillers.

C. Upon completion of work, remove from site all excess materials, debris, and equipment. Repair damage resulting from paving operations.

END OF SECTION

SECTION 32 16 00

CURBS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits indicated on the plans and includes, but is not limited to the following:
   1. Concrete curb (Cast-in-Place)
   2. Work shall also include all associated items and operations necessary and required to complete the installations and restoration of surfaces in kind, including but not limited to surface preparation, formwork, finishing and curing.

B. Related Sections:
   1. Section 02 30 00 "Subsurface Investigation."
   2. Section 31 23 00 “Excavation and Fill.”
   3. Section 31 23 33 “Trenching and Backfilling”
   4. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control"
   5. Section 32 05 23 “Cement and Concrete for Exterior Improvements.”

PART 2 PRODUCTS

2.1 CURBS

A. Concrete Curb (Cast-in-Place)
   1. Concrete curb shall be constructed of Class "A" concrete, 4,000 psi at 28 days.
   2. Forms shall be metal or acceptable planed and matched lumber, straight and free from warp or other irregularities that will adversely affect the installation.
   3. Expansion joints shall be one-half (1/2) inch in width and formed with premolded bituminous joint filler, in accordance with ASTM Designation D-1751.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. As applicable, subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer. The most stringent geotechnical requirements stated in the Geotechnical Report or by the Owner's Field Representative, or any other place in the Contract Documents shall be adhered to be the Contractor.

B. General Requirements - The Contractor shall install all curbs as specified in the locations and to the lines and grades as shown on the Drawings and/or as directed by the Owner's Field Representative.

C. The installation of all curbs within Public Rights-of-Way shall be in accordance with the rules and requirements of the Municipality. Work shall include all items and operations

necessary and required to complete the curb installation to the satisfaction of the Municipality, including maintenance and protection of traffic and pedestrians.

D. Contractor's Responsibility - The Contractor shall be responsible for laying out and installing all curbs and related items in accordance with the cross-sections, lines and grades as specified herein and shown on the Drawings and/or in accordance with the directions of the Owner's Field Representative and/or Site Engineer. All curbs and related items which are not constructed to the proper section, grade or alignment shall be corrected by repair or replacement by the Contractor in accordance with the directions of the Owner's Field Representative and/or Site Engineer and at no additional cost to the Owner. Improper finishing or improper expansion or construction of joints shall also be cause for rejecting the curb.

E. Concrete - Unless otherwise specified, all cast-in-place concrete items as specified herein shall be constructed in accordance with the requirements of Section 32 05 23 "Cement and Concrete for Exterior Improvements".

F. Protection from Damage - The Contractor shall protect all curb and sidewalk installation from damage until acceptance of the Work by the Owner. Any damage prior to acceptance of the Work, shall be repaired or replaced by the Contractor. at his expense.

G. Defective Concrete - Concrete work that is not formed as indicated or is not true to alignment, or is not plumb or level, or is not true to grades or levels, is frozen, or has voids or rock pockets, or has saw dust, wood or debris embedded in it, or does not fully conform to the Contract Documents, shall be considered defective and shall be removed and replaced by the Contractor at no additional cost to the Owner with work that conforms to the Contract Documents.

3.2 CURBS

A. Concrete Curb (Cast-in-Place)

1. General Requirements - Curb shall be cast in place to proper size and shape and to the line and grade shown on the Drawings. The curbing shall be constructed using conventional forms and in segments separated by construction joints and expansion joints as specified herein.
2. Forms - Forms shall conform to the curb cross-section shown on the Drawings and shall be carefully set to line and grade and thoroughly braced and secured in place so that there will be no displacement during placing of the concrete. On curves, all forms must be bent to meet the required curvature; the use of short chords will not be permitted. All forms shall be thoroughly cleaned prior to reuse. Forms which have become worn, bent or broken shall not be used.
3. Placing of Concrete - Concrete shall be placed in the form as near to its final position as practicable, struck off with a template, vibrated or spaded to prevent "rock-pockets" or "honey-combing" adjacent to the forms and finished to a smooth even surface.
4. Expansion Joints - Vertical expansion joints shall be located approximately every twenty (20) feet or as detailed or directed, and shall be so arranged that they shall match expansion joints in adjacent concrete pavements and sidewalks. Unless directed otherwise, expansion joints shall also be installed at the PC and PT of all radius curb. Expansion joints shall be constructed vertical, plumb and at right angles to the face of the curb. They shall be cut to conform to the cross-section of the curb.
5. Construction Joints - Vertical construction joints shall be located approximately every ten (10) feet being equally spaced between expansion joints. The length of

these curb segments may be varied slightly for closures but in no case shall they be less than four (4) feet. Construction joints shall be vertical, plumb and right angles to the face of the curb and shall be formed by approved method that will provide complete separation of the curb segments during placing of the concrete.

6. Finishing - Forms shall be left in place for 24 hours or until the concrete has sufficiently hardened as determined by the Owner's Field Representative, so that they can be removed without injury to the curb. Upon removal of the forms, the exposed faces of the curb shall be immediately rubbed to a uniform surface. Rubbing shall be done by experienced and competent concrete finishers. No plastering will be permitted.
7. Curing - After finishing, the curb shall be cured in accordance with the requirements as specified under Section 32 05 23 of these Specifications entitled "Cement and Concrete for Exterior Improvements".

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS AND SIGNS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 SUMMARY

A. This Work of this Section may include, but is not limited to the following, as applicable:
   1. Installation of new pavement striping in roadways, driveways and parking areas including striping of parking stalls and temporary striping.
   2. Replacement of all existing pavement striping disturbed by construction.
   3. Installation of all pavement markings may include arrows, symbols, numbers and letters in roadways, driveways and parking areas.
   4. Installation of all signs, both temporary and permanent.
   5. All items and operations required to complete the work including, but not limited to, cleaning of pavement, layout and protection of striping and markings and the removal of temporary striping as directed.

PART 2 PRODUCTS

2.1 PAVEMENT STRIPING AND MARKINGS

A. Paint - shall be formulated and manufactured from first-grade materials and shall be free from defects that may adversely affect the serviceability of the finished product. When the paint is stored in its container, the pigmented binder shall not liver or settle out to the extent that re-mixing is difficult by standard methods or the application is detrimentally affected.

B. All paint furnished must be shipped in strong, substantial and properly sealed containers. Five (5) gallon steel pails shall have a full diameter hub cover, wire bail and handle and shall conform to I.C.C. Specification 37A. Steel drums shall be equipped with a ring and lock closure and removable lid which can be readily resealed after partial use of the contents. Steel drums shall conform to I.C.C. Specification 17-H or 37A.

C. Unless indicated otherwise, paint shall be Sherwin-Williams Hotline-Fast Dry Reflectorized Pavement Marking Paint or equal as approved by the Owner's Field Representative. Paint within the right-of-way shall be as required by the Authority having control over the roadway.

2.2 SIGNS

A. Reflectorized Signs - Unless indicated otherwise, signs shall be "Scotchlite" reflectorized sheeting or approved equal, mounted on aluminum alloy, flat sheet conforming to ASTM Designation B-209, Alloy GS-11A-T6 (6061-T6). Thickness shall be 0.080 inches for signs up to and including eight (8) square feet and 0.100 inches for signs with an area greater than eight (8) square feet.

   The manufacturer shall insure the aluminum is free of all corrosion, white rust and dirt.

   The pre-coated adhesive shall form a durable bond to aluminum. The pre-coated adhesive, after 48 hours of aging at 75 degrees F. from the time of application, shall be strong enough to resist scuffing and marring during normal handling, elastic enough at low temperatures to resist shocking off when struck at 20 degrees F., and moisture

resistant enough to withstand eight (8) hours of soaking in water at 75 degrees F. without appreciable decrease in adhesion. The pre-coated adhesive shall have no staining effect on the reflective sheeting and must be mildew resistant.

Reflective sheeting shall be free from ragged edges, cracks, scale and blisters. Reflective sheeting shall be moisture resistant and readily cut with scissors, knife, blade or heats without cracking, checking or flaking.

B. Non-Reflectorized Signs - Steel shall be 18 gauge medium weight cold rolled iron phosphorized steel.

Background and message shall be of at least two (2) coats of DuPont Delux or approved equal, separately applied and baked, in color specified in the Traffic Sign Table. All signs shall be given a baked over-coating of DuPont Delux or approved equal, clear varnish.

The finished product shall be neat and uniform in appearance. All faces shall be smooth, even and free from burrs and irregularities.

Paint shall be applied in such a manner as to obtain smooth and uniform coats, free from runs.

C. Hardware - shall consist of 5/16 inch diameter bolts complete with washers and nuts.

Nuts and bolts shall be hexagonal and made from aluminum alloy 2024 wire or rod (ASTM Specification B-211, alloy CG42A). The thread fit for the bolts shall conform to American Standards Association Class 2A and the thread fit for the nuts shall be Class 2B. Finished bolts and nuts shall be supplied in the T4 temper.

Flat washers shall be 21/64" I.D. x 3/4" O.D. x 0.091" and shall be made from aluminum alloy Alclad 2024-T4 sheet (ASTM Specification B-209, alloy CG42A-T4).

D. Steel Channel Posts - shall conform to the standard specification for cold rolled carbon sheet steel, commercial quality ASTM Designation A-366. Posts shall be minimum 11 gauge steel weighing no less than three (3) lbs./ft. with 3/8" holes on one (1) inch centers to receive sign faces.

Posts shall be galvanized for the full length and total area by the hot dip method and shall have a continuous coating of pure zinc of a uniform thickness, so applied that it will adhere firmly to the surface of the posts, and shall be capable of withstanding four immersions in a standard testing solution of copper sulphate without showing any trace of metallic copper. The first three immersions shall be for a period of one (1) minute each and the fourth immersion for a period of one-half (1/2) minute. All holes in the steel posts shall be pierced before galvanizing.

PART 3 EXECUTION

3.1 PAVEMENT STRIPING AND MARKINGS

A. General
   1. The Contractor shall install all temporary, interim and final pavement striping and markings where and as shown on the Drawings and/or as directed by the Owner's Field Representative.
   2. Before any temporary, interim and final pavement striping and marking work is begun, a schedule of operations shall be submitted to the Owner's Field Representative for his review and approval.
   3. The Contractor shall be responsible for removing, to the satisfaction of the Owner's Field Representative, all tracking marks, spilled paint or paint applied in unauthorized areas.

4. Temporary striping and markings and areas to be re-striped, shall be removed as approved by and to the satisfaction of the Owner's Field Representative.
5. The Contractor shall establish marking line points for striping at twenty-five (25) foot intervals throughout the length of the pavement or as directed by the Owner's Field Representative.
6. The Contractor shall also be required to remove all existing lines and markings which are no longer required in the new construction due to revised stall layouts, new driveway locations, etc.
7. Removal of painted lines and markings from the pavement as specified may be done by any method that does not materially damage the surface or texture of the pavement. The Contractor shall advise the Owner's Field Representative of the method he intends to use to remove painted lines and markings.
8. The Contractor shall be responsible for cleaning the pavement, to the satisfaction of the Owner's Field Representative, of dust, dirt, old pavement striping and markings, concrete curing compounds and other foreign material which may be detrimental to the adhesion of the paint film.
9. The paint shall be applied only on thoroughly dry pavement surfaces, when the atmospheric temperature is at or above 40 degrees F. and when the weather conditions are favorable in the opinion of the Owner's Field Representative.
10. After striping and/or markings have been installed, they shall be properly protected to prevent tracking and marring of the striping and markings.
11. The installation of pavement striping and markings shall be installed in accordance with the Authority having jurisdiction.

B. Application of Pavement Striping and Markings
   1. Painted pavement striping and markings shall, unless otherwise noted herein, be applied with atomizing spray type striping machines. The equipment shall be compatible with and suitable for the application of the type of paint being used and shall be approved by the Owner's Field Representative. Applied markings shall have clean-cut edges, true and smooth alignment and uniform film thickness of 15 +1 mils.
   2. The Contractor may apply white and yellow paint, utilizing rollers and/or brushes for marking gore areas, turn arrows, letters, stop bars, short temporary detours or other such areas as approved by the Owner's Field Representative.
   3. Normal spreading rates for pavement marking paints shall be from 100 to 115 square feet per gallon so as to obtain a wet film thickness of 15 +1 mils.

C. Striping and Marking Schedule
   1. Unless otherwise specified or approved by the Owner's Field Representative, the Contractor shall provide striping and marking colors as follows and as applicable:

WHITE	CHROME YELLOW
1. STOP LINES	1. SOLID DOUBLE LINES
2. PEDESTRIAN CROSSWALKS	2. HATCHED AREAS
3. PARKING STALLS	
4. EDGE LINES	BLUE
5. LANE LINES	1. ACCESSIBLE PARKING STALLS
6. HATCHED AREAS	2. ACCESSIBLE SYMBOLS

7. ARROWS

3. ACCESSIBLE HATCHED AREAS

3.2 SIGNS

A. General - The Contractor shall furnished and install signs where and as shown on the Drawings and/or as directed by the Owner's Field Representative. The installation of signs within the right-of-way shall be as required by the Authority having control over the roadway.

B. Reflectorized Signs - shall be as indicated in the Sign Table on the Drawings and shall be fabricated in accordance with the details of the Drawings and the following requirements:

1. Fabrication of all metal parts shall be accomplished in uniform and workmanlike manner. All fabrication, including shearing, cutting and punching of holes shall be completed prior to metal degreasing and application of reflective sheeting. Metal panels shall be cut to size and shape and shall be free of buckles, warp, dents, cockles, burrs and defects resulting from fabrication. The surface of all sign panels shall be flat.
2. All holes shall be 3/8" diameter drilled or punched, and all hole locations shall be centered and shall not crush, chip, burn or otherwise mar the sign face.
3. Degreasing - shall be done by one of the following methods:
   a. Vapor Degreasing - Signs shall be totally immersed in a saturated vapor of trichloroethylene or perchloroethylene. Trademark printing shall be removed with lacquer thinner or controlled alkaline cleaning system. Follow with a thorough rinse.
   b. Alkaline Degreasing - Signs shall be immersed in a tank containing solution, controlled and titrated to the solution manufacturer's specifications. Immersion time shall depend upon the amount of soil present and the gauge of the metal. Rinse thoroughly with running water.
4. Etching - shall be done by one of the following methods:
   a. Acid Etch - Etch well in a 6% - 8% phosphoric acid solution. Rinse thoroughly with running cold water at 100 degrees F. followed by hot water tank rinse.
   Alkaline Etch - Etch well the pre-cleaned aluminum surface in an alkaline etching material that is controlled by titration, use time, temperature and concentration specified by the solution manufacturer. Rinse thoroughly. Remove smut with an acidic, chromium compound type solution as specified by the solution manufacturer and then thoroughly rinse.
   Panels shall be dried by use of a hot air dryer. Metal shall not be handled except by device or clean canvas gloves between all cleaning and etching operations and the application of reflective sheeting. There shall be no opportunity for metal to come in contact with greases, oils or other contaminants prior to the application of reflective sheeting.
   In the case of Scotchlite sign faces, finishing coats of 700 Finishing Clear shall be applied in accordance with manufacturer's specifications.
   Reflective sheeting shall be applied to properly treated base panels, mechanically with the equipment and in the manner specified by the manufacturer.
   Recommendations of the sheeting manufacturer shall be followed with respect to cutting, matching, positioning, and butting of sheets. The Contractor shall insure that signs shall have a uniform appearance and

brilliance both day and night. All sheeting used shall be inspected to insure color matching throughout each sign face.

5. Non-Reflectorized Signs - Those signs that are not required to be reflectorized and so indicated in the Sign Table, shall be galvanized, bonderized steel with embossed messages and borders and baked enamel finish.
6. Steel Channel Sign Posts - shall be set vertical and plumb in the locations shown, specified and/or ordered by the Owner's Field Representative. Posts shall be driven a minimum of three (3) feet into firm ground and/or installed in concrete-filled steel pipe protection posts where so specified on the Drawings. Posts installed within rock shall be drilled, and the post set in epoxy as directed. Signs shall be securely fastened to the posts at the correct height by means of non-corrosive hardware as specified herein.

END OF SECTION

SECTION 32 31 00
FENCING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section is for work to the limits as indicated on the plans and includes, but is not limited to the following:
   1. Removal and resetting existing chain link fencing as indicated on the Drawings.
   2. Concrete footings.

B. Related Sections:
   1. Section 31 23 33 "Trenching and Backfilling."
   2. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control."
   3. Section 32 05 23 "Cement and Concrete for Exterior Improvements."

1.3 SUBMITTALS

A. As applicable, submit manufacturer's product data (shop drawings) and samples for approval.

B. Submit shop drawings. Include plan layout and details illustrating finish, height, location, and sizes of posts, rails, braces and anchorage. Provide hardware list and erection procedures.

C. Submit installer’s certification that furnished materials meet specification requirements.

1.4 QUALITY ASSURANCE

A. Provide fence components as complete unit produced by a single manufacturer, including necessary erection accessories, fittings, and fastenings.

B. Installation: Performed only by an experienced fence installer.

C. Materials and installation shall comply with the following standards:
   1. American Society for Testing and Materials, (ASTM).
   2. New York State Building Code.
   3. Local Building Code.

D. Provide warranty for fencing installed. Contractor shall warranty installation for one (1) year from project completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fence materials in the manufacturer's original packaging with tags and labels intact and legible.

B. Handle and store material to prevent damage and deterioration.

1.6 PROJECT CONDITIONS

A. Do not begin fencing installation before completion of final grading.

PART 2 PRODUCTS

2.1 CHAIN LINK FENCE

A. The Contractor shall remove and reset existing chain link fence behind the proposed retaining wall as indicated on the Drawings, and as directed by the Owner's Field Representative.

B. Prior to installation of the fence, the Contractor shall check the fence layout with the Owner's Field Representative who must approve the layout before any of the work is done.

C. Posts and Rails - If the existing posts and rails are not reusable as determined by the Owner's Field Representative, the Contractor shall furnish be standard full weight vinyl coated galvanized Schedule 40 pipe to match existing, manufactured and galvanized in accordance with ASTM Designation A-120 except that the zinc coating shall average not less than 2.0 oz. per sq. ft. and no single coating shall show less than 1.8 oz. per sq. ft. All materials shall be new and first class and shall not include reconditioned or rerolled pipe. Vinyl coating shall be ten (10) to fifteen (15) mils in thickness and coated by the thermal fusion process. Pipe sizes shall be as follows:

1. Fence 5 Feet or Less in Height

End, Corner and Gate Posts	2 1/2" O.D. 3.65 #/LF
Line Posts	2" O.D. 2.72 #/LF
Top and Brace Rails	1 5/8" O.D. 2.28 #/LF
Bottom Rails	1 5/8" O.D. 2.28 #/LF

2. Fence Greater Than 5 Feet in Height

End, Corner and Gate Posts	3" O.D. 5.79 #/LF
Line Posts	2 1/2" O.D. 3.65 #/LF
Top and Brace Rails	1 5/8" O.D. 2.28 #/LF
Bottom Rails	1 5/8" O.D. 2.28 #/LF

D. Fittings - shall be vinyl coated to match existing malleable iron fittings conforming to the requirements of ASTM Designation A-47 and galvanized in accordance with ASTM Designation A-153.

E. Fabric - Fabric shall be reused, however if new fabric is required as directed by the Owner's Field Representative, fabic shall be 9 gauge galvanized two (2) inch mesh (or as directed), which shall be vinyl clad to match existing in conformance with the requirements of AASHTO Designation M-181, Type III, except as may be modified herein. Vinyl coating shall be firmly and continuously extrusion bonded to the galvanized steel wire. Top selvage shall have a knuckled finish.

F. Bottom Tension Wire - shall be vinyl coated 7 gauge meeting the requirements of ASTM Designation A-641 as modified herein. The tensile strength shall be at least 80,000 psi with a galvanized coating of not less than 0.7 oz. per sq. ft.

G. Fabric Ties - shall be minimum 9 gauge vinyl coated galvanized steel or aluminum. Minimum spacing shall be as follows:
   1. 14" o.c. at line posts
   2. 24" o.c. at top and bottom rails
   3. 12" o.c. at bottom tension wire

H. Color of Vinyl Coating – Color of Vinyl coating shall match existing or as directed by the Owner.

2.2 CONCRETE

A. Concrete: ASTM C94 ready-mixed concrete, minimum 28-day compressive strength of 4,000 psi, air-entrained 2% to 4%.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start fence system work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. The Contractor shall remove existing fence materials, store, clean, and reinstall as directed by the Owner's Field Representative.

B. Layout complete fence lines. Ensure that the fence lines are located in the exact location required.

C. Locate and mark post positions. Space line posts equally and at maximum 8'-0" on center spacing. All posts shall be set vertically and to the required grade and alignment.

D. Provide corner posts at positions where fence changes direction more than 10 degrees. Provide end posts at both sides of all openings.

E. Fence shall generally follow the contour of the ground. Grading shall be performed where necessary to provide a neat appearance.

F. Installation shall not commence until the layout is approved by the Owner's Field Representative.

3.3 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvements and special construction requirements must be followed as indicated by the Geotechnical Engineer or the Owner's Field Representative.

B. Prior to installation of the fence, the Contractor shall check the fence layout with the Owner's Field Representative who must approve the layout before any of the work is done.

C. Assemble and install fencing in accordance with manufacturer’s recommendations, details**,** final shop drawings**,** and industry standards.

D. All posts shall be set vertical and plumb in each direction, in concrete foundations of the depth and diameter shown in detail on the Drawings or in accordance with manufacturer's requirements. Set posts in 4,000 psi concrete having a diameter 4 times the diameter of the post, and 6" deeper than the bottom of the post. Forms are not necessary or recommended. Tamp concrete in hole to eliminate pockets. Posts shall be set to the required grade and alignment and shall be equally spaced along each side. Post spacing shall be not greater than eight (8) feet or in accordance with the manufacturer.

E. Perform fitting required for installation. Set the work accurately in location, alignment, and elevation free of rack, measure from established lines and levels. Assembled fencing shall be firm, rigid, free of rattle, and provide maximum protection against tampering and vandalism.

F. Fit exposed connections accurately together to provide flush, tight hairline joints.

G. Fabric shall be securely fastened to posts, rails, braces and tension wire (or bottom rail when specified) by approved method. The fabric shall be secured to all end, corner and gate posts with stretcher bars fastened to the posts and stretcher bands spaced at a maximum of 14 inches in a manner permitting adjustment of fabric tension. Fabric shall be continuous along each stretch of fence. Bottom of fabric shall be installed with a maximum of one and one-half (1-1/2) inch clearance from ground surface.

   All top rails shall pass through the base of the post caps and shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with sleeve couplings with expansion sleeves provided at 100 foot intervals. Top rails shall be securely fastened to end posts by approved rail end connectors. Horizontal braces shall be provided at end and corner panels between line post and each adjacent end, corner, and gate post midway between the top rail and ground as shown in detail on the Drawings. Diagonal truss rod with turn buckle shall also be provided at these locations.

H. Attach panels to brackets using two (2) 1/4 aluminum air craft rivets.

I. Adjust fence before securing in place to ensure proper matching at butting joints and proper alignment throughout their length.

3.4 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from site improvements installation.

END OF SECTION

SECTION 32 32 20
UNIT MASONRY WALLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions included in the Contract Documents.

B. Related Work specified elsewhere

1. Site Preparation	Section 31 10 00
2. Excavation and Fill	Section 31 23 00
3. Trenching and Backfilling	Section 31 23 33
4. Cement and Concrete for Exterior Improvements	Section 32 05 23

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials, tools, equipment and related items required for complete installation/construction of unit masonry walls and step risers.

B. Extent of all unit masonry work is indicated on drawings.

C. Types of masonry work required include:

1. Concrete work.

2. Granite veneer walls.

3. Segmental retaining walls and window wells.

1.3 QUALITY ASSURANCE

A. Standards: Comply with latest printed specifications and recommendations of:

1. American Society of Testing and Material (ASTM)

2. National Concrete Masonry Association (NCMA).

B. Mortar and Masonry Units: Obtain mortar materials and exposed masonry units from one single manufacturer for each different for each different product required for each continuous surface or visually related surfaces.

C. Sample Panel: Prior to installation of masonry work, erect 4' long x 2' high full thickness sample wall panel to verify sections made for color and textural characteristics, and to represent completed masonry work for qualities of appearance, materials and construction.

1. Build mock-up to include typical granite veneer wall.

2. Retain sample panel during construction as standard for judging completed masonry work. When directed, demolish mock-ups and remove from site.

1.4 SUBMITTALS

A. Submit manufacturer's product data for each type of masonry unit, accessories, and other manufactured products, including certifications that each type complies with specified requirements.

B. Submit a minimum of five full size samples of each masonry unit required. Include full range of style, size, exposed finish, color, and texture proposed for work.

C. Submit sample of granite wall veneer.

D. Submit sample of segmental wall unit.

E. Submit shop drawings detailing all special shapes and locations special shapes will be used.

F. Submit samples of crushed stone, filter fabric, and perforated pipe.

G. Submit manufacturer supplied shop drawings signed and sealed by a New York State licensed engineer for all segmental walls and window wells. Design calculations shall include all surcharge loads and proposed guiderail at driveway condition.

H. Submit samples of wall ties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials and accessories to project in undamaged condition.

B. Store and handle materials to prevent their deterioration or damage to moisture, temperature changes, contaminants, corrosion or other causes. Store off of the ground on pallets or wood platforms.

1.6 PROJECT CONDITIONS

A. General: Review procedures and coordinate unit masonry work with other work affected by unit masonry work.

1. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

2. Extend cover a minimum 24 inches down both sides and hold cover securely in place.

3. Do not apply concentrated loads for at least three days after building masonry walls.

4. Staining: Prevent grout, or mortar, or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.

5. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

6. Protect ledges and projections from droppings of mortar.

B. Cold Weather Protection:

1. Do not lay masonry units which are wet or frozen.

2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to touch.

3. Remove masonry damaged by freezing conditions.

4. For clay masonry units with initial rates of absorption (suction) which require them to be wetted before laying, comply with BIA requirements.

5. For specific requirements and procedures for the work in progress in various temperature ranges, comply with the BIA "Technical Notes" Bulletin 11-A.

PART 2 PRODUCTS

2.1 CONCRETE WORK

A. General: Comply with referenced standards and other requirements indicated in Cement and Concrete for Exterior Improvements Section 32 05 23.

2.2 MORTAR AND GROUT MATERIALS:

A. General: All masonry work covered in this Section shall be provided using field-mixed Portland Cement-Lime mortar and grout.

1. Select color mixes shall be provided for all granite masonry.

2. Natural color mixes shall be provided for all other masonry work.

B. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction.

C. Colored Portland Cement for use in select color mixes shall be "Colorport" Portland Cement as manufactured by the Riverton Corporation, Riverton, Virginia or equal and subject to the Town Engineer's acceptance of the mock-up sample panel.

D. Hydrated Lime: ASTM C 207, Type S.

E. Hydraulic Hydrated Lime: ASTM C-141.

F. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing through No. 16 sieve.

G. Aggregate for Grout: ASTM C 404.

H. Water: Clean and potable.

2.3 SETTING BED MATERIAL

A. Mortar: Type M Portland mortar.

B. Portland Cement: ASTM C150, except complying with the staining requirements of ASTM C91 for not more than 0.03% water soluble alkali. Provide Type I, except Type III may be used for setting stonework during cold weather. Color as required for grout.

C. Hydrated Lime: ASTM C207, Type S.

D. Sand: ASTM C144, except graded with 100% passing the No. 16 sieve for ¼" and narrower joints.

E. Water: Clean and free of deleterious materials that would impair the work.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Non-Metallic Expansion Joint Strips: Pre-molded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35%, of width and thickness indicated or 1/2" wide if not indicated.

B. Premolded Control Joint Strips: Polyvinyl chloride complying with ASTM D 2287, General Purpose Grade, Designation PVC-63506, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Wall ties: #141 U-Type Stone Anchor by Heckmann Building Products, Inc. or approved equal. Spaced maximum 24" O.C.

D. Wall drainage: 4" Perforated PVC pipe connected to drainage system.

E. ¾" Crushed stone as noted on drawings wrapped with Mirafi 140N filte fabric,

2.5 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

B. Acidic Cleaner: Manufacturer's standard strength general purpose cleaner designed for new masonry surfaces of type indicated; composed of blended

organic and inorganic acids combined with special wetting systems and inhibitors; expressly approved for intended use by manufacturer of masonry units being cleaned.

C. Products: Subject to compliance with requirements, provide "Sure Klean Vanatrol" ProSoCo, Inc. or approved equal.

2.6 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.

1. Limit cementitious materials in mortar to portland cement-lime.

2. Use Type M mortar for masonry below grade and in contact with earth, and where indicated.

3. Use Type S mortar for reinforced masonry and exterior, above-grade loadbearing and non-loadbearing walls.

D. Grout for Unit Masonry: Comply with ASTM C 476 for grout use in construction of reinforced and non-reinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

1. Use fine grout in grout spaces less than 2" in horizontal direction, and coarse grout in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated.

2.7 STONE

A. Granite:

1. Wall Veneer – 4” thick granite to match stone in random sizes and color

that are used on existing campus walls and building veneer. Stone to be supplied by Connecticut Stone, O&G, or other approved sources. Provide samples for approval and or approved equal.

B. Segmental Walls and Window Well:

1. Segmental precast wall units including capstone shall be provided by Unilock- RomanPisa/ Romanwall Model: Granite Color, Provide geogrid where specified by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

B. Thickness: Build cavity and composite walls, and other masonry construction to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as shown or required for the work of other trades.

D. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

E. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible. Use dry cutting saws to cut concrete masonry units.

F. Follow manufacturer’s instructions and specifications rigidly for installation of segmental walls.

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of walls and arises do not exceed 1/4" in 10'. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4" in 20' maximum. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.

B. Variation from Level: For bed joints, horizontal grooves and other conspicuous lines, do not exceed 1/4" in 20' maximum.

C. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

D. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.3 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns, and off-sets. Avoid the use of less-than-half-size units at corners, and wherever possible at other locations. Establish new granite coursing and mortar joints to align and match with existing structure.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

C. Granite veneer in ashlar pattern to match existing stone walls and building veneer on campus.

D. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-In-Work:

1. As the work progresses, build in anchor bolts, and other items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

3.4 MORTAR BEDDING AND JOINTING

A. Lay solid bluestone and granite size masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints or as directed by Town Engineer.

C. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

D. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.

E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners to shift adjacent stretcher units which have been set in position. If adjustment are required, remove units, clean off mortar and reset in fresh mortar.

F. Collar Joint: After each course is laid, fill the vertical longitudinal joint between wythes solidly with mortar in all walls except cavity walls.

3.5 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. General: Unless specifically noted on drawings use either individual metal ties or continuous joint reinforcement to bond wythes together.

B. Individual Ties: Provide ties as shown, but not less than one metal tie for 4 sq. ft. of wall area spaced not to exceed 24" O.C. horizontally or vertically.

C. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide some type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties at not more than 24" O.C.

2. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

3.6 CONCRETE WALLS

A. See section 02515 Site Concrete.

B. Tie exterior wythe to concrete wall with continuous horizontal joint reinforcing, installed in mortar joints at not more than 16" O.C. vertically.

3.7 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide all types of masonry walls with continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side walls, 1/2" elsewhere. Lap

reinforcing a minimum of 6".

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by use of prefabricated 3/16" diameter extra heavy "L" and "T" sections spaced 8" O.C. vertically. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, and other special conditions.

D. Space continuous horizontal reinforcement as required by code but not more than 16" O.C. vertically, except for parapets, space reinforcement at 8" O.C. vertically, unless otherwise indicated.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown, and if not shown provide 1/2" expansion joints at all wall off sets and at a maximum 50' on center. Build-in related items as the masonry work progresses.

B. Build-in non-metallic joint fillers where indicated.

C. Build-in non-metallic joints where indicated; construct joints by either leaving in air space or inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

3.9 REPAIR, POINTING, AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non- metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Town Engineer's approval of sample cleaning before proceeding with cleaning of masonry.

3. rotect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.

4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clean water.

D. Protection: Provide final protection and maintain conditions in manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

END OF SECTION

SECTION 32 33 00
SITE FURNISHINGS AND COURTYARD AMENITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. Related Work specified elsewhere:

1.	Site Preparation	Section 31 10 00
2.	Excavation and Fill	Section 31 23 00
3.	Landscaping	Section 32 90 00
4.	Exterior Lighting	Section 26 56 19
5.	Low Voltage Electrical Power Conductors and Cables	Section 26 05 19

1.2 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services necessary for and reasonably incidental to complete the site furnishings as shown on the drawings, or specified, including, but not limited to the following:

1. Solid Stone Bench

2. Site Lighting (Fixture Specifications)

3. Gravel Pavement

4. Pavement with River Round Joints

5. Wood Timber Edging

1.3 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following Standards:

1. American Society for Testing and Materials, (ASTM)

1.4 SUBMITTALS

A. Submit manufacturer's product data for each type if factory fabricated item required showing size, materials, and installation procedures to the Landscape Architect.

B. Submit shop drawings for each custom fabrication showing materials, dimensions and installation procedures to the Landscape Architect.

C. Submit sample of each indicated finish to the Landscape Architect.

1.5 PROJECT CONDITIONS

A. Do not begin site furnishings and courtyard amenity work until final grading and surfacing is complete.

PART 2 PRODUCTS

A.1 MATERIALS

A. Solid Stone Bench : Furnish and install solid stone bench as follows: with thermal finish top and bottom and rock face sides. Set a 12” deep ¾” crushed stone bed single slab of granite. Size: 2’ W x 6’ L x 1.5’ H

Installation: Secured to concrete base according to manufacturer’s specs.

B. Landscape Lighting: Furnish and Install landscape lighting along asphalt walkway and courtyard.

1. Site Lighting Type ‘A’ at courtyard: As manufactured by Spectrum or approved equal. Warehouse Fixture with Arm Mount. Model 16 11GV-2L35K-EX.

   Pole: Cedar Wooden Post (12’x 5 ½’ Square) by Ryther Purdy or approved equal. See structural engineering plans for concrete footing.

   Cooper Post Cap: 100% cooper top, flat top by Coopertops USA (770)-837-3776 or approved equal. Model CFT0358W.

2. Mounted Building Lights: As manufactured by Spectrum or approved equal. Warehouse Fixture with Arm Mount. Model 16 11GV- 2L35K-EX. See Architectural and electricals plans.

3. Site Lighting Type ‘B’: As manufactured by Spring City or approved equal. Yorktown LED Luminaire with borough finale. Model ALMYRK-M2-LE040/EVX/X2-30-CR3-YSDP-FBR-CU. See drawings for more information.

   Pole: As manufactured by Spring City or approved equal. Washington Pedestrian Lamp Post. Model APSWSH-17-10.00-E4-TN2.88/3.00-CU. See drawings for more information.

Installation: Refer to Electrical Drawings and secure to concrete base according to manufacturer’s specs.

C. Gravel Pavement

1. Pea Gravel 1 ½” Thick Surface Course. Submit Sample for approval.

2. Filter fabric non-woven geotextile as supplied by MIRAFI Construction Products or approved equal; 140 N series to be installed over compacted subgrade below washed stones.

3. Steel Edge: As manufactured by Border Concepts or approved equal 1800-845-3343. Border King Series (1/4” Thick x 5” Height) with super stake staking system (3/16” Thick x 24” Long). Edging to be painted with manufacturer’s standard black enamel paint.

D. Pavement with River Round Joints: Furnish and install pavement with river round joints.

1. Washed Grey natural toned stones- 2” – 3” round. Submit sample for approval: 4” depth.

2. Filter fabric non-woven geotextile as supplied by MIRAFI Construction Products or approved equal; 140 N series to be installed over compacted subgrade below washed stones.

3. Steel Edge: As manufactured by Border Concepts or approved equal 1800-845-3343. Border King Series (1/4” Thick x 5” Height) with super stake staking system (3/16” Thick x 24” Long). Edging to be painted with manufacturer’s standard black enamel paint.

E. Wood Timber Edging: Northern white cedar; stacked and secured with re-bar as noted on drawings.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine subgrades and finish surfaces prior to beginning work. Do not install site furnishings and courtyard amenities until final surface is complete.

B. Remove loose and extraneous material from bare surface before placing site furnishings and courtyard amenities.

C. Prepare trenching for all wiring and conducts as per applicable electrical sections of project specifications.

3.2 INSTALLATION

A. Install all manufactured products per manufacturer's instructions.

B. Install all wiring, conduits, and fixtures as per applicable electrical sections of project specifications.

C. Erect plumb and secure.

D. Repair all surfaces damaged during installation.

3.3 CLEAN UP

A. Perform cleaning during installation of work and upon completion of work. Remove from site all excess materials, debris and equipment.

END OF SECTION

SECTION 32 90 00
LANDSCAPING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. Related work specified elsewhere

1. Meadow Seeding Section 32 92 00

1.2 SUMMARY

A. This Section includes the following:

1. Trees, Shrubs, & Ground covers.

2. New Lawn

3. Hydroseeding

4. Topsoil and soil amendments

5. Planting Mixes Fertilizers and mulches.

6. Bio-Retention Plantings

7. Stakes and guys.

8. Mulches, binders, and erosion control blankets.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.

2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packing.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of architects and owners, and other information specified.

E. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.

1. Analysis of existing surface soil.

2. Analysis of imported topsoil.

F. Manufacturer’s and suppliers test reports and product data for all mulches, binders and erosion control blankets.

1.4 QUALITY ASSURANCE

A. Standards: Comply with latest specifications and recommendations of New York State Department of Transportation for seeding.

B. Installer Qualifications: Engage an experienced Installer who has completed landscaping work including hydroseeding similar in material, design, and extent to that indicated for this Project and with a record of successful landscape, lawn and meadow establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

D. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce satisfactory topsoil.

E. Measurements: Measure trees and shrubs 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 (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by the Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

D. Handle balled and burlapped stock by the root ball.

E. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of trees and shrubs stored on site with a fine- mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 PROJECT CONDITIONS

A. Prior to submitting bid, contractor shall visit and familiarize himself with site and scope of work to be done by others. He is advised to examine all existing conditions not shown on drawings or mentioned in specifications, which would affect the cost of work required under the Contract, and to judge for himself conditions which will exist when he carries out his Contract, as he will not be allowed extra compensation for any additional work required thereby.

B. The Contractor shall review the plans showing approximate location of existing and proposed utilities and underground and surface structures. He shall acquaint himself with these features and any damage to them by reason of his performance of work will be his

responsibility and shall be repaired at his expense to the satisfaction of the Landscape Architect.

C. Percolation Test: Prior to any tree or shrub planting, the Contractor shall fill a minimum of 25% of the planting pits with water and observe the rate of percolation. If in the opinion of the Contractor, slow percolation indicates a soil condition might endanger the health of materials to be planted, he shall contact the Landscape Architect to establish a mutually acceptable method of providing adequate drainage. Compensation for any necessary drainage provisions shall be at a negotiated price. No claims for additional compensation arising from the loss of plant material due to ground water problems will be accepted unless this procedure is followed.

D. Protection: The Contractor shall provide at his own expense protection against trespassing and damage to all planted and seeded areas. If any areas are damaged, they shall be restored at the Contractor's expense. The Landscape Architect shall approve any means of protection prior to its erection.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during specified planting seasons for each type of plant material required.

1.8 WARRANTY

A. Warrant material and workmanship in accordance with Contract Documents for a period of one year after acceptance or for not less than two full planting seasons, whichever period is greater.

B. During the warranty period, the Contractor shall replace any plant which, for any reason has died or is in a dying condition, or which has failed to flourish in such a manner or to such a degree that its usefulness or appearance has been impaired, and he shall further make good any other damage, loss, impairment or defect in materials or work where the loss, impairment, destruction, or failure to flourish sufficiently is the result of inferior or defective materials of workmanship, or unfavorable weather conditions. The decision of the Landscape Architect as to the necessity of replacing any plants or materials or repair any defects in workmanship or of the cause of any destruction, loss, impairment, or failure to flourish shall be conclusive and binding upon the Contractor. The Contractor shall also make good all damage to persons or property caused by defective workmanship or materials or by the work required to remedy such defects.

C. During the warranty period, the contractor shall from time to time, inspect the maintenance operations carried on by the owner and promptly report to the Landscape Architect any methods, practices or operations which he considers unsatisfactory, and not in accord with his interests or good horticultural practices. The failure of the Contractor to so inspect or report shall be construed as an acceptance by him of the Owner's maintenance operations, and he shall not thereafter claim or assert that any defects which may later develop are the results of such methods, practices or operations.

D. Replacements: All trees, shrubs and ground cover found to be unacceptable, during the warranty period, shall be removed from the site and replaced, with material as originally specified, during the immediate planting season following the Landscape Architect's notification.

E. Lawn Warranty: Warrant all lawn areas for a period of one year after acceptance. At the end of the warranty period, all areas that are in a dead or dying or have not germinated condition shall be replaced.

1.9 TREE AND SHRUB ESTABLISHMENT

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs until owner acceptance.

1.10 GROUND COVER AND PLANT ESTABLISHMENT

A. Maintain ground cover and plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings until owner acceptance.

1.11 LAWN ESTABLISHMENT

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days or until Substantial Completion whichever is longer.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn- watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).

1. Water lawn at the minimum rate of 1 inch (25 mm) per week.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without

cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

1.12 ACCEPTANCE

A. Acceptance: Upon completion of the planting operations, the contractor shall request, in writing, an inspection by the Landscape Architect. If all work is acceptable the Landscape Architect will issue a certificate of acceptance and the one year warranty will begin. If any work is found to be defective or incomplete, the Contractor will not be issued an acceptance certificate.

B. Final Acceptance: At the end of the warranty period, the Contractor shall request an inspection by the Landscape Architect. If all work is found to be acceptable, the Landscape Architect shall authorize payment of the 10% retention. If replacements and/or remedial work are found to be necessary, this work will be completed by the Contractor and approved by the Landscape Architect prior to final payment.

PART 2 PRODUCTS

2.1 SLOW RELEASE WATER BAGS

A. Slow release watering bags placed at each tree- Treegater as manufactured by Spectrum Products or approved equal.

2.2 TREE AND SHRUB MATERIAL

A. Inspection: All plants shall be subject to inspection and approval by the Landscape Architect. Plants shall be inspected and tagged at the place of growth prior to digging. Inspection and tagging at the place of growth before shipment shall not affect the right to reject such plants if damage has occurred during digging, handling or delivery. Inspection will be for quality and size, variety and color, all other requirements are the responsibility of the Contractor.

The Contractor or his authorized representative shall be present during inspections.

The Contractor shall make a written request to the Landscape Architect ten working days in advance for all inspections at the various nurseries and collecting grounds. State the location of the nursery or collecting grounds and list the particular plants which are to be inspected as well as the sizes and quantities of such plants.

If the plants and materials to be inspected are located outside a 20 mile radius of the project site, the cost of inspection shall be paid for by the Contractor at a per diem rate plus travel, lodging and other out-of- pocket expenses.

B. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

C. Grade: Provide trees and shrubs of sizes and grades conforming to 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.

D. Label a minimum of one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical name and common name. These labels shall remain on plant material until Final Review for Warranty Conformance.

2.3 PLANT MATERIAL

A. General: Refer to the PLANT SCHEDULE on the drawings for specific types and quantities of plants to be furnished.

1. Plants shall be nursery grown in accordance with good horticultural practices and grown under climatic conditions similar to those in the locality of the project for at least two years. They shall have been root pruned within the last two years.

2. Plants shall be freshly dug. No heeled-in plants or plants from cold storage will be accepted.

3. Unless specifically noted otherwise, all plants shall be of specimen quality, exceptionally heavy, symmetrical, tightly-knit plants, so trained or favored in their development and appearance as to be unquestionably and outstandingly superior in form, number of branches, compactness, and symmetry.

4. Plants shall be sound, healthy and vigorous, well-branched and densely foliated when in leaf, free of disease, insect pests, eggs or larvae, and shall have healthy, well-developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving with the specified result.

5. Plants shall be true species and variety and shall conform to measurements specified in the plant schedule except that plants larger than specified may be used if acceptable to the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are accepted the ball of earth shall be increased in proportion to the size of the plant.

6. Container grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together.

2.4 GRASS MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated on Schedules at the end of this Section.

2.5 TOPSOIL

A. .Topsoil: ASTM D 5268, pH range of 5.5 to 7.0, 4 percent organic material minimum,20% maximum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth including invasive weeds.

1. Imported topsoil from offsite sources shall be obtained from naturally well-drained sites where topsoil occurs at least 4 inches (199 mm) deep; do not obtain from bogs or marshes.

2.

Mechanical Analysis Screen Size	**% By Weight Passing**
1”	100
¼”	97-100
No. 200	20-65

3. Topsoil in which more than 65% of the material passing a No. 200 sieve as determined by the Bouyoucous Hydrometer or by the decantation method, shell be rejected. All percentages based on the dry weight of the samples.

4. No on-site topsoil may be used for planting mixture backfill for tree or shrub planting pits or for perennial beds. On-site topsoil may be used for lawn areas if, when amended, its physical and nutrient properties meet the requirements of these specifications.

5. All topsoil suitable shall be kept separate from other material, stored and stocked piled on the site in locations approved by the Owner’s field representatives.

6. If there is not a sufficient quantity of topsoil present on the site the Contractor shall supply from off-site sources the necessary quantity of topsoil to complete the topsoil operations as specified here in or shown on the drawings. All such topsoil shall be furnished and spread as part of the contract sum. No claim for extra compensation by the Contractor will be allowed.

2.5 PLANTING MIXES

A. All planting mixes shall be prepared prior to delivery to site.

1. Planting Mix for Tree and Shrub Pit Planting Mix shall be as follows:

3 parts screened topsoil

1 part clean washed coarse sand

1 part peat humus

5 lbs. super phosphate per cubic yard of mix.

Submit certification of Planting Mix from soil distributor to the Landscape Architect for approval. Certification shall verifying composition of soil after mixing.

2.6 BIO-RETENTION MIX

A. Refer to Engineering drawings and specifications for planting mix specifications in all bio-retention areas, rain garden and planter boxes.

2.7 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.

1. Provide lime in the form of dolomitic limestone.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, coarse, ungraded, meeting ASTM C33 requirements for mason's sand free of toxic materials.

D. Humus: Shall be FS Q-P-166E Type IV natural domestic reed peat or sedge peat, but not peat-moss, free from sticks, stones, weeds, roots or other foreign matter and when delivered from stock piles containing between 35-50% moisture, suitable for mulch and of composition to provide ample water holding capacity and retention of plant food. Dark brown or black in color. Provide humus of the following analysis:

1. Maximum moisture content 70% by weight.

2. pH 5.0 to 7.5.

3. Water absorbing capacity not less than 300% of its own weight (oven dried basis)

4. Organic matter shall test 80% on a dry weight basis (samples dried at 100 degrees C)

5. Humus with organic matter of 75%-80% may be accepted, the deficiency to be made up in the quantity.

6. Low in content of woody material, iron and sulphur. Ash, on dry basis shall not be more than 20%.

E. Herbicides: EPA registered and approved, of type recommended by manufacturer.

F. Water: Potable.

2.8 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

E. Natural Organic Fertilizer: Similar to Milorganite, produced by the Sewerage Commission, Milwaukee Wisconsin having the following analysis:

1. Total Nitrogen (6.5% water insoluble nitrogen) 6.0%
Available Phosphoric Acid 2.0%
Soluble Potash 0.0%
Iron (Fe) 3.0%

2.9 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Shredded cedar bark for all plants. Fibrous texture and uniform dark brown color. Material shall be partially decomposed, of a consistency that not more than 25% will pass through a 1/2" sieve, 1 1/2" max. size with an organic content of not less than 90% and white wood content not exceeding 8%. "Cedar Scape" Decorative Shredded Cedar Bark by Atlantic Forest Product, Edenton, NC 27932 is an approved product.

B. Straw mulch for lawns.

1. Provide straw mulch over new lawns per New York State Department of Transportation item 713-19. Provide air-dry, clean, mildew, and seed free, salt hay or threshold straw of wheat, rye, oats or barley.

C. Mulch, Binders, and Erosion Control Blankets for Lawn Areas

1. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching. Acceptable products include Conwed Hydromulch, Conwed Corp., St. Paul, Minn., Cellin Hydromulch, Cellin Manufacturing, Inc., Lorton, VA. or approved equal.

2. Tackifier: Liquid concentrate diluted with water forming a transparent three-dimensional film-like crust permeable to water and containing no agents toxic to seed germination. Acceptable products include Polybind DLR, Celtite, Inc. Cleveland, Ohio; Curasol AK, American Hoechst Corp., Elk Grove, Illinois. or approved equal.

3. Erosion Control Blanket (slopes greater than 3:1) : Biodegradable made of curled wood excelsior with 80% six- inch fiber or greater. Material shall not contain any weed seed or chemical additives. Acceptable products include Curlex Single Net (Curlex 1), Green Color, as manufactured by American Excelsior Company, Arlington Texas or approved equal.

2.1 STAKES AND GUYS

A. Upright and Guy Stakes: Sound white cedar 3 to 3 1/2" inches in diameter by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized- steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

C. Hose Chafing Guard: Reinforced rubber hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.2 MISCELLANEOUS MATERIALS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.2 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. Contractor shall have planting mix prepared prior to delivery to the site.

1. Install planting mix as shown on the drawings.

3.3 LAWN PLANTING PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture. Total topsoil depth shall be 4" for all lawn areas.

C. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.

2. Till surface soil to a depth of at least 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.

3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

D. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading

to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations. Seed bed shall be inspected by the Owner's representative to ensure it has been properly compacted and fine graded prior to seeding, mulching and blanket installation.

E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 GROUND COVER, PLANT BED, AND PERENNIAL BED PREPARATION

A. Remove all existing soil to the required depth as shown on the drawings.

B. Install new planting mix to a depth as indicated on drawings.

3.5 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

1. Balled and Burlapped Trees and Shrubs: Excavate a minimum of 1 foot wider than the rootball diameter and equal to ball depth.

2. Container-Grown Trees and Shrubs: Excavate to a minimum of 1 foot wider than the container and equal to the container depth.

B. Obstructions: Notify the Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

3.6 PLANTING TREES AND SHRUBS

A. Planting Season: Plants shall be planted only within the following dates or as specified on the drawings. If special conditions exist which may warrant a variance in the planting dates, a written request shall be submitted to the Landscape Architect stating the special conditions and the proposed variance. Permission for the variance will be given if, in the opinion of the Landscape Architect, the variance is warranted.

1. Deciduous Trees and Shrubs: March 15 to May 31, and Sept. 15 to Nov. 15.

2. Evergreen Trees and Shrubs, Vines, Perennials: March 1 to May 15, and Sept. 1 to Nov. 1.

3. Ground Covers: March 1 to September 15.

B. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Place stock on setting layer of compacted planting soil.

2. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.

3. Place planting mix around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.

2. Place stock on setting layer of compacted planting soil.

3. Place planting mix around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

D. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

3.7 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by the 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 directed by the 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 size after pruning.

3.8 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk.

Allow enough slack to avoid rigid restraint of tree.

B. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) and more than 3-inch (75-mm) caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

3.9 PLANTING GROUND COVER AND PLANTS

A. Space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.10 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 3 inches (50 mm).

3.11 SEEDING NEW LAWNS

A. Sow seed with a spreader, hydro seeder, or a seeding machine. Use spreader at all confined areas and as directed by Owner's representative. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed at the following rates: Seeding Rate: 3 to 4 lb per 1000 sq. ft. (1.5 to 2 kg per 100 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

D. Install erosion control blankets on all slopes 3:1 or greater. Follow manufacturer's installation instructions rigidly. Install mulch and binders compatible with hydro seeding operations.

3.12 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

3.14 SEED MIXTURE SCHEDULE

A. General Lawn Mix: Provide certified grass-seed blends or mixes, proportioned by weight, as follows:

Proportion	Name	Pct. Germ.	Pct. Pure Sd.	Pct. Weed Sd.
55 pct.	Kentucky Bluegrass (Poa pratensis)	80	90	0.50
10 pct.	Perennial Rye Grass (Lolium perenne)	90	88	0.50
35 pct.	Turf- Type Tall Fescue	85	85	0.50

END OF SECTION

SECTION 32 92 00
MEADOW SEEDING

PART 1 GENERAL

1.1 GENEAL REQUIREMENTS

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

B. Related Work Specified Elsewhere:

1. Landscaping — Section 32 90 00

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials, tools, equipment, and services necessary for and reasonably incidental to complete the installation of seeded areas as shown on the drawings, or specified, including, but not limited to the following:

1. Soil preparation
2. Installation of meadow planting
3. Establishment period
4. Guarantee

B. All meadow installations specified in this section and on the drawings shall be in addition to lawn and installation performed for soil erosion, dust control, or construction stabilization purposes during construction of the project. Contractor shall provide the specified slope stabilization plantings and meadows in a fully established condition for all areas of the project within the contract limit line and areas of disturbance.

1.3 QUALITY ASSURANCE

A. Installation of meadows and related work shall be performed by a firm with a minimum of five years' experience specializing in this type of work.

B. Contractor shall be responsible for obtaining all permits and owners approval with regards to the application of any herbicides and removals.

1.4 SUBMITTALS

A. Provide and pay for soil tests for representative site soil samples and topsoil to be used. Tests shall show pH factor, mechanical analysis, percentage of organic content, recommendations on type and quantity of additives to establish the required pH factor and recommendations for any additional soil additives that are necessary to establish the meadows. Furnish all test results and recommendations to Landscape Architect prior to

beginning work. All testing to be done by a qualified testing service laboratory.

B. Submit soil test results to seed supplier: Amend seed mixture as recommended by supplier based on test results.

C. Submit seed vendor's certification for all required seed mixtures, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass and cover crop species.

1.5 PROJECT CONDITIONS

A. Work Notification: Notify Landscape Architect at least ten (10) calendar days prior to start of meadow planting installation operations.

B. Protect existing utilities, paving, and other facilities from damage caused by MEADOW installation operations.

C. Perform meadow installation work only after planting and other work affecting ground surface has been completed.

D. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

E. Restrict traffic from meadows until seeded areas are established. Erect signs and barriers as required.

F. Review site conditions with Landscape Architect to determine dry and moist areas surrounding basin for meadow planting.

1.6 REVIEW AND ACCEPTANCE

A. Final Review and Acceptance:

1. Review to determine final acceptance of meadow area will be made by the Landscape Architect, upon Contractor's written request. Provide notification at least five (5) calendar days before requested review date. Meadow areas will be acceptable provided all requirements, including the establishment period have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects. Upon final acceptance, the Owner will assume meadow maintenance.

1.7 GUARANTEE

A. All meadow areas shall be guaranteed for one year or until final acceptance whichever is longer.

B. The Contractor shall provide a uniform stand of meadow that is healthy, even colored, free of weeds, undesirable grass species, disease, and insects.

C. The Contractor shall repair or reseed without cost to the Owner, all planting areas that are not in the specified acceptable condition. Repair method shall be the same as originally specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Engineer's drawings and specifications for bio-retention soil specifications at basins where meadow seeding will occur.

B. Topsoil: ASTM D 5268, pH range of 5.5 to 7.0, 4 percent organic material minimum,20% maximum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth including invasive weeds.

1. Imported topsoil from offsite sources shall be obtained from naturally well-drained sites where topsoil occurs at least 4 inches (199 mm) deep; do not obtain from bogs or marshes.

2.

Mechanical Analysis Screen Size	**% By Weight Passing**
1"	100
¼"	97-100
No. 200	20-65

3. Topsoil in which more than 65% of the material passing a No. 200 sieve as determined by the Bouyoucous Hydrometer or by the decantation method, shell be rejected. All percentages based on the dry weight of the samples.

4. On-site topsoil if required may be used for meadow areas if, when amended, its physical and nutrient properties meet the requirements of these specifications.

5. All topsoil suitable shall be kept separate from other material, stored and stocked piled on the site in locations approved by the Owner's field representatives.

C. Lime: Lime material shall be ground agricultural limestone that contains at least 50% total oxides calcium oxide plus magnesium oxide. Ground limestone shall be ground to such a fineness that at least 50% will pass through a 100-mesh sieve and 98 to 100% will pass through a 20-mesh sieve. Lime shall be applied at rates as recommended by seed supplier and as determined by soil testing.

D. Fertilizer: No fertilizers shall be added to meadows unless specifically called out by seed supply company after analysis of soil samples. All fertilizers shall be uniform in composition, free flowing, and suitable for application with approved equipment.

Fertilizers shall be delivered to the site fully labeled according to applicable State Fertilizer Laws and shall bear the name, trade name, or trademark and warranty of the producer. Fertilizer should not be typical Lawn Food, but a Low nitrogen fertilizers recommended by the seed supply company for meadow establishment.

E. Seed Mix for Meadows: Seed shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures and pure live seed. Seed shall be labeled in conformance with U.S. Department of Agricultural rules and regulations under the Federal Seed Act. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Shall be supplied by Ernst Conservation Seeds, Inc., 8884 Mercer Pike, Meadville, PA 16335 (1-800-873-3321) or approved equal.

1. Seed Mix 'Fescue Meadow Mix' : shall be supplied by Ernst Conservation Seeds, Inc., 8884 Mercer Pike, Meadville, PA 16335 (1-800-873-3321), or approved equal.

Seed Mix 'Fescue Meadow' Mix shall be as follows:

Chewings Fescue	50.0%
Fescue Rubra Spp. Rubra (Fescue Native Red)	50.0%

F. Inoculants: Provide proper fresh rhizobium inoculum supplied by Preferred Seed Company, Inc., or approved equal.

G. Mulch and Binders:

1. Provide straw mulch over new meadows per New York State Department of Transportation item 713-19. Provide air-dry, clean, mildew, and seed free, salt hay or threshold straw of wheat, rye, oats or barley.

2. Wood Cellulose Fiber Mulch: Degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching. Acceptable products include Conwed Hydromulch, Conwed Corp., St. Paul, Minn., Cellin Hydromulch, Cellin Manufacturing, Inc., Lorton, VA or approved equal.

3. Tackifier: Liquid concentrate diluted with water forming a transparent three-

dimensional film-like crust permeable to water and containing no agents toxic to seed germination. Acceptable products include Polybind DLR, Celtite, Inc. Cleveland, Ohio; Curasol AK, American Hoechst Corp., Elk Grove, Illinois.

PART 3 EXECUTION

3.1 INSTALLATION SEASON

A. Installation of meadows shall be done only within the following dates:

1. Mix for dry sites can be applied at any time of the year. Mix for moist sites shall be sown between March 15th and May 1st or between August 21st and October 15th with a light mulching of weed free straw to conserve moisture.

3.2 SOIL PREPARATION

A. Examine finish surfaces and grades. Work shall proceed only after subgrade is within 0.10' of final grade, allowing for topsoil depth.

   Grades on the areas where plantings are to be established shall be maintained in a true and even grade.

B. Loosen subgrade of slope stabilization plantings areas to a MINIMUM DEPTH OF 4". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas that will be planted promptly after preparation.

C. Place approximately ½ the thickness of topsoil if required. Work into top of loosened subgrade to create a transition layer and then spread remainder of topsoil to meet lines, grades, and elevations shown, after light rolling and natural settlement.

D. Apply lime, at a rate determined by a soil test, to adjust the pH of the soil to not less than 6.5 and not more than 7.0. Distribute evenly over the soil and fully incorporate into the soil by tilling.

E. Apply low nitrogen fertilizer, at a rate determined by a soil test, to the soil. Distribute evenly over the soil and fully incorporate into the soil by tilling. Fertilizer application may be incorporated into hydroseeding procedure.

F. Grade slope stabilization plantings areas to a smooth, even surface with loose uniform fine texture. Roll and rake and remove ridges and fill depressions. Restore slope stabilization plantings areas to specified condition if eroded or otherwise disturbed after fine grading and prior to installation of plantings.

3.3 INSTALLATION OF MEADOW

A. Existing on site topsoil may be utilized for meadow areas if test results indicate soil is suitable

based on supplier's recommendations. Contractor to add amendments as required. Follow supplier's instructions ridgley for installation of all meadow seed mixes.

1. Provide a freshly rototilled seedbed free of rocks or dirt clumps greater than two inches in diameter.

2. Apply 10-10-10 fertilizer as recommended by seed supplier.

3. Divide the mixture in half and broadcast one half of the seed evenly over site using seed spreader. Apply the second half of the seed evenly over the site in a perpendicular direction. Seed at rates as recommended by seed supplier
4. Cover the seed with one eighth to one fourth inch of soil using a rake, drag, or piece of chain link fence.

5. Roll lightly and water with fine spray.

6. Mulch the designated planting area with approximately one inch of weed-free straw.

B. The Contractor shall provide at his own expense's protection against trespassing and damage to meadow areas. If any areas are damaged, they shall be restored at the Contractor's expense.

3.4 ESTABLISHMENT OF MEADOWS

A. Establishment shall begin immediately after plantings are installed and shall continue until final acceptance. The establishment period is intended to ensure that the project is delivered to the Owner with all slope stabilization plantings installed and in full, vigorous health.

B. Maintain seeded areas for a period of 60 days or until final acceptance, whichever is longer. Establishment shall begin after completed installation. Maintain seeding and work incidental thereto by performing the following and all other operations of care for the promotion of growth so that all work meets specifications throughout the establishment period.

1. Watering: Provide all labor and materials for watering operations required for maintenance. During the first week, perform daily watering to keep soil moist at all times and to maintain moist topsoil to a depth of at least four inches. During subsequent weeks, water the seeded areas to maintain adequate moisture in the upper four inches of soil necessary for the promotion of deep root growth. Minimum precipitation rate shall be one inch per week.

2. Mowing: Mow meadow at intervals recommended by the seed supplier.

3. Reseeding: During the establishment period, replace seeded areas that are dead, or are in an unhealthy, unsightly, or badly impaired condition as soon as possible during the specified planting season. Make such replacements in the same manner as specified for the original seeding at no additional cost to the Owner.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION

SECTION 33 00 00

MISCELLANEOUS UTILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. Coordinate with the Utility Companies for demarcation of work to be performed by the Utility Company and work to be performed by the Contractor.

B. This Section includes work to the limits indicated on the plans and includes, but is not limited to the following, as applicable:
   1. Installation and rerouting of electric service within the site, and electric lines to and from the building to the transformer as indicated on the plans.
   2. Installation and rerouting of telephone/communication service(s).
   3. Furnishing and installing pull/splice boxes and/or manholes as required.
   4. All trenching, excavation, and proper bedding and backfilling necessary and required for the installation of all conduit, manholes, splice boxes and all other items necessary for the complete installations.
   5. Complying with the requirements of the Geotechnical Engineer, Utility Company and all Authorities having jurisdiction.

C. Related Sections:
   1. Section 01 41 00 "Regulatory Requirements."
   2. Section 02 30 00 "Subsurface Investigation."
   3. Section 31 10 00 "Site Preparation."
   4. Section 31 23 00 "Excavation and Fill."
   5. Section 31 23 33 "Trenching and Backfilling."
   6. Section 31 25 00 "Temporary Soil Erosion, Sediment and Dust Control."
   7. Section 32 05 23 "Cement and Concrete for Exterior Improvements."

PART 2 PRODUCTS

2.1 SUBMITTALS

A. The materials used in the construction shall be those indicated on the Drawings, specified herein, required by the Utility Company, and/or required by Code. The Contractor shall supply, prior to installation, certificates of compliance for the materials used. The Contractor shall also submit shop drawings and catalog cuts to the appropriate Authority for all utility items and appurtenances for review and approval prior to ordering.

2.2 CONDUIT

A. PVC - PVC conduit with pull line shall be as required by the Utility Company having jurisdiction, or as required by Code.

B. Electrical Pull Boxes - The electrical pull/splice boxes to be used in the installation shall be of reinforced concrete construction, furnished complete with roadway type

cast iron frames and covers, and designed to accommodate an H-20 loading, as may be detailed on the Plans.

C. Submit shop drawings and catalog cuts of all items and appurtenances for approval prior to ordering.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer, Structural Engineer, MEP Engineer and all Authorities having jurisdiction. The most stringent requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to by the Contractor.

B. Prior to bidding, the Contractor will be required to become aware of the nature and extent of the work to be performed.

C. Trenching and Backfilling - shall be performed in accordance with Section 31 23 00 and 31 23 33 of these specifications titled "Excavation and Fill" and "Trenching and Backfilling", the details of the Drawings, and/or the Authority having jurisdiction.

D. Coordinate with the Owner's Field Representative and the Utility Owner for the limits of responsibility for work performed by the Utility Companies and work performed by the Contractor, as applicable. The actual locations of conduits, pull boxes, etc. shall be approved by the Authority having jurisdiction.

Refer to the Drawings by the MEP and/or Structural Engineer for additional information.

E. Sheeting and Shoring - The requirements for sheeting, shoring and staybracing shall be as described in Section 31 23 00 and 31 23 33 of these specifications titled "Excavation and Fill" and Trenching and Backfill," or as required by the Authority having jurisdiction.

F. Damage - The Contractor shall be responsible for all damage occurring as a direct or indirect result of his work. Where an item of work is to be “furnished” or “furnished and installed” by the Utility Company, the Site Work Contractor shall be responsible for all damage caused by his neglect or due to his failure to properly protect the item of work.

G. Electric and telephone/communication lines shall be installed in accordance with the requirements of the utility company having jurisdiction. Electric and telephone/communication lines shall be installed in underground conduit.

H. Minimum depth of cover over all underground conduit shall be two (2) feet or as required by the Utility Company or required by Code.

Conduit sizes shall be shown on the Drawings, but where not shown, the size of conduit shall be no smaller than that as required by the National Electric Code for the number and size of wires and cables contained therein. No conduit shall be smaller than one and one half (1 1/2) inch diameter.

All bends shall be made with radii as long as practical, but in no case shall they be less than that allowed by the National Electric Code. Bends shall be made with the specified radii when and where indicated on the Drawings.

Conduit runs shall be straight as is practical and shall be pitched wherever possible, to eliminate traps and pockets in the runs which might collect dirt or moisture.

I. PVC Conduit - PVC conduit shall be joined by means of solvent cement joints in accordance with the manufacturer's recommendations. Conduit shall be cut square and deburred prior to joining.

Conduit may be bent on the job providing approved heat bending equipment is used. Bending shall be performed so as not to distort or diminish the cross-section of the conduit.

J. Metal Conduit - The ends of all metal conduit shall be cut square, and reamed to remove all burrs and obstructions. When conduit ends are threaded, reaming shall be done after the threads are cut. Reaming shall be performed with a proper reamer, and not with makeshift tools.

All joints shall be made with approved galvanized threaded couplings, and the ends of the conduit shall butt squarely and solidly into the coupling.

K. Approved insulated grounding bushings shall be provided wherever conduit ends are exposed or open and are not to be capped or plugged.

L. All buried conduit shall be painted with a bitumastic asphalt compound.

M. Underground Electrical Pull/Splice Box - The cover shall be placed flush with finished grade surface, and the boxes shall be installed only in areas where there will be no vehicular traffic or where directed.

3.2 COORDINATION

A. The Contractor is referred to the Building Construction Drawings for the electric and telephone/communication service line work.

B. Coordinate with all Utility Owners and Authorities having jurisdiction for the installation of work.

3.3 RECORD DRAWINGS (AS APPLICABLE)

A. In addition to the requirements stated in Division 1 Specification Sections, if directed, an "as-built" set of record drawings shall be kept on the site concurrently with the progress of the work. These "as-built" record drawings shall consist of a marked set of the drawings with additional sketches as required, denoting and dimensioning accurately and neatly all changes and conditions that are variations from the drawings.

B. All changes in alignment and grade of the newly installed underground piping which are not marked by a visible surface structure such as manholes, shall be recorded. These locations shall be located in reference to three (3) separate permanent surface reference points and recorded on the "as-built" record drawings. An accurate record shall also be kept of all existing site items which are reworked or relocated.

C. Upon completion of the work, the Contractor shall deliver the final "as-built" record drawings in Autocad format and on a thumb drive, and bear the original signature and seal of a licensed land surveyor in the State of New York or the design engineer, prepared pursuant to the New York State Education Law. All modifications must be included on the "as-built" with all changes bubbled in red, including details, and be of the same scale as the approved plans. All information pertaining to the utilities must be included on the plan and profiles, with clear delineation between pre-existing utilities and newly installed utilities. All drawings must include the date and an "as-built" stamp or notation on each sheet, and the full set of plans including detail sheets. A list must be provided of all deviations from the original approved plans shown on the record drawings, together with the Contractor's explanation thereof.

D. If utilities are constructed within easements, the easements must be included, showing dimensions of the utilities located within the easements, demonstrating that they are located wholly within the easement boundaries.

END OF SECTION

SECTION 33 10 00
WATER UTILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. The Water Authority referred to herein shall be Westchester Joint Water Works. A bonded and insured, licensed, and pre-qualified water main contractor may be required for all water work in the public right-of-way, as applicable.

B. Coordinate with the Water Authority for demarcation of work to be performed for a fee (as applicable), by the Water Authority, and work to be performed by the Contractor.

C. The Contractor is required to obtain all permits and pay all fees for all work contained herein, and shall be included in the Contract sum.

D. This Section includes work to the limits indicated on the plans and includes, but is not limited to the following:
   1. Installation of water service(s) consisting of all pipe, fittings, valves, valve boxes, hydrants, anchor and/or thrust blocks, joint restraint, harnessing, and all necessary and required appurtenances, accessory items and operations including connection(s) to the proposed and existing water piping and relocation of an existing hydrant.
   2. Resetting new or existing castings to grade.
   3. Testing and disinfection.

E. Related Sections:
   1. Section 01 41 00 "Regulatory Requirements."
   2. Section 02 30 00 "Subsurface Investigation."
   3. Section 31 10 00 "Site Preparation."
   4. Section 31 23 00 "Excavation and Fill."
   5. Section 31 23 33 “Trenching and Backfilling.”
   6. Section 31 25 00 “Temporary Soil Erosion, Sediment and Dust Control.”
   7. Section 32 05 23 “Cement and Concrete for Exterior Improvements.”

PART 2 PRODUCTS

2.1 SUBMITTALS

A. The materials to be used in the construction shall be those indicated on the Drawings and specified herein, and/or as required by the Water Authority. The Contractor shall supply, prior to installation, certificates of compliance for the materials used. The Contractor shall also submit shop drawings and catalog cuts of all water items and appurtenances (pipes, fittings, joints, restraints, valves, valve boxes, hydrants, etc.) for review and approval prior to ordering.

2.2 WATER SYSTEM AND APPURTENANCES

A. General - All materials for water lines shall be in accordance with the requirements of the Water Authority, including but not limited to domestic made pipe, couplings, fittings, valves, valve boxes, joint restraint, etc.

B. Ductile Iron Pipe (DIP) - All water lines greater than three (3) inches in diameter and appurtenances, shall be ductile iron pipe, Class 52 or of the class and size indicated on the plans, and shall conform to the requirements of AWWA Specifications C-150 and C-151. Pipe shall be furnished in eighteen (18) or twenty (20) foot nominal lengths. (See "Service Lines" for water piping less than three (3) inches in diameter).

Lining and Coating - All pipe shall be double cement lined in conformance with AWWA Specification C-104.

Joints - shall be push-on or mechanical joints as required by the Water Authority, in accordance with AWWA Specification C-111 and shall be furnished complete with Nitrile rubber gaskets or as required by the Water Authority, and brass wedges to permit electrical conductivity across the joints (2 wedges per joint). Ductile iron pipe and restrained joint gaskets must be from the same approved pipe manufacturer.

Fittings - All iron fittings shall be compact ductile iron fittings in accordance with AWWA Specification C-110, and/or AWWA Specification C-153, pressure rated 350 psi, and shall be furnished with mechanical joints in accordance with AWWA Specification C-111. Fittings shall be double cement lined and bituminous coated in conformance with AWWA Specification C-104. All joints shall be furnished complete with accessories.

Joint Restraint - shall be Mega-lug series 1100 mechanical joint retaining glands by EBBA, EZ restraint glands by Capital Industries, Inc. or MJ Tuf Grip TLD Series 1000 mechanical joint restraint by Tyler/Union.

T-Head Bolts and Nuts - shall be Cor-Blue manufactured by NSS Industries or Birmingham T-bolts and nuts manufactured by Birmingham Fastener Manufacturer.

Transition Couplings - shall be Power Seal Model 3501, Dresser Model 253 or Omni Model 441 with stainless steel nuts and bolts per AWWA C-219.

Bronze Wedges - The manufacturer of the pipe shall furnish two silicon bronze wedges for each length of pipe to be used in the pipe installation to provide a positive means of electrical conductivity across the pipe joint.

C. Hydrants - All hydrants shall be Water Authority standard, and may be equal to Super Centurion 250, Model A-423, three-way type, dry barrel and traffic model design, opening counter-clockwise, as manufactured by Mueller Company or approved equal and conform to the latest revision of AWWA C502 Standards. Hydrant must be approved by the Water Authority.

The compression type main valve of the hydrant shall be 5.25 inch diameter, that closes with pressure for positive seal and be reversible in design.

Also, the hydrant shall:

a. be rated for 250 psig maximum working pressure.
b. have a high flow capacity with 6-inch D-150 mechanical joint inlet connection;
c. three-way nozzle arrangement of one pumper nozzle and two hose nozzle. The hose nozzles shall have 2.5-inch nominal inside diameter (ID) and 3-inch outside diameter (OD) with eight (8) threads per inch - type of thread - New

York Corporation. The pumper nozzle shall have 4.5-inch ID and 5.75-inch OD with four (4) threads per inch - type of thread - National Standard;

d. have a 1.5 inch pentagon shaped operating nut that opens counter-clockwise;
e. have stainless steel nuts and bolts on bonnet and mechanical joints.
f. have five and a half (5 1/2) feet of bury, unless otherwise noted or required. Hydrant lateral shall be installed level, therefore the correct hydrant burial must be installed to clear all utility crossings.

D. Installation of a Fire Hydrant - The fire hydrant shall have a minimum 6 inch diameter double cement lined DIP lateral that connects the hydrant with a new/existing water main. A 6 inch resilient wedge valve that opens counter-clockwise shall be installed between the hydrant and the supply main to permit isolation of the hydrant for maintenance purposes.

A valve box shall be provided for the valve. The valve box shall be of three piece, cast iron construction, and adjustable screw-type with 51/4 inch shaft. It shall be designed for heavy traffic, H-20 loading. The cover shall be round and shall be marked "WATER".

The valve box shall be placed on concrete and shall be centered plumb over the operating nut of the valve.

It shall be adjusted so that the cover will be flush with the finished grade of the pavement or ground.

Hydrants shall be cleaned and their operation checked before installation. The hydrant barrel shall be set so that the pumper or hose nozzle cap will be 24 inches from the gutter face of the road's curb or as directed by the Water Authority. When the hydrant is set in the median between the curb and the sidewalk or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk.

The hydrant shall stand plumb and shall be set to the established grade, with nozzles at least 18 inches above ground, as shown on drawing or as directed by the Water Authority.

The pumper outlet nozzle shall face the street and the hose nozzles shall be parallel with the curb.

The hydrant shall rest on a block of concrete of adequate size. Thrust blocks shall be placed against undisturbed ground.

It shall be strapped with rods in two distinct operations. The tee at the supply main shall be rodded to the hydrant branch valve and then from the valve to the hydrant. The tie rods shall be ¾ inch diameter cold rolled steel full threaded. The hydrant base shall be surrounded by ¾ inch clean crushed stone/gravel to level of 6 inches above the drain outlets (weep-holes). The stone shall be extended at least 1 foot on all sides of the hydrant. The stone shall be covered with 8 mil polyethylene or similar waterproof material before backfilling.

An assurance shall be made that the weep holes are clear and the hydrant properly drains after use.

The newly installed hydrant shall be painted with two coats of paint in the standard Water Authority colors, and disinfected and tested for proper drainage in accordance with AWWA standards. Any hydrant that does not properly drain shall be re-excavated and corrections shall be made to ensure proper drainage.

The area that was disturbed during the installation/replacement of the hydrants shall be restored to match the existing conditions.

E. Tapping Sleeve and Gate Valves (as applicable) - may be installed by the Water Authority. If not, it shall be installed by the Contractor in accordance with AWWA specification C-500 and meet the specifications for resilient seated gate valves. Gate valves shall have mechanical joints x flanged ends. It shall be equal to Mueller Co., style T-2360 with stainless steel nuts and bolts. Interior surfaces shall be epoxy coated to meet all the applicable requirements of ANSI/AWWA C550. Valve shall meet or exceed ANSI/AWWA A509 standards for resilient seated valves and be non-rising stem type, opening counter-clockwise. Tapping sleeve shall be full circle construction, Power Seal Model 3490 fabricated stainless steel with type 304 (18-8) stainless steel flange. Shell gasket shall be 1/4" thick Nitrile (Buna-N, NBR) Check-O-Seal with multi o-ring sealing ribs from 100% new rubber. Branch gasket shall be Hydro Twin Seal dual o-ring design. Stainless steel type 304 (18-8) nuts and bolts per ASTM A193 and A194. Tapping valves have oversize seat rings to permit entry of a standard machine cutter. In the open position, valve gates shall be clear of the ports so the cutter will pass through without making contact with the gates. Valves shall have an inlet flange to assure correct alignment. Valves shall have a standard mechanical joint outlet end and shall fit any standard tapping machine.

   The flange shall be gasketed to accept a standard tapping valve. All gasket material for flange gasket and circle seal shall be compounded to resist water, oil, hydrocarbon fluids, temperatures up to 212 degrees Fahrenheit and designed for water service.

F. Resilient Seated Gate Valves - as required by the Water Authority and may be equal to Mueller Co. Style A-2361, opening counter-clockwise, with stainless steel nuts and bolts, made in accordance with AWWA Specification C-515. Gate valves shall be iron body, bronze mounted, non-rising stem assembly, with triple O-Ring seals and mechanical joint ends complete with fittings. The interior body and bonnet shall be coated with 8 mils minimum fusion bonded epoxy complying with AWWA Specification C-550. Valves are to be rated at 350 psig maximum working pressure, 700 psig static test pressure. All valves are to be hydrostatically tested at 400 psi. Gate valves shall conform to the requirements of the Water Authority.

G. Gate Valve Boxes - may be furnished by the Water Authority. If not, boxes shall be adjustable two piece screw type and shall be made of cast iron (heavy pattern), having a minimum interior diameter of 5 1/4 inches, length as required, equal to Tyler boxes, Series 6855 or B & T Figure 4908. It shall have a base of the proper size to fit the valve upon which it is installed and shall have a drop cover marked "WATER". Gate valve boxes shall meet the requirements of the Water Authority.

H. Service Lines - All service lines less than three (3) inches in diameter shall be Type K copper tubing conforming to the "Specifications for Seamless Copper Water Tube" ASTM Designation B-88 and AWWA Specification C-800. Joints between the water main and curb stop shall be connected by Mueller Cat. #H-15403 straight coupling three part union, 110 conductive compression for CTS O.D. tubing, both ends, or approved equal.

   All service lines three (3) inches or greater in diameter shall be the class ductile iron pipe indicated on the plans and as determined by the Water Authority, conforming to the requirements specified elsewhere in this Section for Ductile Iron Pipe.

I. Corporation Stops - shall be Mueller 300 ball type Cat. #B-25008, AWWA taper thread inlet with Mueller 110 conductive compression connection for CTS O.D., tubing outlet,

constructed of 85-5-55 ASTM B62 brass, and shall conform to AWWA Specification C-800. For service sizes greater than 1 1/2", service saddle equal to Mueller DR25 Series with double stainless steel straps and AWWA taper thread (C.C.) outlet is required.

J. Curb Stops - shall be Mueller 300 ball type Cat. #B-25204 with Mueller Cat. #H-15071 straight coupling, quarter turn check. Inlet and outlet shall be copper flare nut, both ends, constructed of 85-5-55 ASTM B62 brass, and shall conform to AWWA Specification C-800.

K. Curb Box for Curb Stop - shall be cast iron, approved equal to Mueller H-10350 "Buffalo" type, arch pattern, adjustable curb box complete with necessary extension section, lid and brass locking screw.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer, Structural Engineer and/or MEP Engineer. The most stringent requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to by the Contractor.

B. As applicable, work may not commence until the water main has been approved by the Westchester County Department of Health.

C. The Contractor shall install all water line pipe, fittings and appurtenances in the locations as shown on the Drawings and/or as directed by the Owner's Field Representative. Pipe and fittings shall be of the type and sizes specified and shall be laid accurately to line and grade. Hydrants, valves and all other water line appurtenances shall be accurately located and properly oriented.

D. The installation of all water lines shall conform to the requirements of all Authorities having jurisdiction. The Authority as referred to herein shall be understood to refer to the Water Authority. This authority shall also include maintenance of traffic.

E. The requirements of the Health Department and any other Authority having jurisdiction shall govern the horizontal and vertical separation of water lines from sanitary sewers and storm drains and the hydrostatic testing and disinfection of the water line.

F. Water lines which are installed within easements shall be installed in accordance with the requirements of the Water Authority. Prior to acceptance of the Work, the Contractor will be required to submit a plan prepared by a licensed land surveyor, registered in the State in which the Work is performed, certifying the location of the water lines within the easements. The plan shall also show the location of all valves and hydrants, and service locations, with ties from three accessible points of reference to each appurtenance. All additional information required by the Water Authority shall also be included. (See Section 3.12, "Record Drawings.")

3.2 STORAGE AND HANDLING

A. Storage - Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the job shall be in accordance with the manufacturers' recommendations, subject to the approval of the Owner's Field Representative. Location of storage areas on the site shall be subject to the approval of the Owner's Field Representative.

B. Handling - All pipe, fittings, valves, hydrants and other water line appurtenances shall be protected against impact, shock and free fall, and only equipment of sufficient

capacity and proper design shall be used in their handling. Special care shall be taken to prevent damage to pipe coatings. The interior of the pipe shall be cleaned before being laid and shall be kept clean until accepted.

All material shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning; and all nuts and bolts checked for tightness. Valves, hydrants and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced to the satisfaction of the Owner's Field Representative and Site Engineer at the Contractor's expense.

3.3 DAMAGE

A. General - Pipe, fittings, valves, hydrants and other water line appurtenances which are defective from any cause, including damage caused by handling, and determined by the Owner's Field Representative as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Field Representative.

B. Damage Due to Cutting - All cutting of ductile iron pipe shall be done with an approved power-driven or mechanical cutter. All cut ends shall be thoroughly examined for possible cracks caused by cutting, and any cut pipe found to have such cracks shall be rejected. The cut ends of all pipe shall be beveled and ground smooth.

C. Inspection for Damage - All pipe and fittings shall be subjected to a careful inspection and proper testing just before being laid. Any pipe, fitting or appurtenance which shows a crack or which has received a severe blow that may have caused an incipient fracture even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work.

D. Damage Prior to Acceptance - Pipe and all water line appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced as directed by the Owner's Field Representative, at the Contractor's expense.

3.4 PIPE INSTALLATION

A. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with the details on the Drawings and Section 31 23 33 "Trenching and Backfilling". Pipe shall be laid upgrade with bells uphill unless otherwise directed by the Owner's Field Representative, with the top of pipe at a minimum depth as specified hereinafter, except where otherwise noted on the Drawings or directed by the Owner's Field Representative.

No pipe, valve, blow-off or fitting shall be laid on wood blocks. Similarly, no pieces of rock, brick, or other material other than earth or gravel shall be left under or adjacent to the pipe. Pipe laying, in general, shall conform to the latest Standard Specifications of the AWWA for laying ductile iron pipe.

Generally, trenches shall not be opened for more than 200 feet in advance of pipe laying nor left unfilled for more than 100 feet in the rear of pipe laying. New trenches will not be permitted when earlier trenches require backfilling.

Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and debris before installing in the line. Extreme care shall be taken to keep the bells of the pipe free from dirt and debris so that joints may be properly assembled.

No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe.

B. Bedding and Backfilling - The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 31 23 33 of these Specifications entitled "Trenching and Backfilling", as shown on the details of the Drawings, and in accordance with the Water Authority.

C. Sheeting and Shoring - The requirements for sheeting, shoring and staybracing shall be as described in Section 31 23 00 and 31 23 33 of these specifications titled "Excavation and Fill" and "Trenching and Backfilling."

D. Protection During Construction - The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk.

At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

The Contractor shall furnish a sufficient pumping plant and shall provide and maintain at his own expense satisfactory drainage wherever needed in the trench and other excavations during the progress of the Work and at its completion for final inspection. No pipe or other structure shall be laid in water, and water shall not be allowed to flow or rise under any concrete or other masonry. All water pumped or bailed from the trench or other excavation shall be conveyed in proper manner to a suitable point of discharge. The flow in all sewers, drains and watercourses encountered on the Work and in gutters along the sides of or across the Work shall be entirely provided for, both temporarily and permanently, as required, by the Contractor at his expense. All offensive water shall be removed from the Work at once.

E. Pipe Deflection - Maximum allowable deflection for pipe laid without fittings shall not exceed the pipe manufacturer's requirements and the requirements of the Water Authority. Deflection which exceeds the maximum allowable as established by the pipe manufacturer and the Water Authority or any other Authority having jurisdiction shall be grounds for rejection of the line of pipe by the Owner's Field Representative.

F. Cover on Main - The water main shall be laid so as to provide a minimum cover of four and one-half (4 1/2) feet below existing grade if existing grade is to remain, and four and one-half (4 1/2) feet below proposed finished grade or future grade, whichever is lower, or meet the requirements of the Water Authority, whichever is more stringent. The Contractor is advised that at pipe crossings, minimum cover must be maintained and also proper clearance between pipes must be maintained. No additional payment will be made for increased depth of trench to comply with crossing requirements.

3.5 JOINTS

A. All joints are to be made watertight and pressure-tight in accordance with the requirements specified herein.

B. Unless otherwise permitted, jointing of all pipe and fittings shall be done entirely in the trench.

C. Except as may be otherwise specified herein, all sections of the pipe to be joined shall have a bell end and a plain end. Installation of cut sections of pipe without a bell end will not be allowed, except as specifically authorized by the Owner's Field Representative and/or Site Engineer in instances where repairs are to be made or pipe

closures are required. In such instances, the design of the joint shall be as approved by the Site Engineer.

3.6 WATER LINE APPURTENANCES

A. Fittings
   1. Fittings shall be used at all breaks in grade or alignment where deflection of the pipe exceeds the maximum allowable pipe deflection as specified hereinabove. Only proper fittings shall be used to obtain the required deflection.

B. Valves and Valve Boxes
   1. Valves and Valve Boxes
      a. Gate valves shall be installed on all water lines where and as shown on the Drawings and as specified herein. Unless otherwise stated, valves shall be of the same size as the line.
      b. Gate valves shall be installed on all hydrant laterals where and as shown on the Drawings.
      c. Valves shall be installed on all service lines in the locations shown and/or where directed by the Owner's Field Representative.
      d. Valve boxes shall be placed over all buried valves. Valve boxes shall be placed so as not to transmit vehicle loads or shock to the valves and shall be centered and set plumb over the operating nut of the valve. The cover of the box shall be set even with finished grade.

C. Hydrants
   1. Hydrants shall be installed where and as shown on the Drawings and as specified herein.
   2. Hydrants shall be installed vertical and plumb, with the proper cover over the hydrant lateral and proper vehicular clearance from curb line and/or edge of pavement. The installation shall provide proper access for fire department connections.
   3. Hydrant leads shall be installed level.
   4. Hydrants and their installation shall conform to the requirements of the Water Authority and the Fire Department.

D. Hydrants Relocated
   1. Remove existing hydrant, valve and valve box, store, clean and relocate where shown on the plans, including excavation and backfill.
   2. Abandon existing piping in accordance with the Water Authority.
   3. Dispose of existing concrete blocking, piping and harnessing off-site in accordance with all regulations.
   4. Hydrant or appurtenances damaged in removing, handling, storing or hauling due to the Contractor's operations shall be replaced in kind by the Contractor at no cost to the Owner.
   5. Install hydrant and appurtenances with new piping, harnessing, fittings, connections, and concrete blocking, including backfill material required by the Authority having jurisdiction.
   6. Paint the hydrant(s) with two coats of paint as required by the Water Authority.

E. Restraining Devices
   1. Mega-lugs are required to restrain push-on DIP to mechanical joints.
   2. At hydrants and fittings, the installation shall also be rodded in accordance with the detail shown on the Drawings and/or as directed by the Owner's Field Representative.

3. All plugs, caps, dead-ends and other fittings as may be directed shall also be harnessed to the adjacent pipe with steel clamps and tie rods. If directed by the Owner's Field Representative, harnessing shall be extended beyond the adjacent pipe to provide proper length of restrained pipe.
4. The installation of the restrained joints and rodding shall be as approved by the Site Engineer and the Water Authority.

F. Concrete Blocking
1. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and whenever abnormal thrust forces are developed, the Contractor shall construct thrust and/or anchor blocks as detailed on the Drawings. They shall be constructed of Class "A" 4,000 psi concrete, of minimum dimensions as detailed on the Drawings or of adequate size to suit actual conditions to withstand the pressures anticipated, and shall be founded in virgin soil.

3.7 CONNECTIONS TO EXISTING FACILITIES

A. General Requirements - The Contractor shall make all required connections of the proposed water line facilities where and as shown on the Drawings and/or as directed by the Owner's Field Representative.

B. As applicable, and at the Contractor's expense, pressurized line stops may be required by the Water Authority so that the existing water line remains active while connections are made.

C. Compliance with Requirements of Owner of Facility - Connections made into existing water line facilities shall be done in accordance with the requirements of the owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the owner of the existing facility shall be included in the Contract Sum.

3.8 RELAYING AND/OR ALTERATION OF EXISTING WATER LINE

A. General Requirements - The Contractor shall relay portions of the existing water line which interfere with the proposed construction where and as shown on the Drawings and/or as directed by the Owner's Field Representative.

B. Compliance with Requirements of Owner of Facility - Relaying and/or alteration of existing water line facilities shall be done in accordance with the requirements of the owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of relaying and/or alterations in accordance with the requirements of the owner of the existing facility shall be included in the Contract Sum.

C. Damage to Existing Water Line - The Contractor shall exercise extreme care during such relaying and/or alteration so as not to damage any portions of the water line which are to remain. Any such damage shall be repaired by the Contractor at his own expense and to the satisfaction of the Owner's Field Representative and the owner of the facility.

3.9 SERVICE LINES

A. General Requirements - If not performed by the Water Authority, the Contractor shall make all required connection(s) of the building water service line(s) into the water distribution system where and as shown on the Drawings and/or as directed by the Owner's Field Representative. Unless indicated otherwise by the Water Authority, work shall include making the service line connection(s) to the water distribution

system, furnishing and installing pressurized line stops where required, service line valves, valve boxes and all service line pipe from the on-site water distribution system to point(s) located five (5) feet outside of the building lines and properly sealing the end(s) with watertight and pressure-tight plug(s).

B. Service Lines Smaller than Three (3) Inches - Unless otherwise specified, all service lines two (2) inches or smaller in diameter shall be Type K copper pipe. Each service line shall be valved with curb stop where and as directed, and a curb box shall be installed over the curb stop. A corporation stop shall be used to connect the service line to the main. Taps shall be made using proper tools and proper procedures as recommended by the manufacturer of the water pipe. Unless otherwise specified, there shall be no joints in the service line between the water main and the curb stop.

C. Service Lines Three (3) Inches or Greater - All service lines greater than three (3) inches in diameter shall be double cement lined, Class 52 ductile iron pipe. Each service line shall be valved with a gate valve where and as directed. Unless specified otherwise, connections of service lines at the main shall be made with appropriate size tees.

D. Coordination with Building Plumbing Contractor - The Contractor will be required to coordinate his work with the work of the building plumbing contractor to determine the exact location(s) and elevation(s) of the point(s) of entry into the building(s).

3.10 TESTS

A. The Contractor shall provide all necessary equipment and shall perform all work required in connection with all tests as specified herein. All pipe shall be tested by hydrostatic pressure, fifty (50) percent in excess of the normal psi working pressure but not less than 150 psi or more than the design rating of the pipe or appurtenances, in accordance with AWWA Specification C-600. The test pressure shall be determined by the Water Authority and/or Owner's Field Representative. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. If necessary, the pipes shall be tapped at high points to vent the air. Required pressure, as measured at the point of lowest elevation, shall be applied for not less than two (2) hours, and all pipe, fittings, valves, hydrants and joints shall be carefully examined for defects. Leaky joints shall be made watertight.

B. A leakage test shall also be conducted in accordance with AWWA Specification C-600. Permissible leakage shall be in accordance with AWWA Specification C-600.

C. If the section being tested shall fail to pass the pressure test or the leakage test, or both, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fittings or joints, and all such work shall be done at his expense and at no additional cost to the Owner.

D. In the event of conflict between the tests specified herein and the test requirements of the Water Authority, Health Department or any other Authority having jurisdiction over all or any portion of the water lines installed under this Contract, the more restrictive requirements shall govern.

3.11 DISINFECTION OF COMPLETED LINE

A. After the water line has passed the required pressure and leakage tests and before being placed in service, the entire line shall be disinfected. All disinfecting methods and materials shall be in accordance with AWWA Specification C-651, except that the "Tablet Method" as specified in Section 4.4.2 of AWWA Specifications C-651 shall not be used. Two acceptable results of bacteriological analyses of samples of water

collection from every 1,200 feet and at least 24 hours apart from the new distribution water line after disinfection and before use of the water lines shall be submitted to the Water Authority (and Department of Health if required), as part of certification of construction compliance. All disinfection operations and procedures shall meet with the approval of the Water Authority and Health Department.

B. If the initial bacteriological tests are not satisfactory, the Contractor shall do everything necessary to obtain satisfactory bacteriological tests including making provisions to isolate shorter sections of the line if necessary to locate the source of contamination. All work necessary and required to obtain satisfactory bacteriological tests shall be at the Contractor's expense and at no additional cost to the Owner.

C. In the event of conflict between the tests specified herein and the test requirements of the Water Authority, Health Department or any other Authority having jurisdiction over all or any portion of the water lines installed under this Contract, the more restrictive requirements shall govern.

3.12 RECORD DRAWINGS

A. In addition to the requirements stated in Division 1 Specification Sections, an "as-built" set of record drawings shall be kept on the site concurrently with the progress of the work. These "as-built" record drawings shall consist of a marked set of the drawings with additional sketches as required, denoting and dimensioning accurately and neatly all changes and conditions that are variations from the drawings.

B. All changes in alignment and grade of the newly installed underground piping which are not marked by a visible surface structure such as manholes, shall be recorded. These locations shall be located in reference to three (3) separate permanent surface reference points and recorded on the "as-built" record drawings. An accurate record shall also be kept of all existing site items which are reworked or relocated.

C. The as-built may be required for submission to Westchester County Department of Health (DOH), prior to submitting the final record drawings. The newly installed works may not be placed into service, until the completed works approval is received from the DOH, as applicable.

D. Upon completion of the work, the Contractor shall deliver the final "as-built" record drawings in Autocad format and on a thumb drive, and bear the original signature and seal of a licensed land surveyor in the State of New York or the design engineer, prepared pursuant to the New York State Education Law. All modifications must be included on the "as-built" with all changes bubbled in red, including details, and be of the same scale as the approved plans. All information pertaining to the utilities must be included on the plan and profiles, with clear delineation between pre-existing utilities and newly installed utilities. All drawings must include the date and an "as-built" stamp or notation on each sheet, and the full set of plans including detail sheets. A list must be provided of all deviations from the original approved plans shown on the record drawings, together with the Contractor's explanation thereof.

E. If utilities are constructed within easements, the easements must be included, showing dimensions of the utilities located within the easements, demonstrating that they are located wholly within the easement boundaries.

END OF SECTION

SECTION 33 30 00
SANITARY SEWERAGE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits indicated on the Plans, and includes but is not limited to the following:
   1. Installation of sanitary sewer service to the proposed building consisting of all manholes, pipe, drop connections (as applicable), and all necessary and required accessory items and operations including clean-outs if required, and connection(s) to the proposed and/or existing sanitary sewer piping.
   2. Resetting new or existing castings to grade.
   3. Testing.

B. Related Sections:
   1. Section 01 41 00 “Regulatory Requirements.”
   2. Section 02 30 00 “Subsurface Investigation.”
   3. Section 31 10 00 “Site Preparation.”
   4. Section 31 23 00 “Excavation and Fill.”
   5. Section 31 23 33 “Trenching and Backfilling.”
   6. Section 31 25 00 “Temporary Soil, Erosion, Sediment and Dust Control.”
   7. Section 32 05 23 “Cement and Concrete for Exterior Improvements.”

C. The Contractor is required to obtain all permits and pay all fees for all work contained herein, which shall be included in the Contract sum.

PART 2 PRODUCTS

2.1 SUBMITTALS

A. The materials to be used in the construction shall be those indicated on the Drawings and specified herein and/or as required by the Authority having jurisdiction. The Contractor shall supply prior to installation, certificates of compliance for the materials used. The Contractor shall also submit shop drawings and catalog cuts of all sanitary sewer items and appurtenances (pipe, fittings, castings, steps, precast concrete structures, etc.) for review and approval prior to ordering.

2.2 SANITARY SEWER PIPE, FITTINGS AND JOINTS

A. General - All materials for sanitary sewerage shall be in accordance with requirements of the Authority having jurisdiction, including but not limited to domestic made pipe, fittings, couplings, castings, etc. The Authority referred to herein shall be the Town of Harrison.

B. Polyvinyl Chloride Pipe and Fittings for Gravity Lines (PVCP) (Private) - shall conform to the requirements of ASTM Designation D-3034 for SDR-35 extra strength pipe fittings. Pipe shall have integral wall bell and spigot joints. Assembly shall be by

means of push-on joints using flexible elastomeric seals conforming to ASTM Designation D-3212.

All fitting and accessories shall be furnished by the pipe manufacturer. Joint lubricant shall be as recommended by the pipe manufacturer.

2.3 STRUCTURES

A. General - Where material requirements specified hereinafter conflicts with the requirements of those Authorities having jurisdiction, the requirements of the Authority having jurisdiction shall govern.

B. Brick - shall conform to the "Specifications for Sewer and Manhole Brick (made from Clay or Shale)", AASHTO Designation M-91, Grade MS.

C. Concrete Block - shall be solid block and shall conform to the "Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes," ASTM Designation C-139.

D. Precast Concrete Structures - Prior to fabrication, the Contractor shall submit five (5) sets of plans of the proposed precast concrete structures, along with design criteria and certification by the manufacturer from a licensed Professional Engineer registered in the State of New York that the structure will support the design load. All precast concrete structures shall be designed for an H-20 design load. The minimum compressive strength of the concrete used for all precast concrete structures shall be 4,000 psi.

Precast concrete manhole sections shall conform to ASTM Designation C-478. Precast concrete square or rectangular box structures shall conform to ASTM Designation C-913.

Joints in the structures shall be tongue and groove joints, formed in such a manner so that a watertight rubber seal can be applied. Joints for precast concrete manhole sections shall conform to ASTM Designation C-443 or ASTM designation C-990. Joints for precast concrete box sections shall conform to ASTM Designation C-990. Provisions shall be made for installation of approved watertight connections at pipe entrances to the precast concrete structure.

Where steps are required in structures, steps shall be installed during the casting of the structures, aligned as specified herein. Steps shall be spaced 12 inches vertically on-centers, and shall be arranged so that the lowest rung is not more than 15 inches above the bench in structures with an invert and above the bottom of the structures with no invert. The top rung is to be installed no more than 24 inches below the top of the casting. Steps shall be arranged out of the alignment of the pipes and/or floor channel and shall be centered in the opening of the cover.

No precast concrete structure shall be fabricated or delivered to the job site until it has received final review status by the Site Engineer. All structures shall have an identifying number and manufacturer's name on each section.

When precast concrete structures are to be used, the Contractor shall bear all responsibility for the proper locations and sizes of all openings to receive the pipe. Final review of shop drawings by the Site Engineer shall not relieve the Contractor of his responsibility in this matter.

E. Manhole Frames and Covers - shall be as specified on the Drawings and/or as required by the Sewer Authority. Castings may be equal to Campbell Pattern No. 1204 or East Jordan Cat. #1204Z (frame) and 1203B2 (cover). Manhole covers may be equal to "Flow-Seal" fitted with an O-Ring gasket as manufactured by Campbell

Foundry Co., and may have a pick hole on the edge of the cover. Castings shall be gray cast iron, American made by a nationally recognized casting manufacturer conforming to the requirements of ASTM A48, Class 30B and AASHTO Designation M-105, and shall be true to pattern in form and dimensions as specified, and shall be free from pouring faults, sponginess, cracks, blowholes and other defects that affect their strength and other characteristics for the intended use. All surfaces shall have a workmanlike finish.

All component parts shall fit together in a satisfactory manner and frames and covers shall be of a design that will prevent rocking or rattling under traffic. Frames and covers that are warped or rocking, as determined by the Owner's Field Representative, shall be rejected and shall be removed and replaced to the satisfaction of the Owner's Field Representative at no cost to the Owner.

Unless otherwise specified, the words "SEWER" shall be integrally cast on the cover in raised letters and centered. Letter size shall be two (2) inches.

If directed, and at no additional cost to the Owner, castings shall be coated with an asphalt paint which shall result in a smooth coating and not be tacky or brittle.

F. Concrete and Reinforcing - shall conform to the requirements as specified herein under Section 32 05 23 "Cement and Concrete for Exterior Improvements."

G. Mortar - shall be composed of one (1) part Portland cement and two (2) parts sand by volume. Material requirements shall be as follows:
   1. Portland Cement - shall conform to the requirements of AASHTO Designation M-85.
   2. Mortar Sand - shall conform to the requirements of AASHTO Designation M-45, except that aggregate shall be no coarser than #8 sieve size.
   3. Water - shall be clean and shall not contain any oil, acid, alkali, salts, vegetable matter, organic matter or other deleterious substances. When possible, water shall be from a municipal system.

   Hand mixing of mortar will be permitted only when, in the opinion of the Owner's Field Representative, the amount of mortar to be used makes machine mixing undesirable. When hand mixing is used, the ingredients must first be thoroughly mixed dry in a tight box. The proper quantity of clean water shall then be gradually added, and the materials shall be hoed or worked until a uniform mixture is secured. Admixtures may be added only with the prior written consent of the Owner's Field Representative.

   No greater quantity of mortar is to be prepared than is required for immediate use, and it shall be worked over constantly with hoe or shovel until used. No mortar shall be retempered, and none shall be used more than one and one-half (1-1/2) hours after mixing. All mortar which remains upon stopping work shall be discarded.

H. Steps - Steps in sanitary sewer structures shall be as specified herein and on the details of the Drawings and shall meet the requirements for steps and ladders as specified under ASTM Designation C-478.
   1. Malleable or Ductile Cast Iron - shall be designed for a minimum design live load of a single concentration of 300 pounds. Material shall be of Iron, Class 25A, in accordance with ASTM Designation A-48 or Malleable Iron, Grade 35018 in accordance with ASTM Designation A-47.
   2. Plastic Coated Steel - shall be No. 4 deformed reinforcement bar meeting the requirements of ASTM Designation A-615, Grade 60 which shall be coated with polypropylene plastic meeting the requirements of ASTM Designation D-2146 for Type II, Grade 49108.

All steps shall be true to pattern, form dimensions, and free from defects which would affect their strength. Steps having defects filled with putty or cement of any kind shall be rejected.

I. Drop Connection (as applicable) - shall consist of ductile iron pipe and fittings (same size as lateral or 6" minimum), of the same class as the sewer main in accordance with the detail on the plans. Rubber boot connections (see paragraph 2.4), shall be provided at pipe entrances to the manhole. Drop connection shall be encased by Class "A" concrete (4,000 psi). Slope invert channel to provide smooth transition of flow.

2.4 PIPE-TO-MANHOLE CONNECTOR

A. Shall be equal to "Kor-n-Seal" connector, as manufactured by NPC Inc. Rubber boot shall be constructed of resilient EPDM rubber and meet ASTM C923. The internal and external expander-type clamp shall be manufactured of 304-Series stainless steel and meet ASTM C923 and A167.

2.5 CLEAN OUT (AS APPLICABLE)

A. General - Unless indicated otherwise, sanitary sewer service clean-out shall conform to the requirements of AWWA C-151 for Class 56 ductile iron pipe and AWWA C104/ANSI A21.4 fittings and/or as shown on the detail on the plans (refer to the MEP drawings). Fittings to be restrained joint pipe and shall be EBBA Iron Megalug, U.S. Pipe Field Lok Gasket, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer, Structural Engineer and/or MEP Engineer. The most stringent requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to by the Contractor.

B. Work may not commence until the sanitary sewer main and services (as applicable), have been approved by the Westchester County Department of Health.

C. The Contractor shall install all sanitary sewer structures and pipe in the locations shown on the Drawings and/or as directed by the Owner’s Field Representative. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

D. The installation of all sanitary sewer structures and pipe shall conform to the requirements of all Authorities having jurisdiction.

E. The requirements of the Health Department and any other Authority having jurisdiction shall govern the horizontal and vertical separation of sanitary sewers from water lines.

F. Sanitary sewer lines which are to be installed within easements shall be installed in accordance with requirements of the Sewer Authority. Prior to acceptance of the Work by the Owner, the Contractor will be required to submit a plan prepared by a licensed land surveyor, registered in the State in which the Work is performed, certifying the location of the sanitary sewer lines within the easements. The plan shall also show the location of all manholes and service locations with ties from three accessible points of reference to each. All additional information required by the Sewer Authority shall also be included. (See Section 3.12, "Record Drawings.")

3.2 STORAGE AND HANDLING

A. Storage - Storage of sanitary sewer pipe and appurtenances on the job shall be in accordance with the manufacturers' recommendations, subject to the approval of the Owner's Field Representative. Storage locations of pipe and appurtenances on the site shall be subject to the approval of the Owner's Field Representative.

B. Handling - All sanitary sewer pipe and appurtenances shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in handling the pipe and appurtenances.

3.3 DAMAGE

A. General - Sanitary sewer pipe and appurtenances which are defective from any cause, including damage caused by handling, and determined by the Owner's Field Representative as unrepairable, shall be unacceptable for installation and shall be replaced by the Contractor at no cost to the Owner.

Sanitary sewer pipe and appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced by the Contractor as directed by the Owner's Field Representative, at the Contractor's expense.

3.4 PIPE INSTALLATION

A. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with the details as shown on the Drawings and Section 31 23 33 of these Specifications entitled "Trenching and Backfilling". Pipe shall be laid upgrade with bells uphill unless otherwise directed by the Owner's Field Representative.

Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and debris before installing the line. Extreme care shall be taken to keep the bells of the pipe free from dirt and debris so that joints may be properly assembled without overstressing the bells. No pipe is to be trimmed or chipped to fit.

No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.

B. Full Lengths of Pipe - Only full lengths of pipe are to be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

C. Pipe Entrances to Structures - All pipe entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow or affect the hydraulic characteristics of the installation. The method of cutting and finishing shall be subject to the approval of the Owner's Field Representative. Connections shall be made watertight by the use of approved rubber seals.

D. Bedding and Backfilling - The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 31 23 33 of these Specifications entitled "Trench Excavation and Backfill" and as shown on the details of the Drawings.

E. Sheeting and Shoring - The requirements for sheeting, shoring and staybracing shall be as described in Section 31 23 00 and 31 23 33 of these specifications titled "Excavation and Fill" and "Trenching and Backfilling."

F. Protection During Construction - The Contractor shall protect the installation at all times during construction. Movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk.

G. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

H. The Contractor must maintain the flow in the existing sewer main at all times and provide sufficient pumping plant as directed, until the new sewer is approved to be placed into service. As applicable, no portion of the new sewer may be utilized unless a DOH approval is obtained; bypass pumping and/or temporary piping will be required.

I. The Contractor shall furnish a sufficient pumping plant and shall provide and maintain at his own expense satisfactory pumping and drainage wherever needed in the trench and other excavations during the progress of the Work and at its completion for final inspection. No pipe or other structure shall be laid in water and water shall not be allowed to flow or rise under any pipe, concrete or other masonry. All water pumped or bailed from the trench or other excavation shall be cleaned and conveyed in proper manner to a suitable point of discharge. The flow in all sewers, drains and watercourses encountered on the Work and in gutters along the sides of or across the Work shall be entirely provided for, both temporarily and permanently, as required, by the Contractor at his expense. All offensive water shall be removed from the Work at once.

J. Grade and Alignment
   1. Gravity Sewers - Pipe for sanitary sewer gravity lines shall be laid accurately to the line and grade shown on the Drawings and/or as directed by the Owner's Field Representative. Each section of pipe shall be checked for line and grade after being laid. A survey instrument shall be used at all times during pipe laying operations, and all adjustments which must be made shall be made by removing material or filling with select bedding material under the barrel of the pipe as necessary and not by wedging or blocking any portion of the pipe. Deviations from line and grade shall be a basis for rejection of the line of pipe by the Owner's Field Representative. Any line which has been rejected shall be rebuilt to the correct line and grade by the Contractor at his own expense.

3.5 PIPE JOINTS

A. All joints are to be made watertight in accordance with the requirements specified herein and on the Drawings.

B. Unless otherwise permitted, jointing of all pipe and fittings shall be done entirely in the trench.

3.6 STRUCTURES

A. General Requirements - All sanitary sewer structures shall be built in accordance with the details and at the locations shown on the Drawings and as specified herein. Where a specific material of construction is indicated, no substitution will be allowed unless authorized in writing by the Site Engineer. Where more than one type of material of construction is indicated, the Contractor shall have the option of

constructing the structure of any one of the materials specified. Precast concrete structures shall require shop drawing submission for review by the Site Engineer.

Cast-in-place concrete and/or masonry shall not be laid when the temperature is below 40 degrees F., or when indications are for lower temperatures within 24 hours, unless protection of concrete and masonry is approved by the Owner's Field Representative. In this event, the Contractor shall take measures to prevent concrete and masonry from being exposed to freezing temperatures for a period of not less than five (5) days after installation. Approval of the method of protection by the Owner's Field Representative shall not relieve the Contractor of his responsibility to protect the concrete and masonry from freezing, and any damage to the structure because of freezing shall be corrected by the Contractor at his own expense, to the satisfaction of the Owner's Field Representative.

All cast-in-place concrete and masonry shall be installed by personnel experienced and skilled in this work, and any person not deemed to be such by the Owner's Field Representative shall be removed and replaced by a person so qualified.

Sanitary sewer structures are to be constructed as soon as the pipe laying reaches the location of the structures. Should the Contractor continue his pipe laying without making provision for completion of the structures, the Owner's Field Representative shall have the authority to stop the pipe laying operations until the structure is completed.

In constructing manholes and other sanitary sewer structures, the Contractor shall accurately locate each structure and set accurate templates to conform to the required line and grade. Any structure which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at the Contractor's expense.

The Contractor shall use extreme care in the handling of precast concrete structures. Any damage occurring to the precast concrete structures due to carelessness in handling or due to any of the Contractor's operations shall be repaired or replaced by the Contractor at his own expense to the complete satisfaction of the Owner's Field Representative and Site Engineer.

Unless otherwise specified, all structures shall be constructed on concrete foundations. All foundations shall rest on firm soil of uniform bearing. If the soil beneath the foundation is unsuitable, the Contractor shall remove this unsuitable material as directed by the Owner's Field Representative and/or Geotechnical Engineer and replace it with and approved properly compacted granular backfill material conforming to the requirements of Section 31 2333 of these Specifications entitled "Trenching and Backfilling" to the bottom elevation of the structure.

1. Cast-in-Place Concrete Structures - Cast-in-place concrete structures shall be constructed of a Class “A” concrete with reinforcing as shown in detail on the Drawings and as specified herein.
    a. Material and construction requirements shall be as specified under Section 32 0523 of these Specifications entitled "Cement and Concrete for Exterior Improvements".
2. Precast Concrete Structures - Precast concrete structures shall be installed only after shop drawings have received final review by the Site Engineer. All precast concrete structures shall be designed and fabricated for an H-20 design load.
    a. The base of the precast concrete structures shall be set on a foundation pad of crushed stone eight (8) inches in compacted thickness. Foundations of all precast concrete structures shall rest on firm soil of uniform bearing. If soil

beneath the foundation is unsuitable, the Contractor shall remove the unsuitable material as directed by the Owner's Field Representative and/or the Geotechnical Engineer and replace it with and approved properly compacted granular material conforming to the requirements of the Section of these Specifications entitled "Trench Excavation and Backfill" to the bottom elevation of the crushed stone pad.

b. Provisions shall be made for installation of approved watertight connections at pipe entrances to precast concrete structures by the use of approved rubber seals.
c. The precast concrete top section shall be set sufficiently below finished grade to permit adjustment of the casting using brick or precast concrete adjustment rings as risers to adjust the grade of the casting (minimum 4" - maximum 12" adjustment). Manhole frames shall be set on a grout pad as specified hereinabove.

3. Shallow Circular Structures - For shallow circular structures, the top section shall be replaced by a flat reinforced concrete slab with the proper size opening to accommodate the specified casting. The reinforced concrete slab shall have a minimum thickness of six (6) inches and shall be designed for a H-20 design load. In general, and unless otherwise specified or directed by the Owner's Field Representative and/or Site Engineer, the flat slab top shall be used for circular structures whose depth from pipe invert to finished grade is five (5) feet or less.
4. Inverts - Smooth invert channels shall be constructed in all manholes. Unless otherwise specified, inverts channels shall be constructed of brick or concrete, as determined by the Authority having jurisdiction.
   a. If brick inverts are specified or permitted, special care shall be taken in laying brick inverts. Joints shall not exceed three-sixteenth (3/16) inch in thickness and each brick shall be carefully laid in full cement mortar joints on bottom, sides and ends in one operation. No grouting or working in of mortar after laying of the brick shall be permitted.
   b. Extreme care shall be taken by the Contractor to construct invert channels to the shape, elevations and dimensions shown, specified or ordered by the Owner's Field Representative and/or Site Engineer.
   c. When a curve in the invert channel or some other condition prevents the use of channels as shown on the Drawings, then such channels shall be constructed in accordance with the directions of the Owner's Field Representative and/or Site Engineer.
   d. When pipes entering and leaving a manhole are of different diameters, the invert channel shall be constructed so as to provide a smooth transition from the inflow pipe(s) to the outflow pipe.
   e. The invert channel shall be carried up to the elevations shown on the Drawings and/or as directed by the Owner's Field Representative. Channels shall slope smoothly and evenly from the inflow pipe(s) to the outflow pipe.
   f. Invert channels shall be built for future extensions where shown on the Drawings and/or where directed by the Owner's Field Representative.
5. Frames and Covers - Frames and covers for sewer structures shall be of the types and sizes indicated on the Drawings. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade. In areas to be paved, frames shall be set by using four (4) points of reference, set 90 degrees apart, to insure accurate setting to proposed pavement grade.

6. Steps - Steps shall be installed in all manholes. Steps shall be set securely in place during fabrication of the wall section for precast concrete structures. Spacing of steps shall be as shown in detail on the Drawings.

3.7 ALTERATION AND/OR RECONSTRUCTION OF EXISTING STRUCTURES (AS APPLICABLE)

A. General Requirements - Existing structures shall be altered and/or reconstructed where as shown on the Drawings, and/or directed by the Owner's Field Representative. In general, alterations shall be made with the same type of material used in the original construction unless otherwise indicated on the Drawings or directed by the Owner's Field Representative.

B. Adjustment to New Grade and Alignment - All castings on existing structures that are to remain shall be adjusted to new grade and alignment. When such adjustment is required the castings shall be carefully removed and the walls of the structures reconstructed as required. The castings shall be cleaned and reset in a firm mortar bed to the new grade and alignment. Existing castings which are broken, damaged or otherwise unfit for incorporation into the new work shall be replaced under the Contract Sum.

C. Removal of Portions of Walls of Existing Structures - In all cases of alteration and/or reconstruction of existing structures, existing walls shall be removed to a point where the existing walls will provide sound and adequate foundation for the construction of the new walls as determined by the Owner's Field Representative.

D. Reconstruction and/or Rebuilding of Existing Invert - Where new pipes are to be installed into an existing structure, the existing invert shall be reconstructed and/or rebuilt as directed to accommodate installation of the new pipes and provide for proper transition of flows into and out of the structure.

E. Damage to Existing Structure and/or Pipe - Extreme care shall be exercised by the Contractor during such alteration and/or reconstruction so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired by the Contractor at his own expense, to the satisfaction of the Owner's Field Representative.

F. Structures to be Cleaned - Upon completion of alteration and/or reconstruction of existing structures, all structures shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be kept clean of such accumulation until final acceptance of the work.

3.8 RELOCATION AND/OR ABANDONMENT OF EXISTING FACILITIES

A. The Contractor shall not abandon, disconnect, obstruct or in any other way interfere with the operation of an existing sewer facility until such time as adequate permanent or temporary substitute facilities have been constructed and authorized to be placed in operation.

3.9 SERVICE LINES

A. General Requirements - The Contractor shall make all required connection(s) of the building sanitary sewer service line(s) into the sanitary sewer piping where and as shown on the Drawings and/or as directed by the Owner's Field Representative. Work shall include making the service line connection(s) to the sewer piping, furnishing and installing all service line pipe to point(s) located five (5) feet outside of the building lines and properly sealing the end(s) with watertight plugs.

1. Coordination with Building Plumbing Contractor - The Contractor will be required to coordinate his work with the work of the building plumbing contractor to determine the exact location(s) and elevation(s) of the point(s) of entry into the building(s).

B. As applicable, clean-outes shall be installed where shown on the plans or as directed by the Authority having jurisdiction. Over-excavation under clean-outs shall require thorough compaction prior to installation of the pipe and fittings, with select material as directed by the Owner's Field Representative.

3.10 TESTS (AS APPLICABLE)

A. General Requirements - The Contractor shall test the completed sanitary sewers for leakage as specified herein. In the event of conflict between the test requirements specified herein and the test requirements of Authorities having jurisdiction over all or any portion of the sanitary sewers installed under this Contract, the more restrictive requirements shall govern.
   1. The tests shall be conducted by the Contractor, as directed by the Owner's Field Representative and Site Engineer, and the Contractor shall furnish all necessary equipment, materials and labor for the tests as specified.
   2. The Contractor shall notify the Owner's Field Representative and Site Engineer at least 48 hours prior to the start of testing. Testing shall be done only in the presence of the Owner's Field Representative and Site Engineer.
   3. Runs of pipe and/or manholes tested for leakage prior to completion of the Project shall be subject to additional leakage tests, if warranted, in the opinion of the Owner's Field Representative or Site Engineer.

B. Gravity Sewers - shall be tested as follows:
   1. Leakage Tests - The test length intervals and type of leakage test shall be approved by the Owner's Field Representative and Site Engineer. In the case of sewers laid on steep grades, the length of line to be tested by exfiltration at any one time may be limited by the maximum allowable internal pressure on the pipe and joints at the lower end of the line. Depending on field conditions and/or desire of the Contractor, the following tests for leakage may be employed:
      a. Hydrostatic Test
         1) The test period, wherein the measurements are taken shall not be less than four (4) hours in either type of test. The total leakage of any section tested shall not exceed the rate of 100 gallons per mile of pipe per 24 hours per inch of nominal pipe diameter. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of pipe and shall be tested at a level above the highest joint prior to the concrete/rim connection.
         2) Infiltration Test - This test may be used only when ground water levels are at least two (2) feet above the top of the pipe for the entire length of the section to be tested during the entire period of the test. Ground water levels may be measured in an open trench or in standpipes previously placed in backfilled trenches during the backfilling operations. When standpipes are installed in the backfill for ground water measurement, the lower ends of these shall be satisfactorily embedded in a mass of crushed stone or gravel to maintain free percolation and drainage. Infiltration through joints shall be measured by using a watertight weir or any other approved device for volumetric measurement installed at the lower end of the section under test.

3) Exfiltration Test - This test consists of filling the pipe with water to provide a head of at least two (2) feet above the top of the pipe or two (2) feet above ground water, whichever is higher, at the highest point of the pipe line under test, and then measuring the loss of water from the line by the amount which must be added to maintain the original level. In this test the line must remain filled with water for at least twenty-four (24) hours prior to the taking of measurements. Exfiltration shall be measured by the drop of water level in a closed-end standpipe or in one of the sewer manholes available for convenient measuring.

4) When a standpipe and plug arrangement is used in the upper manhole of a line under test, there must be some positive method of releasing entrapped air in the sewer prior to taking measurements.

Vacuum Testing of Manholes - shall conform to the requirements of ASTM Designation C-1244 "Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test Prior to Backfill".

Low-Pressure Air Test of Plastic Pipe Lines - shall conform to the requirements of ASTM Designation F-1417 "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air".

5) Correction of Defective Work - If the tests exceed the specified amount, the Contractor shall, at his own expense, make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the test requirements are met. All additional tests required by the Owner and Authorities having jurisdiction shall be at the Contractor's expense.

Any defects found in the sanitary sewers shall be made good by and at the expense of the Contractor so as to conform strictly to the Specifications and to the satisfaction of the Owner's Field Representative. All repairs shown necessary by the tests shall be made, broken or cracked pipe replaced, all deposits removed, and the sanitary sewers left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance shall be made by the Owner.

3.11 CLEANING AND REPAIR

A. Prior to testing, the Contractor will be required to clean the entire sanitary sewer system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sanitary sewers or streams. All debris shall be removed from the system.

1. After the system has been cleaned, the Contractor shall thoroughly inspect the system and all repairs shown to be necessary shall be promptly performed by the Contractor.
2. All work of cleaning and repair as specified herein shall be performed at the Contractor's expense and to the complete satisfaction of the Owner's Field Representative.

3.12 RECORD DRAWINGS (AS APPLICABLE)

A. In addition to the requirements stated in Division 1 Specification Sections, an "as-built" set of record drawings shall be kept on the site concurrently with the progress of the work. These "as-built" record drawings shall consist of a marked set of the drawings with additional sketches as required, denoting and dimensioning accurately and neatly all changes and conditions that are variations from the drawings.

B. All changes in alignment and grade of the newly installed underground piping which are not marked by a visible surface structure such as manholes, shall be recorded. These locations shall be located in reference to three (3) separate permanent surface reference points and recorded on the "as-built" record drawings. An accurate record shall also be kept of all existing site items which are reworked or relocated.

C. The as-built is required for submission to Westchester County Department of Health (DOH), prior to submitting the final record drawings. The newly installed works may not be placed into service, until the completed works approval is received from the DOH.

D. Upon completion of the work, the Contractor shall deliver the final "as-built" record drawings in Autocad format and on a thumb drive, and bear the original signature and seal of a licensed land surveyor in the State of New York or the design engineer, prepared pursuant to the New York State Education Law. All modifications must be included on the "as-built" with all changes bubbled in red, including details, and be of the same scale as the approved plans. All information pertaining to the utilities must be included on the plan and profiles, with clear delineation between pre-existing utilities and newly installed utilities. All drawings must include the date and an "as-built" stamp or notation on each sheet, and the full set of plans including detail sheets. A list must be provided of all deviations from the original approved plans shown on the record drawings, together with the Contractor's explanation thereof.

E. If utilities are constructed within easements, the easements must be included, showing dimensions of the utilities located within the easements, demonstrating that they are located wholly within the easement boundaries.

3.13 FINAL INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, the entire sanitary sewer system shall be subjected to a final inspection in the presence of the Site Engineer and/or Owner's Field Representative. The work shall not be considered complete until all requirements for line, grade, cleanliness, tests and workmanship have been met.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. This Section includes work to the limits indicated on the Plans and includes, but is not limited to the following:
   1. Installation of drainage system(s) consisting of manholes, lawn inlets, drain basins, catch basins, pipe including end section, underdrains, water quality structure, outlet control structure, subsurface detention system, bioretention basins, stormwater planter, stormwater basin insert filters, and all necessary and required accessory items and operations, including connection(s).
   2. Alteration, reconstruction and/or conversion of existing structures as applicable, including resetting existing and/or new castings to grade and replacing existing castings as required.
   3. Connection of building leader drainage consisting of all pipe, fittings and required accessory items and operations, including connections to the proposed and/or existing drainage system.

B. Related Sections:
   1. Section 01 41 00 "Regulatory Requirements."
   2. Section 02 30 00 "Subsurface Investigation."
   3. Section 31 10 00 "Site Preparation."
   4. Section 31 23 00 “Excavation and Fill.”
   5. Section 31 23 33 “Trenching and Backfilling.”
   6. Section 31 25 00 “Temporary Soil, Erosion, Sediment and Dust Control.”
   7. Section 31 37 00 "Rip Rap Apron/Energy Dissipator."
   8. Section 32 05 23 “Cement and Concrete for Exterior Improvements.”

C. The Contractor is required to obtain all permits and pay all fees for all work contained herein, which shall be included in the Contract Sum.

PART 2 PRODUCTS

2.1 SUBMITTALS

A. The materials to be used in the construction shall be indicated on the Drawings and specified herein and/or as required by the Authority having jurisdiction. The Contractor shall supply, prior to installation, certificates of compliance for the materials used. The Contractor shall also submit shop drawings and catalog cuts of all storm drain items and appurtenances (pipe, fittings, joints, castings, steps, precast concrete structures, etc.) for review and approval prior to ordering.

2.2 STORM DRAIN PIPE, FITTINGS AND JOINTS

A. Materials for storm drainage shall be domestic made; i.e. fittings, castings.

B. Corrugated Polyethylene Drain Pipe, Fittings and End Section (HDPE) - shall be dual wall, and of the size indicated on the plans, and have smooth interior and annular exterior corrugations in accordance with ASTMF-2648 and conform to the requirements of AASHTO Designation M-294, Type S.

Pipe and joints shall meet watertight requirements and shall be ADS N-12 WT pipe as manufactured by Advanced Drainage Systems, Inc. or Blue Seal pipe as manufactured by Hancor or approved equal.

C. Perforated Underdrains - Perforated Polyvinyl Chloride Pipe (PPVCP) shall be of the size indicated and detailed on the plans conforming to the requirements of AASHTO Designation M-278, and shall be Perforated Highway Underdrains and Fittings as manufactured by Carlon or approved equal. Filter material shall be approved coarse aggregate meeting the requirements of ASTM Designation C-33, Size No. 57. Filter fabric shall be Mirafi Filterweave 404 (sandy soils) or 500 (silty/clay soils), or approved equal.

2.3 STRUCTURES

A. General - Where material requirements specified hereinafter conflicts with the requirements of Authorities having jurisdiction, the requirements of the Authority having jurisdiction shall govern.

B. Brick - shall conform to the "Specifications for Sewer and Manhole Brick (made from Clay or Shale)", AASHTO Designation M-91, Grade MS.

C. Concrete Block - shall be solid block and shall conform to the "Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes," ASTM Designation C-139.

D. Precast Concrete Structures - Prior to fabrication, the Contractor shall submit five (5) sets of plans of the proposed precast concrete structures, along with design criteria and certification from the manufacturer by a licensed Professional Engineer registered in the State of New York that the structure will support the design load. All precast concrete structures shall be designed and fabricated for an H-20 design load. The minimum compressive strength of the concrete used for all precast concrete structures shall be 4,000 psi.

Precast concrete manhole sections shall conform to ASTM Designation C-478. Precast concrete square or rectangular box structures shall conform to ASTM Designation C-913.

Joints in the structures shall be tongue and groove joints, formed in such a manner so that a watertight rubber seal can be applied. Joints for precast concrete manhole sections shall conform to ASTM Designation C-443 or ASTM designation C-990. Joints for precast concrete box sections shall conform to ASTM Designation C-990. Provisions shall be made for installation of approved watertight connections at pipe entrances to precast concrete structures.

Where steps are required in structures, steps shall be installed during the casting of the structures, aligned as specified herein. Steps shall be spaced 12 inches vertically on-centers, and shall be arranged so that the lowest rung is no more than 15 inches above the bench in structures with an invert and above the bottom of the structures with no invert.

The top rung is to be installed no more than 24 inches below the top of the casting. Steps shall be arranged out of the alignment of the pipes and/or floor channel and shall be centered in the opening of the grate or cover.

No precast concrete structure shall be fabricated or delivered to the job site until it has received final review status by the Site Engineer. All structures shall have an identifying number and manufacturer's name on each section.

When precast concrete structures are to be used, the Contractor shall bear all responsibility for the proper locations and sizes of all openings to receive the pipe. Final review of shop drawings by the Site Engineer shall not relieve the Contractor of his responsibility in this matter.

E. Plastic Inlets - Contractor shall submit shop drawings of the inlets prior to ordering. Inlets shall have concrete collars and shall be Nyloplast drain basins/yard drains. Drain basin varies 15" or 18" with solid cover assembly, Nyloplast 1599 CGC/Nyloplast 1899 CGC or approved equal. Yard drain shall be 15" with slotted cover assembly, Nyloplast 1599 CGP or approved equal. If directed, decorative 2" to 3" rounded river stone grey/tan color range shall be installed as a collar surrounding inlets in non-paved areas as detailed on the plans.

F. Manhole Frames and Covers - shall be as specified on the Drawings. Castings shall be equal to Campbell Pattern No. 1204 or East Jordan Cat. #1204Z (frame) and 1203B2 (cover). Manhole cover shall have a pick hole on the edge of the cover. Castings shall be gray cast iron, American made by a nationally recognized casting manufacturer conforming to the requirements of ASTM A48, Class 30B and AASHTO Designation M-105, and shall be true to pattern in form and dimensions as specified, free from pouring faults, sponginess, cracks, blowholes and other defects that affect their strength and other characteristics for the intended use. All surfaces shall have a workmanlike finish.

   All component parts shall fit together in a satisfactory manner and frames and covers shall be of a design that will prevent rocking or rattling under traffic. Frames and covers that are warped or rocking, as determined by the Owner's Field Representative, shall be rejected and shall be removed and replaced to the satisfaction of the Owner's Field Representative at no cost to the Owner.

   Unless otherwise specified, the word "DRAIN" shall be integrally cast on the cover in raised letters and centered. Letter size shall be two (2) inches.

   If directed, and at no additional cost to the Owner, castings shall be coated with an asphalt paint which shall result in a smooth coating and not be tacky or brittle.

G. Concrete and Reinforcing - shall conform to the requirements as specified under Section 32 0523 "Cement and Concrete for Exterior Improvements".

H. Mortar - shall be composed of one (1) part Portland cement and two (2) parts sand by volume. Material requirements shall be as follows:
   1. Portland Cement - shall conform to the requirements of AASHTO Designation M-85.
   2. Mortar Sand - shall conform to the requirements of AASHTO Designation M-45, except that aggregate shall be no coarser than #8 sieve size.
   3. Water - shall be clean and shall not contain any oil, acid, alkali, salts, vegetable matter, organic matter or other deleterious substances. When possible, water shall be from a municipal system.

      Hand mixing of mortar will be permitted only when, in the opinion of the Owner's Field Representative, the amount of mortar to be used makes machine mixing undesirable. When hand mixing is used, the ingredients must first be thoroughly mixed dry in a tight box. The proper quantity of clean water shall then be gradually added, and the materials shall be hoed or worked until a uniform mixture

is secured. Admixtures may be added only with the prior written consent of the Owner's Field Representative.

No greater quantity of mortar is to be prepared than is required for immediate use, and it shall be worked over constantly with hoe or shovel until used. No mortar shall be retempered, and none shall be used more than one and one-half (1-1/2) hours after mixing. All mortar which remains upon stopping work shall be discarded in accordance with local regulations.

I. Steps - Steps in drainage structures shall be as specified herein and on the details of the Drawings and shall meet the requirements for steps and ladders as specified under ASTM Designation C-478.
   1. Malleable or Ductile Cast Iron - shall be designed for a minimum design live load of a single concentration of 300 pounds. Material shall be of Iron, Class 25A, in accordance with ASTM Designation A-48 or Malleable Iron, Grade 35018 in accordance with ASTM Designation A-47.
   2. Plastic Coated Steel - shall be No. 4 deformed reinforcement bar meeting the requirements of ASTM Designation A-615, Grade 60 which shall be coated with polypropylene plastic meeting the requirements of ASTM Designation D-2146 for Type II, Grade 49108.

      All steps shall be true to pattern, form dimensions, and free from defects which would affect their strength. Steps having defects filled with putty or cement of any kind shall be rejected.

J. Stormwater Basin Insert Filters - shall be equal to Flexstorm Pure Inlet Filters for permanent inlet protection, with framing comprised of 304 stainless steel with a 25 year life rating furnished with PC (post construction) bags, 22 inch depth, clean water flow rate of 137 GPM/SqFt, furnished in large (62 LHD) and extra large (62 XLHD) bags, as detailed on the Plans.

K. Water Quality Structure - shall be equal to hydrodynamic separator, Model CDS Cascade CS-4 or as detailed on the plans, manufactured by Contech Engineered Solutions, and conform to the Plans and Details for all work associated with the supply and installation of the complete system, as well as the applicable sections of these specifications.

L. Outlet Control Structure - shall be a precast concrete structure including bypass weir and orifice for multi-stage flow control, and conform to the Plans and Details for all work associated with the supply and installation of the complete system, as well as the applicable sections of these specifications. Refer to the plan detail for construction requirements.

M. Subsurface Detention System - shall be equal to Duro Maxx subsurface detention pipe storage system with joints as detailed on the Plans, size as indicated on the Plans and as detailed, manufactured by Contech Engineered Solutions LLC, and conform to the Plans and Details for all work associated with the supply and installation of the complete system, as well as the applicable sections of these specifications.

N. Stormwater Planter - Materials within the stormwater planter shall consist of solid HDPE pipe, perforated PVC pipe, filter fabric Mirafi 160 N, Nyloplast drain basin Model 2812AG with Nyloplast ductile iron frame and grate Model 1299 CGS, clean crushed stone, sandy loam topsoil, rip-rap apron, and plantings. Refer to the plan detail for construction requirements. The planter enclosure shall be designed and detailed by the Structural Engineer.

O. Bioretention Basins - shall be constructed to the lines an grades indicated on the plans. Materials within the basins shall consist of perforated PVC pipe, clean gravel, filter fabric Mirafi 160N, soil media, mulch layer, and plantings. Refer to the plan detail for construction requirements.

2.4 PIPE-TO-MANHOLE CONNECTOR

A. Shall be equal to "Kor-n-Seal" connector, as manufactured by NPC Inc. Rubber boot shall be constructed of resilient EPDM rubber and meet ASTMC923. The internal and external expander-type clamp shall be manufactured of 304-Series stainless steel and meet ASTM C923 and A167.

PART 3 EXECUTION

3.1 INSTALLATION

A. The on-site installation of materials and infrastructure may be subject to special construction requirements. Subgrade improvement measures and special construction requirements must be followed as indicated by the Geotechnical Engineer, Structural Engineer and/or MEP Engineer. The most stringent requirements stated in the Geotechnical Report, or any other place in the Contract Documents shall be adhered to by the Contractor.

B. The Contractor shall install all drainage structures, pipe and appurtenances in the locations shown on the Drawings, as required by manufacturer's instructions, and as directed by the Owner's Field Representative. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

C. The installation of all drainage structures, pipe and appurtenances shall conform to the requirements of all Authorities having jurisdiction.

D. The requirements of the Health Department and any other Authority having jurisdiction shall govern the horizontal and vertical separation of storm drains from water lines.

3.2 TRENCH EXCAVATION AND BACKFILL / SHEETING AND SHORING

A. The provisions of Section 31 23 33 "Trenching and Backfilling" shall govern all work under this Section.

B. The requirements for sheeting, shoring and staybracing shall be as described in Section 31 23 00 and 31 23 33 of these specifications titled "Excavation and Fill" and Trenching and Backfilling."

3.3 STORAGE AND HANDLING

A. Storage - Storage of storm drain pipe and appurtenances on the job shall be in accordance with the manufacturer's recommendations, subject to the approval of the Owner's Field Representative.

B. Handling - All storm drain pipe and appurtenances shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in handling the pipe and appurtenances.

3.4 DAMAGE AND DISTURBANCE

A. General - Pipe and/or appurtenances which are defective from any cause, including damage caused by handling, and determined by the Owner's Field Representative as unrepairable, shall be unacceptable for installation and shall be replaced by the Contractor at no cost to the Owner.

Pipe and/or appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work, shall be repaired, realigned or replaced by the Contractor as directed by the Owner's Field Representative, at the Contractor's expense.

3.5 PIPE INSTALLATION

A. Laying Pipe - Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with the details as shown on the Drawings and Section 31 23 33 of these Specifications entitled "Trench Excavation and Backfill". Pipe shall be laid upgrade unless otherwise directed by the Owner's Field Representative.

Bell and spigot pipe shall be laid with the bell end upgrade; tongue and groove pipe shall be laid with the groove end upgrade. Trimming of the pipe will not be allowed.

Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. Prior to the placing of a length of pipe, the end of the previously laid length shall be carefully and thoroughly wiped smooth and cleaned to obtain an even and close-fitting joint.

No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe. Sections of pipe shall be joined so that the interior surfaces are flush and even.

B. Full Lengths of Pipe - Only full lengths of pipe are to be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

C. Pipe Entrances to Structures - All pipe entering structures (e.g. manholes, drain inlets, catch basins, etc.) shall be cut flush with the inside face of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation. The method of cutting and finishing shall be subject to the approval of the Owner's Field Representative.

Only full sections of pipe shall be used where entering a structure which will be exposed to view, such as headwalls, end sections, etc.

D. Bedding and Backfilling - The type of materials to be used as bedding and backfill and the method of placement shall conform to the requirements of Section 31 23 33 of these Specifications entitled "Trench Excavation and Backfill" and as shown on the details of the Drawings. Special attention shall be given to placing and compacting material under the haunches of the pipe.

E. Protection During Construction - The Contractor shall protect the installation at all times during construction. Movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk.

At all times when pipe laying is not in progress, all open ends of all pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plugs shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

F. The Contractor shall furnish a sufficient pumping plant and shall provide and maintain at his own expense satisfactory drainage wherever needed in the trench and other excavations during the progress of the Work and at its completion for final inspection. No pipe or other structure shall be laid in water, and water shall not be allowed to flow or rise under any concrete or other masonry. All water pumped or bailed from the

trench or other excavation shall be conveyed in proper manner to a suitable point of discharge. The flow in all sewers, drains and watercourses encountered on the Work and in gutters and swales along the sides of or across the Work shall be entirely provided for, both temporarily and permanently, as required, by the Contractor at his expense. All offensive water shall be removed from the Work at once.

G. Grade and Alignment - Pipe for storm drain gravity lines shall be laid accurately to the line and grade shown on the Drawings and/or as directed by the Owner's Field Representative. Each section of pipe shall be checked for line and grade after being laid. A survey instrument shall be used at all times during pipe laying operations, and all adjustments which must be made shall be made by removing material or filling with select bedding material under the barrel of the pipe as necessary and not by wedging or blocking any portion of the pipe. Deviations from line and grade shall be a basis for rejection of the line of pipe by the Owner's Field Representative. Any line which has been rejected shall be rebuilt to the correct line and grade by the Contractor at his own expense.

3.6 PIPE JOINTS

A. Pipe shall be joined as specified herein:
   1. All joints that provide watertight connections shall be used. The joints shall be installed according to the manufacturer's specifications and as approved by the Site Engineer.

3.7 STRUCTURES

A. General Requirements - All drainage structures shall be built in accordance with the details and at the locations shown on the Drawings and as specified herein. Where a specific material of construction is indicated, no substitution will be allowed unless authorized in writing by the Site Engineer. Where more than one type of material of construction is indicated, the Contractor shall have the option of constructing the structure of any one of the materials specified. Precast concrete structures shall require shop drawing submission for review by the Site Engineer.

   All cast-in-place concrete and masonry shall be installed by personnel experienced and skilled in this work, and any person not deemed to be such by the Owner's Field Representative shall be removed and replaced by a person so qualified.

   Drainage structures are to be constructed as soon as the pipe laying reaches the location of the structures. Should the Contractor continue his pipe laying without making provision for completion of the structures, the Owner's Field Representative shall have the authority to stop the pipe laying operations until the structure is completed.

   In constructing drainage structures, the Contractor shall accurately locate each structure and set accurate templates to conform to the required line and grade. Any structure which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at the Contractor's expense.

   The Contractor shall use extreme care in the handling of precast concrete structures. Any damage occurring to the precast concrete structures due to carelessness in handling or due to any of the Contractor's operations shall be repaired or replaced by the Contractor at his own expense to the complete satisfaction of the Owner's Field Representative and Site Engineer.

   Cast-in-place concrete and/or masonry shall not be laid when the temperature is below 40 degrees F., or when indications are for lower temperatures with 24 hours, unless

protection of concrete and masonry is approved by the Owner's Field Representative. In this event, the Contractor shall take measures to prevent concrete and masonry from being exposed to freezing temperatures for a period of not less than five (5) days after installation. Approval of the method of protection by the Owner's Field Representative shall not relieve the Contractor of his responsibility to protect the concrete and masonry from freezing, and any damage to the structure because of freezing shall be corrected by the Contractor at his own expense, to the satisfaction of the Owner's Field Representative.

Unless otherwise specified, all structures shall be constructed on concrete foundations. All foundations shall rest on firm soil of uniform bearing. If the soil beneath the foundation is unsuitable, the Contractor shall remove this unsuitable material as directed by the Owner's Field Representative and/or the Geotechnical Engineer and replace it with an approved properly compacted granular material conforming to the requirements of Section 312333 of these Specifications entitled "Trenching and Backfilling" to the bottom elevation of the structure.

B. Masonry Structures - The first course of masonry shall be embedded in the concrete foundation immediately after the foundation has been poured.

All masonry shall be laid in a full bed of mortar, and all vertical and horizontal joints shall be filled solid with mortar. Vertical joints on each succeeding course shall be staggered. Joints shall be not less than three-eighths (3/8) inch or more than one-half (1/2) inch wide. Joints on the inside of the structure shall be neatly struck and pointed.

Corner units for rectangular concrete block structures must be "L" shaped with an inside return side equal to half the length of the normal unit. Units shall be designed so that only full length units are required to lay any one course. Cut block will not be allowed unless approved by the Owner's Field Representative and/or Site Engineer.

Unless otherwise specified, the interior surface of the walls of masonry structures shall be painted upon completion with three (3) coats of neat cement grout without sand, applied with an interval of at least 24 hours between applications. The exterior surface of the walls of masonry structures shall be plastered with a one-half (1/2) inch coat of 1:2 cement mortar.

C. Cast-in-Place Concrete Structures - Cast-in-place concrete structures shall be constructed of Class "A" concrete with reinforcing as shown in detail on the Drawings and as specified herein.

D. Precast Concrete Structures - Precast concrete structures shall be installed only after shop drawings have received final review by the Site Engineer. All precast concrete structures shall be designed and fabricated for an H-20 design load.

The base of the precast concrete structures shall be set on a foundation pad of crushed stone eight (8) inches in compacted thickness. Foundations of all precast concrete structures shall rest on firm soil of uniform bearing. If soil beneath the foundation is unsuitable, the Contractor shall remove the unsuitable material as directed by the Owner's Field Representative and/or the Geotechnical Engineer and replace it with an approved properly compacted granular backfill material conforming to the requirements of the Section of these Specifications entitled "Trench Excavation and Backfill" to the bottom elevation of the crushed stone pad.

After pipes have been installed, all openings shall be properly sealed and made watertight with non-shrinking cement mortar grout or concrete as directed by the Owner's Field Representative. Grout around pipes which protrude through the walls of the structure shall contain "Antihydro", or other approved additive, to insure

watertightness. Cement grout shall contain one (1) part cement to two (2) parts sand by volume and additive in accordance with manufacturer's recommendations. Mortar shall be applied to the bottom one-third (1/3) of the opening before the pipe is inserted.

Connections for ductile iron pipe shall be made watertight by the use of approved rubber seals.

The precast concrete top section shall be set sufficiently below finished grade to permit adjustment of the casting using brick or precast concrete adjustment rings as risers to adjust the grade of the casting (minimum 4" - maximum 12" adjustment). Frames shall be set on a grout pad as specified hereinabove.

E. Shallow Circular Structures - For shallow circular structures, the top section shall be replaced by a flat reinforced concrete slab with the proper size opening to accommodate the specified casting. The minimum thickness of the reinforced concrete slab shall be six (6) inches and shall be designed for an H-20 design load. In general, and unless otherwise specified or directed by the Owner's Field Representative and/or Site Engineer, the flat slab top shall be used for circular structures whose depth from pipe invert to finished grade is five (5) feet or less.

F. Inverts - Smooth invert channels shall be constructed in all manholes and in all drain inlets and catch basins which do not have sumps, to insure a smooth flow of water through the structure.

Inverts channels for precast concrete structures shall be constructed of brick or concrete; invert channels for masonry structures may be constructed of concrete or brick, in accordance with the Authority having jurisdiction.

If brick inverts are specified or permitted, special care shall be taken in laying brick. Joints shall not exceed three-sixteenth (3/16) inch in thickness and each brick shall be carefully laid in full cement mortar joints on bottom, sides and ends in one operation. No grouting or working in of mortar after laying of the brick shall be permitted.

Extreme care shall be taken by the Contractor to construct invert channels to the shape, elevations and dimensions shown, specified or ordered by the Owner's Field Representative and/or Site Engineer.

When a curve in the invert channel or some other condition prevents the use of channels as shown on the Drawings, then such channels shall be constructed in accordance with the directions of the Owner's Field Representative and/or Site Engineer.

When pipes entering and leaving a manhole are of different diameters, the invert channel shall be constructed so as to provide a smooth transition from the inflow pipe(s) to the outflow pipe.

The invert channel shall be carried up to the elevations shown on the Drawings and/or as directed by the Owner's Field Representative. Channels shall slope smoothly and evenly from the inflow pipe(s) to the outflow pipe.

Invert channels shall be built for future extensions where shown on the Drawings and/or where directed by the Owner's Field Representative.

G. Frames and Covers/Grates - Frames and covers/grates for drain structures shall be of the types and sizes indicated on the Drawings. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade. In areas to be paved, frames shall be set by using four (4) points of reference, set 90 degrees apart, to insure accurate setting to proposed pavement grade.

Where drain inlets and/or catch basins are to be placed on curb lines or at edge of pavements, sufficient length of proposed curb or edge of pavement adjacent to the structure shall be established prior to construction of the drain inlet and/or catch basin to insure that the structure is correctly located and oriented.

H. Steps - Steps shall be installed in all manholes. Steps shall also be installed in all drain inlets and catch basins greater than four (4) feet in depth unless otherwise specified.

Steps shall be set securely in place during the construction of the wall for masonry structures and during fabrication of the wall section for precast concrete structures. Spacing of steps shall be as shown in detail on the Drawings.

3.8 ALTERATION, RECONSTRUCTION AND/OR CONVERSION OF EXISTING STRUCTURES (AS APPLICABLE)

A. General Requirements - Existing structures shall be altered, reconstructed and/or converted where as shown on the Drawings, and/or directed by the Owner's Field Representative. In general, alterations shall be made with the same type of material used in the original construction unless otherwise indicated on the Drawings or directed by the Owner's Field Representative.

B. Adjustment to New Grade and Alignment - All castings on existing drainage structures that are to remain shall be adjusted to new grade and alignment. When such adjustment is required the castings shall be carefully removed and the walls of the structures reconstructed as required. The castings shall be cleaned and reset in a firm mortar bed to the new grade and alignment. Existing castings which are broken, damaged or otherwise unfit for incorporation into the new work shall be replaced under the Contract Sum.

C. Structures to be Converted - Structures which are to be converted (e.g. manholes to drain inlets or catch basins, drain inlets or catch basins to manholes) shall conform as closely as possible to the design of the proposed structure. Sufficient masonry shall be removed from the existing structure to insure that the walls can be rebuilt to conform to the proposed construction. Furnishing and installation of new castings for

the converted structures shall be included in the Contract Sum. (Refer to the detail(s) on the plans).

D. Removal of Portions of Walls of Existing Structures - In all cases of alteration, reconstruction and/or conversions of existing structures, existing walls shall be removed to a point where the existing walls will provide sound and adequate foundation for the construction of the new walls as determined by the Owner's Field Representative.

E. Reconstruction and/or Rebuilding of Existing Invert - Where new pipes are to be installed into an existing structure, the existing invert shall be reconstructed and/or rebuilt as directed to accommodate installation of the new pipes and provide for proper transition of flows into and out of the structure.

F. Damage to Existing Structure and/or Pipe - Extreme care shall be exercised by the Contractor during such alteration, reconstruction and/or conversions so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired by the Contractor at his own expense, to the satisfaction of the Owner's Field Representative.

G. Structures to be Cleaned - Upon completion of alteration, reconstruction and/or conversion of existing structures, all structures shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be kept clean of such accumulation until final acceptance of the Work.

3.9 RELOCATION AND/OR ABANDONMENT OF EXISTING FACILITIES

A. The Contractor shall not abandon, disconnect, obstruct or in any other way interfere with the operation of an existing storm drain facility until such time as adequate permanent or temporary substitute facilities have been constructed and placed in operation.

3.10 LEADER DRAINS

A. General Requirements - The Contractor shall make all required connection(s) of the building leader drain(s) into the on-site drainage system where and as shown on the Drawings and/or as directed by the Owner's Field Representative. Work shall include making the leader drain connection(s) into the on-site drainage system and stormwater planter, furnishing and installing all leader drain pipe from the on-site drainage system to point(s) located five (5) feet outside of the building lines and properly sealing the end(s) with watertight plug(s).

B. Coordination with Building Plumbing Contractor - The Contractor will be required to coordinate his work with the work of the building plumbing contractor to determine the exact location(s) and elevation(s) of the point(s) of entry into the building(s).

C. Connection into On-site Drainage System - Leader drain connection(s) to the on-site drainage system shall be made at structure(s) or into the pipe where and as shown on the Drawings. Pipe connections shall be made with proper size and type tee and/or wye fittings supplied by the pipe manufacturer, in a manner satisfactory to the Owner's Field Representative.

3.11 PERFORATED DRAINS

A. General Requirements - The Contractor shall install underdrains where and as shown on the Drawings and Details and/or as directed by the Owner's Field Representative.

B. Pipe Installation - A layer of approved underdrain filter material (stone) shall be placed and compacted as a bedding and surrounding the pipe. Underdrain pipe of the type

and size specified shall be embedded in the bedding material to the line and grade shown on the Drawings.

Unless otherwise specified, perforated pipe shall be laid with the perforations down and the pipe sections shall be jointed securely with the appropriate fittings or bands. Upgrade ends of pipe underdrains shall be closed with suitable plugs.

C. Backfilling - After the pipe installation has been inspected and approved, underdrain filter material shall be hand-shoveled around and over the pipe to such a depth that, after compaction, it extends a minimum of four (4) inches above the underdrain pipe. The surface of the underdrain filter material shall then be compacted with a vibrating pad compactor, and the remainder of the filter material shall be placed in lifts not more than six (6) inches in thickness with each lift thoroughly compacted with a mechanical vibrating pad compactor. The height of filter material over all pipe shall be as indicated on the Drawings and/or as approved by the Owner's Field Representative.

D. Geotextile Fabric - Geotextile fabric shall be placed where and as shown in detail on the Drawings and/or as directed by the Owner's Field Representative. Ends and sides of fabric shall be lapped a minimum of twelve (12) inches.

E. Pipe Connections and Changes in Alignment - Pipe to pipe connections and changes in pipe alignment shall be made only with prefabricated fittings to be supplied by the manufacturer of the pipe (e.g. tees, wye branches, etc.).

3.12 CLEANING AND REPAIR

A. The Contractor shall clean the entire drainage system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

After the system has been cleaned, the Contractor shall thoroughly inspect the system and all repairs shown to be necessary shall be promptly made by the Contractor.

All work of cleaning and repair as specified herein shall be done at the Contractor's expense and to the complete satisfaction of the Owner's Field Representative.

3.13 FINAL TESTS AND INSPECTION

A. Upon completion of the Work and before final acceptance by the Owner, the entire drainage system shall be subjected to an inspection in the presence of the Site Engineer and/or Owner's Field Representative. The Work shall not be considered as complete until all requirements for line, grade, cleanliness, and workmanship have been met.

If, in the judgment of the Owner's Field Representative and Site Engineer, it is impractical to follow the procedures exactly as specified for any reason, modifications in the procedures may be made as required and as approved by the Owner's Field Representative and Site Engineer, depending upon field conditions. In any event, the

Contractor shall be responsible for the ultimate tightness of the piping within the above requirements.

3.14 RECORD DRAWINGS (AS APPLICABLE)

A. In addition to the requirements stated in Division 1 Specification Sections if directed, an "as-built" set of record drawings shall be kept on the site concurrently with the progress of the work. These "as-built" record drawings shall consist of a marked set of the drawings with additional sketches as required, denoting and dimensioning accurately and neatly all changes and conditions that are variations from the drawings.

B. All changes in alignment and grade of the newly installed underground piping which are not marked by a visible surface structure such as manholes, shall be recorded. These locations shall be located in reference to three (3) separate permanent surface reference points and recorded on the "as-built" record drawings. An accurate record shall also be kept of all existing site items which are reworked or relocated.

C. Upon completion of the work, the Contractor shall deliver the final "as-built" record drawings in Autocad format and on a thumb drive, and bear the original signature and seal of a licensed land surveyor in the State of New York or the design engineer, prepared pursuant to the New York State Education Law. All modifications must be included on the "as-built" with all changes bubbled in red, including details, and be of the same scale as the approved plans. All information pertaining to the utilities must be included on the plan and profiles, with clear delineation between pre-existing utilities and newly installed utilities. All drawings must include the date and an "as-built" stamp or notation on each sheet, and the full set of plans including detail sheets. A list must be provided of all deviations from the original approved plans shown on the record drawings, together with the Contractor's explanation thereof.

D. If utilities are constructed within easements, the easements must be included, showing dimensions of the utilities located within the easements, demonstrating that they are located wholly within the easement boundaries.

END OF SECTION

SECTION 34 71 13

VEHICLE GUIDE RAILS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. If a Geotechnical Report is available and/or a Geotechnical Engineer is retained by the Owner at the Owner's expense, the Contractor must adhere to all requirements contained in the Report and as directed by the Geotechnical Engineer.

1.2 SUMMARY

A. The Contractor shall furnish and install corrugated steel vehicle guide rail where and as shown on the Drawings and/or as directed by the Owner's Field Representative.

Prior to installation of the guide rail, the Contractor shall check the guide rail layout with the Owner's Field Representative who must approve the layout before any of the work is done.

B. Related Sections
1. Section 31 23 33 "Trenching and Backfilling"
2. Section 32 05 23 "Cement and Concrete for Exterior Improvements"

1.3 SUBMITTALS

A. Submit manufacturer's product data and shop drawings of all materials to be used (i.e. posts, rails, terminal sections, hardware) for approval.

B. Include plan layout and details, joint and connection details and erection drawings.

C. Submit installer's certification that furnished materials meet specification requirements.

1.4 QUALITY ASSURANCE

A. Provide guide rail as complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

B. Installation: Performed only by the manufacturer or an experienced guide rail installer approved by manufacturer.

C. Materials and installation shall comply with the following standards:
1. NYSDOT Specifications and Details
2. American Society for Testing and Materials (ASTM)
3. New York State Building Code
4. Local Building Code

D. Provide manufacturer's warranty for guide rail installed. Contractor shall warranty installation for one (1) year from project completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in the manufacturer's original packaging as applicable, with tags and labels intact and legible.

B. Handle and store material to prevent damage and deterioration.

1.6 PROJECT CONDITIONS

A. Do not begin guide rail installation before completion of final grading and approval by the Owner's Field Representative.

PART 2 PRODUCTS

2.1 STEEL RAILS AND POSTS

A. Rail Element: Shall be cold-form standard W sections of 12 gauge (0.109 inches) steel and conforming to the requirements of AASHTO M-180. Rails shall be supplied in lengths of 12 1/2 feet.

B. Posts: Shall be standard rolled structural shape as specified on the Drawings, conforming to the requirements of ASTM A-36 or A-588.

C. Terminal Sections (as applicable): Shall be 12 gauge (0.109) inches galvanized steel and shall be compatible for fastening to the rail section.

2.2 HARDWARE AND COATINGS

A. Coatings: All rails, posts and terminal sections shall be galvanized after fabrication with 2.0 oz. per sq. ft. of double-exposed surface in accordance with ASTM A-525 or A-123.

B. Fastening Attachments: All splice and post bolts shall be flat, round headed with oval shoulders to prevent turning. Bolts shall be 5/8 inch diameter ASTM A-307 and galvanized in accordance with ASTM A-153.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start guide rail installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Layout complete guide rail lines. Ensure that the guide rail is located in the exact location required.

B. Locate and mark post positions. Space line posts in accordance with details or manufacturer's instruction. All posts shall be set vertically and to the required grade and alignment.

C. Installation shall not commence until the layout is approved by the Owner's Field Representative.

3.3 INSTALLATION

A. The installation of materials and infrastructure indicated on the plans may be subject to special construction requirements. Subgrade improvement measures and special construction requirements may be required and must be followed as indicated on the details, plans, and specification sections, prepared by the Geotechnical Engineer, and/or Structural Engineer.

B. Assemble and install guide rail in accordance with manufacturer’s recommendations, details and final shop drawings.

C. Steel posts shall be set vertical and plumb to the depth shown in detail or in accordance with manufacturer's requirements. Posts shall be set to the required grade and alignment and shall be equally spaced and shall be driven unless otherwise specified or permitted. The driving shall be accomplished with approved equipment and materials that will leave the posts in their final position free of distortion, burring or other damage.

As an alternative to driving of the posts where driving is impractical, or where site conditions are such that driving is not possible, as determined by the Owner's Field

Representative, the Contractor may carefully excavate post holes for setting the posts. After the posts have been set, the holes shall then be completely filled with concrete to a level six (6) inches below finished grade.

All posts shall be aligned to a tolerance of 1/4" for plumb and grade.

D. Rails shall be installed with the alignment resulting in a smooth continuous rail, so that the lap is in the direction of the traffic. Rail elements for curve sections from 20 foot to 150 foot radius shall be shop curved. Curves greater than 150 foot radius may be installed using straight elements. Terminal sections shall be placed at the ends of the railing.

E. The final installation shall be to proper location, grade and alignment and subject to the approval of the Owner's Field Representative. Any deviation from proper location, grade and/or alignment, as determined by the Owner's Field Representative, shall be cause for rejection and subject to correction by the Contractor, at his own expense.

3.4 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from site improvements installation.

END OF SECTION