INFRASTRUCTURE DESIGN STANDARDS

THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION

STANDARD GREEN INFRASTRUCTURE SPECIFICATIONS

August 1, 2024

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NYC DDC Department of Design and Construction

NYC Environmental Protection

INTRODUCTION

This publication has been prepared by the New York City Department of Design and Construction ("NYCDDC" or "the Department") to provide a compilation of standard requirements, called specifications, used by the New York City Department of Environmental Protection ("NYCDEP") for construction contracts. These specifications define the Contractor's responsibility in meeting the contract requirements, enumerate the Department's expectations, define how the Department will measure and pay for the Work, and explain what the Contractor is expected to provide. When this publication, entitled Standard Green Infrastructure Specifications and dated August 1, 2024, is incorporated by reference into the Department's construction contracts, it is made a part of that document.

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SPECIAL SPECIFICATIONS (NOT TO BE PAID SEPARATELY)

SECTION GI-1.06 – GENERAL CONDITIONS FOR GREEN INFRASTRUCTURE WORKS

General Conditions herein are to be followed in addition to SECTION 1.06 – General Conditions of NYCDOT STANDARD HIGHWAY SPECIFICATIONS current edition.

GI-1.06.1. START OF CONTRACT WORK. The Contractor is notified that a Notice to Proceed (NTP) date will be issued for Work to commence within 21 to 30 Days of Contract Registration. In the event the Contractor fails to complete all required services set forth in the Contract within the specified time frame, liquidated damages must be assessed on a daily basis in the amount specified in Schedule A on Page SA-1.

GI-1.06.2 WORK TO PROCEED WITH DILIGENCE AND DISPATCH. Timely completion of the Work of this Contract is critical to the completion of the milestone established in the Schedule A. Therefore, it is agreed that all Work hereunder must be executed at such time(s) and in or on such parts of the Contract and with sufficient work force(s), materials, and equipment, so as to assure timely Substantial Completion of the Work as well as the swift completion of all Work hereunder.

GI-1.06.3. WORK FORCE. The Contractor must work with sufficient crews. A minimum number of crews is shown in the Special Provisions (S-Pages) section. The Engineer must periodically assess the rate of progress and may order the Contractor to mobilize additional work crews to complete the Work on time. If the Contractor fails to comply with such orders within seven (7) calendar days after the written notice from the Engineer, the Contractor may, under Article 48 of the Standard Construction Contract, be declared in default of this Contract.

GI-1.06.4. STANDARD ITEM. New York City Department of Transportation Standard Highway Specifications, current edition, including, but not limited to, Sections 4.02, 4.07, 4.08, 4.09, 4.11, 4.13, 4.16, 4.17 and 6.02, will be required for the construction of Green Infrastructure Assets, if shown on the Contract Drawings or in the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices (to be referred to as the Standard GI Drawings) and must be paid under their respective items.

GI-1.06.5. MAINTENANCE SCHEDULE. The Contractor must submit to the Engineer a proposed maintenance schedule for substantially complete Green Infrastructure Assets. The schedule must encompass all Work described in Section GI-7.13E of these specifications. The City will not recognize any site as “substantially complete” until the maintenance schedule for that site has been submitted to and approved by the Engineer and in consultation with NYCDEP.

GI-1.06.6 TYPES OF GREEN INFRASTRUCTURE ASSETS

The following will also be known as Green Infrastructure Assets. Green Infrastructure Practices may be used interchangeably with Green Infrastructure Assets to refer to the below:

Bioswale or Rain Garden:
They are located within the sidewalk and have curb cuts that serve as inlets and outlets to

capture stormwater runoff along the roadway. The surface is a depressed bowl shape of vegetation designed to capture and hold stormwater. This area may or may not include a tree. The vegetation is underlain by an engineered soil of mostly sand mix, followed by an open graded stone area designed to capture maximum stormwater before infiltrating naturally into the existing subsoils. The latest design improvements include new planting plans, a concrete walking strip, and sediment capture mechanisms to trap debris and reduce erosion.

Bioswale with Type D Inlet:
The assets with “Type D” inlets utilize a modified catch basin in the roadway instead of a curb cut inlet to redirect stormwater runoff into the GI practice. This assists with conveying water on streets with steeper slopes, reduces debris from flowing onto the soil bed, and minimizes soil erosion from high intensity storms. These assets have a flat vegetated surface and different planting plan due to the reduced amount of water entering the planting bed.

Stormwater Greenstreet:
Stormwater Greenstreets are very similar to Bioswales, with the exception they jut into the roadway, changing roadway geometry, and can vary in length and width.

Infiltration Basin with Concrete or Grass Top:
Infiltration Basins are designed to match the existing sidewalk (concrete or grass strip). They are the preferred alternative in high-density residential, industrial, or commercial areas where sidewalk space is limited, and plants may not thrive. The Infiltration Basin has an inlet within the curb which leads to a concrete chamber with sump underneath the grate within the sidewalk. The water is then dispersed into the asset by distribution pipes into the open graded stone layer.

PPCP:
Permeable pavement installations in the roadway are ideal for neighborhoods with limited opportunity for green infrastructure on sidewalks due to existing trees, driveways, and other siting constraints. These installations typically extend four feet into the roadway from the curb, remain within the parking lane, and extend the majority of the block. Underneath the permeable pavement layer there is an open graded stone storage layer for managing the collected stormwater.

GI-1.06.7. PRICES TO COVER. No direct payment will be made for costs incurred in complying with the foregoing General Conditions, except as otherwise provided. Said costs will be deemed to have been included in the prices bid for all the scheduled items of the contract.

SECTION GI-R-1 – FINAL RECORD DOCUMENTS FOR GREEN INFRASTRUCTURE ASSETS

(NOT A PAY ITEM)

GI-R-1.1 SECTION INCLUDES

GI-R-1.2 GENERAL REQUIREMENTS FOR SUBMITTALS

(A) Except where otherwise specified, the Contractor must submit the following Final Record Documents according to the requirements of Table GI-R-1.12-1, and as specified herein:

(1) As-Built Drawings
(2) Final Copy Shop Drawings
(3) Approved Working Drawings
(4) Key Documents
(5) Job Photographs
(6) Job Videos
(7) Additional Documents

(B) Submittal of these documents must be a condition precedent to obtaining the final payment under Article 45 of the Standard Construction Contract.

GI-R-1.3 DEFINITIONS

(A) Archive. In this Section, to "archive" must mean to furnish as a final record document.

(B) As-Built Drawings. The “As-Built Drawings” reflect the “as constructed” final product. These drawings must use the same title blocks and sheet numbers as the original “Contract Drawings”, with the exception that an “AB” is prefixed onto the original drawing number.

(C) Final Copy Shop Drawing (FCSD). The “Final Copy Shop Drawing” must be the approved copy (FAS or FAC) of the Shop Drawing corrected to reflect any deviations made for the installed condition showing the actual construction.

(D) Bid Set Specifications (including Addenda). The “Bid Set Specifications” must be the set of original Contract Specifications text issued by NYCDDC for the solicitation of contract bids including any “Addenda” issued during the Bid Period.

(E) The “Change Orders” must include registered “Change Order Forms” and the complete sets of attached text and/or drawings for all Design and Field Change Orders.

(F) Job Photographs and Videos must be prepared by the Contractor as specified in Subsection GI-R-1.9 below and must conform to the requirements of that Subsection.

(G) Key Documents must include, but not be limited, to the following items:

(1) Signed portions of the Standard Construction Contract (including Bonds)
(2) Signed and submitted Bid Schedule of Prices
(3) Award Folder Contents
(4) Contract Award Letter
(5) Order to Commence Work Letter
(6) Approved Detailed Estimate Breakdown
(7) Article 44 Substantial Completion of the Standard Construction Contract
(8) Substantial Completion Payment
(9) Final Evaluation
(10) Final Extension of Time (if applicable)
(11) Final Payment
(12) Claim Settlements (if applicable)
(13) Certificate of Occupancy (if possible)
(14) Warranties
(15) Survey

(H) Additional Documents. Any “Additional Documents” that the Engineer directs to be furnished as a “Final Record Document” in accordance with the requirements of this Section.

GI-R-1.4 ELECTRONIC

All records in electronic format must be produced in conformity with Subsection GI-R-1.13 Records in Electronic Formats.

GI-R-1.5 FORMATS

The “Final Record Documents” must be furnished in electronic formats in the quantities shown on Table GI-R-1.12-1 - Summary of Final Record Documents to Be Furnished herein.

GI-R-1.6 AS-BUILT DRAWINGS

The Contractor is to create an As-Built Drawing Set by revising the Contract Drawings electronically using AutoCAD. The Contractor must independently confirm that the changes made by the Addenda to the original specifications or Contract Drawings are correctly reflected in the As-Built Drawing Set. Files submitted in AutoCAD format must be bound to include all related matter (e.g. base files, font files and shapes). Each file must be viewable and printable in its entirety without recourse to external files.

(A) The Contractor must use the information compiled during construction to create an As- Built Drawing Set. The Contractor must document any deviations, changes, etc. from the configurations shown on the original Contract Drawings or revised drawings issued during the course of executing the Work including Change Orders, Design

Services During Construction (DSDC) or Construction Support Services (CSS) memorandums, Requests for Information (RFIs), Requests for Clarification (RFCs), etc. These deviations, changes, etc. must generally relate to topographic features, relocation of structures, or locations of underground items such as pipelines, duct banks, manholes, footings, and inclusive of any spare water service ducts installed. Survey distances, coordinates, and/or elevations must be included to accurately locate all such items. All deviations, changes, etc. shown must be field verified.

(B) Contractor should have the electronic files of the Contract Drawings. However, should the Contractor require an additional copy, the Engineer will supply the Contract Drawings AutoCAD electronic files via SharePoint or other online file transfer service. The AutoCAD files will consist of a bound set of drawings.

(C) Drawing Size – The As-Built drawings are to be the same size as the full-size Contract Drawings.

(D) Generate the new As-Built drawing number as per the following steps:

(1) The As-Built drawing number will match the original Contract Drawing number. Example: If the drawing number for a Contract Drawing is 36G-02S-14, the As-Built drawing number will be “36G-02S-14”.

(2) If a new drawing is produced, its number can be added to the end of the series. (i.e., if 14 is the last drawing in the series, then the first new drawing becomes 15; the second new one becomes 16, etc.)

(3) If a new drawing is inserted into the middle of a series, it is to have a letter suffix starting with A (i.e., 02A, 02B, etc.)

Example: If the drawing number for a contract drawing is 36G-02S-02, the new, additional As-Built drawing will be numbered “AB-36G-02S-02A”.

(E) Designation – The designation “As-Built” is to be added to the drawing. Using AutoCAD, insert the words “As-Built” above the title box in the right-hand corner of the drawing. (Do not include the quotation marks in “As-Built” when marking the drawing.)

(F) Modifying the Contract Drawings – As-Built drawing made from a Contract Drawing must be submitted to the Engineer for review and acceptance, the Contractor is to create this As-Built drawing by undertaking the following:

(1) Cross out all outdated information and illustrate any of the information, as detailed in Section GI-R-1.6 A**.** above, with red marks and outlined with red revision clouds. The revision cloud layer is to be a 0.024-inch line thickness. Any associated RFI or Field Order should be specifically referenced.

(2) Remove all signatures and certifications from the Contract Drawing
(3) Remove all previous revisions and references from the revision boxes
Remove the Professional Engineers seal, Engineer’s company names, and any initials from the drawing title block

(4) Modify all the original title boxes to show the Contractor information including the name of the Contractor and the date.

(G) Remove all previous markings – notes, revision indicators, balloons, submittal stamps, etc. – from the drawing, if present Contractor’s Information – The Contractor’s name, address, contact information and date (month and year) the project is completed is to be added to the drawing. Place this information in the title

block in the space previously utilized for the Engineer's name.

(H) The Contractor must submit the As-Built for review and approval by the Engineer within 60 days of Substantial Completion. These submittals must show the deviations and changes from the original design drawings by using red-line mark-ups. The Contractor must make modifications to the submitted As-Builts as required by the Engineer. The final As-Builts must be approved by DEP.

(I) Once the As-Built set has been approved by DEP and the Engineer, the Contractor must provide a signed and stamped final 'clean' copy of this As-Built set within 60 days which must comply with the following:

(1) Remove all crossed out information per Section GI-R-1.6 A. above, keeping only the information outlined within the red revision clouds and updating the color of any information that was previously shown in red marks to black.

(2) The final approved set of As-Builts must have the following statement on the cover sheet: *"These As-Built Drawings for Contract ###, as prepared by XYZ Company, have been prepared as Record Drawings".* The aforementioned statement must be signed by the representative of the Contractor. The signer must be identified along with the Contractor.

GI-R-1.7 FINAL COPY SHOP DRAWINGS (FCSD)

(A) Contractor must furnish all FCSD in the NYCDDC format to the Engineer. The required NYCDDC format will be provided by the Engineer to the Contractor. The FCSD must be the approved copy of the Shop Drawing corrected to reflect any deviations made for the installed condition showing the actual construction.

(B) In addition to submitting the FSCD as a final item at the end of construction, each Contractor must prepare and submit FCSD(s) for approval on a continual basis during the performance of the project. The Contractor must submit the FCSD within 30 days after the completion of the Work item.

(C) The drawing revision boxes must have all previous revisions and references removed from the drawings. The revision boxes must indicate FCSD.

(D) Each drawing must bear the original submittal file number, without the revision number, which must be written in the lower right-hand corner of a drawing above the title box. The file number must also have a prefix, which identifies it a FCSD. Additionally, the Contract Name must be added, if it doesn't appear in the original file number.

For example, if the file number for an approved Shop Drawing is 16221-002, the FCSD will be numbered "FCSD-NC-36G-16221-002", where NC-36G represents the specific Contract Number.

(E) Supporting Documentation: Supporting documentation must bear the correlating FCSD file number so as to identify it. All supporting documentation (e.g. catalog cuts, test results, calculations, etc.) must be submitted, together with the related FCSD so as to maintain a complete set of all documents submitted with each FCSD.

(F) Submittal for Approval. Two (2) full size paper prints of each drawing must be submitted for approval. The drawing must be checked by the Resident Engineer against the field records and a copy must either be stamped "Approved" or returned with comments for correction and re-submittal by the Contractor. The Contractor must retain one approved set of the FCSDs for use in submitting the entire set in

paper and electronic copies.

GI-R-1.8 CHANGE ORDERS

All change orders (both field and design) produced during the construction of the projects must be archived.

GI-R-1.9 JOB PHOTOGRAPHS

Job Photographs must be produced and submitted by the Contractor as specified in Section GI-P1.

GI-R-1.10 KEY DOCUMENTS

Key Documents produced during the construction of the projects must be archived. They must consist generally of the items defined under subsection GI-R-1.3.

GI-R-1.11 ADDITIONAL DOCUMENTS

Any additional documents such as Soil Classification Reports, Environmental Impact Statements, Site Assessments, Geotechnical Reports, permits, RFI's, etc. must also be archived when directed by the Engineer in consultation with NYC DEP.. If the Contractor does not have copies of any documents, they will be provided by the Engineer in electronic format, where possible.

GI-R-1.12 QUANTITIES

The quantities to be furnished for each Final Record Document must be as shown in the table below:

Table GI-R-1.12-1 Summary of Final Record Documents to Be Furnished

Final Record Document Type	Electronic
As-Built Drawings	1set (PDF/A & AutoCAD) per Contract Drawings
Final Copy Shop Drawings	1 set (PDF/A & AutoCAD)
Approved Working Drawings	1 set (PDF/A & AutoCAD)
Key Documents	1 set (PDF/A)
Additional Documents	1 set (PDF/A)
Job Photographs	1 set (JPEG)

GI-R-1.13 RECORDS IN ELECTRONIC FORMATS

(A) General

(1) This Specification describes the requirements for the electronic records for the items specified in this section.

(2) This Specification does not cover digital objects which include a time base correction code (e.g., analogue or digital video recordings, analogue or digital audio recordings, instrumentation data feeds, etc.), or geo-coded objects (produced by Geographic Information Systems-GIS).

(B) Definitions

Portable Document Format-Archival (PDF/A) - A standard that identifies a "profile" for electronic documents that ensures the documents can be reproduced the exact

same way in years to come. A key element to this reproducibility is the requirement for PDF/A documents to be 100% self-contained. All of the information necessary for displaying the document in the same manner every time is embedded in the file. This includes, but is not limited to, all content (text, raster images and vector graphics), fonts, and color information. A PDF/A document is not permitted to be reliant on information from external sources (e.g., font programs and hyperlinks).

(C) Source of Electronic Records

In preparing the electronic records, the Contractor must make every reasonable effort to obtain, from the originator (e.g., the manufacturer, the designer, etc.), documents in their original electronic format and incorporate these in the records. Subject to the approval of the Engineer, electronic records may be scanned from a paper version only when the Contractor cannot obtain the electronic version from the originator (e.g., the manufacturer, the designer, etc.).

(D) File Compression, File Formats, and Quality Control

a. File compression is not permitted for any of the files in any format.

b. File formats acceptable to NYC DEP are ISO 19005-1 Portable Document Format- Archival (PDF/A); JPEG. All files must be delivered to NYC DEP with file names that use the default file extension for each of the above formats.

c. Portable Document Format-Archival (PDF/A)

i. Security Settings: records converted to PDF/A must have all security settings deactivated (e.g., encryption, master passwords, and/or permissions) prior to transfer to NYC DEP. Deactivating security settings ensures NYC DEP's ability to support long term migration and preservation of the records. Uncoated paper must not be less than 24 pounds basis weight.

ii. Review of Special Features: Because of the complexities associated with certain PDF/A features, NYC DEP may review PDF/A records containing special features on a case-by-case basis when the records are scheduled. Examples of special features include but are not limited to, digital signatures; links to other documents, files or sites; embedded files (including multimedia objects); form data; comments and/or annotations.

Fonts: electronic records that have been converted to PDF/A from their native electronic formats must have all fonts referenced in the record embedded within the PDF/A file to guarantee the visual reproduction of all text as created. This requirement is met by having, as a minimum, subsets of all referenced fonts embedded within the PDF/A file. All fonts embedded in PDF/A records must be publicly identified as legally embeddable (i.e., font license permits embedding) in a file for unlimited, universal viewing and printing.

(E) Digital Photographs

Digital files shall be captured as 7.2 megapixel files or greater, with a minimum pixel array of 2,400 pixels by 3,000 pixels. The camera used to capture the digital files shall be a Digital SLR (Single Lens Reflex) camera with access to GPS data or approved equal Digital cameras shall produce images using true optical resolution; "digital zoom" is not acceptable. Images shall not be resized or interpolated. The file format for digital files shall be Joint Photographic Experts Group format ("JPG"). The digital files shall not be modified or processed in any way to alter the JPG file's metadata, including the photograph's

original capture date.

(F) File Transfer Media

The current file transfer medium is electronic via SharePoint or other online file transfer service. Alternative file transfer media may be used, at the discretion of Engineer.

(G) General

(1) When transferring files, the Contractor should organize the information in separate folders as presented below.

a. Separate electronic folders must generally be prepared for the following items:

- As-Built Drawings
- Final Copy Shop Drawings
- Bid Set – Specifications (including Addenda) – with Conformed Set of Specifications
- Key Documents
- Change Orders
- Job Photographs
- Additional Documents

b. The folder title must include:

- The Project by number and name
- Location of the site
- The date (month and year) of when the materials were archived
- The preparer of the Final Record Document (i.e., Contractor or Consultant CM)

c. Files submitted in AutoCAD format must be bound to include all related matter (e.g. base files, font files and shapes) so that each file is viewable and printable in its entirety without recourse to external files.

d. PDF/A files must be 1200 dpi print quality.

e. Folder Structure

i. The electronic transfer must contain a folder structure that correlates to the major components of the Record Document, as specified below.

f. Preparation of electronic folder structure

(2) As-Built Drawings

a. The folders must contain the entire set of As-Built Drawings in PDF/A and AutoCAD formats. Numbers must be used in the names for the folders so that they appear in the correct sequence. For example, the folders for a set of contract "G" drawings would look like this:

1 Contract WI-79G– As-Built Drawings ContractWI-79G– As-Built Drawings.xls
2 - Contract WI-79G – As-Built Drawings (AutoCAD)
3 - Contract WI-79G – As-Built Drawings (PDF/A)"

b. In the file title, the file numbers for each drawing must be:

"AB-Contract Number-####" where "AB" = As-Built Drawings
and "Contract Number" = the specific contract number
and "####" = original sequential sheet number of the drawings (if the title

sheet does not have a sheet number, it must be '0000')

(3) Final Copy Shop Drawings (FCSD)

a. The folders must contain the entire set of FCSD(s) in PDF/A and AutoCAD formats. In the PDF/A file for each FCSD, all supporting documentation must be included as part of the file. Numbers must be used in the names for the folders so that they appear in the correct sequence. For example, the folders for a set of contract "G" drawings would look like this:

1 - Contract WI-79G– Final Copy Shop Drawings ContractWI-79G– Final Copy Shop Drawings.xls

2 - Contract WI-79G– Final Copy Shop Drawings (PDF/A)
3 - Contract WI-79G– Final Copy Shop Drawings (AutoCAD)"

b. In the file title, the file numbers for each drawing must be:

"FCSD-Contract Number-XXXXX-####" where "FCSD" = Final Copy Shop Drawing and "Contract Number" must be the specific contract number and "XXXXX" = the Specification Section Number that correlates to the FCSD (i.e. 16221) "####" = the sequential number of the drawing submitted for that specific Section.

(4) Bid Set – Specifications (Including Addenda)

a. The Specifications and Addendum must be archived in PDF/A format as follows:

i. The preferred method or archiving is to use the original PDF files distributed as part of the Bid Set. If the Contractor does not have them, the Contractor must request them from Engineer.

ii. If for some reason the original PDF files are not available, the paper copies must be scanned in as PDF files.

iii. The folders must contain the entire set of original Bid Specifications and Addenda. The Conformed set of Specifications should also be included. Numbers must be used in the names for the folders so that they appear in the correct sequence. For example, the folders and subfolders for a set of contract "G" Bid Specifications would look like the following:

1 - Contract WI-79G– Bid Specifications and Addenda.xls

2 - Contract WI-79G– Bid Specifications (PDF/A)
  a. BidSpec-WI-79G-V1of3.pdf
  b. BidSpec-WI-79G-V2of3.pdf
  c. BidSpec-WI-79G-V3of3.pdf
3 - Contract WI-79G– Addenda (PDF/A)
  a. Addend-WI-79G-1of2.pdf
  b. Addend-WI-79G-2of2.pdf
4 - Contract WI-79G– Conformed Specifications (PDF/A)
  a. ConformedSpec-WI-79G-V1of3.pdf
  b. ConformedSpec-WI-79G-V2of3.pdf
  c. ConformedSpec-WI-79G-V3of3.pdf

iv. Each subfolder (i.e. in this example the subfolders are 2a, 2b, 2c, 3a, and 3b must contain a single PDF/A file with the all the material for that category. If possible, the PDF/A file must be bookmarked in such manner that the

bookmarks are linked to the major chapters of each Volume.

v. In the file title, the file numbers for these files must be:

Bid Spec-Contract Number-V#of#" or
Addend-Contract Number-#of#" where "Bid Spec" = Bid Specifications or
"Addend" = Addendum
and "Contract Number" = the specific contract number
and V#of# = the volume number of the Contract Specification book
or
#of# = the number of the Addendum issued

(5) Key Documents

The folder must contain one file for all the Key Documents. There must be a subdirectory for each type of Key Document. The subdirectory must include the name or description of the Key Document. Each Key Document must be a single complete PDF/A file.

(6) Job Photographs (when required)

a. Digital photographs should be in JPEG format.

b. The folders must be organized as shown below. For example, the folders for a set of contract "G" Job Photographs would look like this:

1- Contract WI-79G– Job Photographs ContractWI-79G– Job Photographs.xls
2- Contract WI-79G– Job Photographs – Pre-Construction (JPEG)
3- 3- Contract WI-79G– Job Photographs – Construction (JPEG)
4- Contract WI-79G– Job Photographs – Post-Construction (JPEG)

c. In the file title, the file numbers for Job Photographs files must be:

"JobPhoto- PreCon-Contract Number-#####" "JobPhoto-Con-Contract Number-#####" "JobPhoto- PostCon-Contract Number-#####"
where "JobPhoto"" = Job Photograph
and "Contract Number" = the specific contract number
and "PreCon" = Pre-Construction and "Con" = Construction
and "PostCon" = Post-Construction
and "#####" = the sequential file number of all photos

(7) Job Videos (when required)

a. Digital videos should be in MPEG2 format as specified in Detailed Specification 01323 - Job Photographs and Videos.

b. The folders must be organized as shown below. For example, the folders for a set of contract "G" Job Photographs would look like this:

1- Contract WI-79G– Job Videos Contract WI-79G– Job Videos.xls
2- Contract WI-79G– Job Videos – Pre-Construction (MPEG 2)
3- Contract WI-79G– Job Videos – Construction (MPEG 2)
4- Contract WI-79G– Job Videos – Post-Construction (MPEG 2)
5- Contract WI-79G – Job Videos – Informational (MPEG 2)

c. In the file title, the file numbers for Job Photographs files must be:

"JobVideo- PreCon-Contract Number-#####" "JobVideo- Con-Contract Number-#####" "JobVideo- PostCon-Contract Number-#####" "JobVideo- Informational-Contract Number-#####"

where "JobVideo"" = Job Video
and "Contract Number" = the specific contract number
and "PreCon" = Pre-Construction and "Con" = Construction
and "PostCon" = Post-Construction and "Informational" = Information
and "#####" = the sequential file number of the Video

(8) Additional Documents

a. The folders, must be containing each individual set of Additional Documents as a single PDF/A file. The PDF/A File must be bookmarked for the major chapters so that each bookmark is linked to the start of that chapter. For example, the folders for a set of contract "G" Additional Documents would look like this:

1-Contract WI-79G– Additional Documents -ContractWI-79G– Additional Documnets.xls 2 - Contract WI-79G– Additional Documents (PDF/A) Additional Document 1 – Soil Classification Reports
AddDoc-WI-79G-001.pdf
Additional Document 2 – Environmental Impact Study AddDoc- WI-79G-002.pdf

b. In the file title, the file numbers for Additional Documents files must be:

"AddDoc-Contract Number-###" where "AddDoc"" = Additional Document.
And "Contract Number" = the specific contract number
And "###" = the sequential number of the specific Additional Document starting with 01

GI-R-1.14 MEASUREMENT AND PAYMENT

Payment for this Work must be included in the unit price bid for all scheduled items.

SECTION GI-2.16A – PVC PIPE

(NOT A PAY ITEM)

GI-2.16A.1 INTENT

This section describes Polyvinyl Chloride (PVC) pipe, fittings, flanges, unions, couplings, as specified in these NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings, or as required for a complete installation. Furnish and install all PVC pipe and fittings in accordance with the specifications, the manufacturers' recommendations, and approved shop drawings.

GI-2.16A.2 REFERENCES

(A) PVC pipe must conform to the latest standards of the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA) and the National Sanitation Foundation (NSF).

(B) PVC pipe, gasket, and fittings must conform to the following ASTM and AASHTO standards:

(1) ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC)
Sewer Pipe and Fittings

(2) ASTM D1784 - Standard Specification for Rigid PVC Compounds and CPVC Compounds

(3) ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel – Plate Loading

(4) ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

(5) ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

(6) ASTM D2152 - Standard Test Method for Adequacy of Fusion of Extruded PVC Pipe and Molded Fittings by Acetone Immersion

GI-2.16A.3 SUBMITTALS

Submit catalog data for pipe, couplings, and other appurtenances.

GI-2.16A.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) The pipe must be as uniform as commercially practicable in color, capacity, density and other physical properties.

(B) The polyvinyl chloride must be extruded from an elastomeric plastic compound of which the basic resin must be polyvinyl chloride (PVC). The compound must contain any additional resins, plasticizers, stabilizers, or other materials needed to ensure qualities that will meet the requirements. The pipe material must conform to the following cell classification requirements:

Table GI-2.16A-1 Cell Classification Requirements

Property	Value	ASTM Test Procedure Designation
Base Resin	PVC homopolymer	D 4216
Notched Izod	0.65 ft-lb/in	D 256
Tensile Strength	5,000 psi	D 638
Tensile Modulus	400,000 psi	D 638
DTUL @ 264 psi	154° F	D 648

(C) The pipe must contain no recycled materials or compounds.

(D) PVC pipe must be marked either continuously or on intervals not to exceed five (5) feet by indirect printing as specified in ASTM D1785

(1) Name and/or trademark of the manufacturer.

(2) Nominal pipe size.

(3) Material designation code

(4) Dimension Ratio (DR).

(5) Manufacturing Standard Reference.

(6) Production Code from which time and date of manufacture can be determined.

(E) Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas or undispersed raw materials will not be acceptable and will result in rejection of the pipe by the Engineer.

(F) PVC fittings must be manufactured to the requirements of ASTM D 3212 and this Specification. Fabricated fittings must be pressure rated to match the system piping.

GI-2.16A.5 MANUFACTURERS

(A) Advanced Drainage Systems, Inc. (ADS) 4640 Trueman Blvd. Hilliard, OH 43026 http://www.ads-pipe.com

(B) Hancor, Inc.
12370 Jacksontown Rd. #172
Findlay, OH 45840 http://www.hancor.com

(C) Royal Building Products 131 Regalcrest Court Woodbridge, ONL4L 8P3 http://www.royalbuildingproducts.com/

(D) National Pipe & Plastics, Inc. 3421 Old Vestal Road Vestal, NY 13850
http://www.nationalpipe.com/

(E) Or Approved Equivalent

GI-2.16A.6 METHODS

(A) Utilize care when lowering unit into the trench. Handle using nylon slings and two (2) pick points.

(B) When the unit consists of two (2) sections, place the downstream section first. Properly lube the bell and spigot to connect and home the remaining section.

(C) Use only couplings to join standard lengths of pipe and as required to complete a straight run of pipe. Do not use couplings to join random lengths of pipe and cuttings from standard lengths.

(D) During construction, keep the lines free from foreign matter. The piping must be left thoroughly clean to the satisfaction of the Engineer.

GI-2.16A.7 MEASUREMENT AND PAYMENT

No separate payment will be made for this Work, the cost of which must be included under all scheduled items.

SECTION GI-4.10 – PLANT ESTABLISHMENT WITHIN GI ASSETS (POST PLANTING CARE)

GI-4.10.1. INTENT. This Work consists of the care of newly planted and transplanted trees, shrubs, groundcovers, bulbs, and herbaceous plants in accordance with the Contract Documents and as directed by the Engineer. The Contractor must provide plant establishment (post planting care), including repairs or replacement, if necessary, for all trees, shrubs, bulbs, groundcover, and herbaceous plants that have been planted or transplanted within GI Assets

GI-4.10.2. MATERIALS. Materials must comply with the requirements of Section GI-4.16 and Section GI-4.17.

GI-4.10.3. CONSTRUCTION DETAILS.

(A) ESTABLISHMENT PERIOD.

The Contractor must water, weed and maintain mulch or erosion control matting within the GI Practice at no cost to the City until the newly planted or transplanted material is accepted. Plants will be accepted when all specified plants meet the following conditions:

(1) Species has been verified and plant is in its designated location;
(2) Planted or transplanted in accordance with ANSI Z60.1;
(3) Planted or transplanted in accordance with Section GI-4.16 and/or Section GI-4.17**;**
(4) Plant is living, healthy, unimpaired and in an undamaged condition;
(5) Plant has successfully passed the Establishment Period, as shown in the flowchart below.

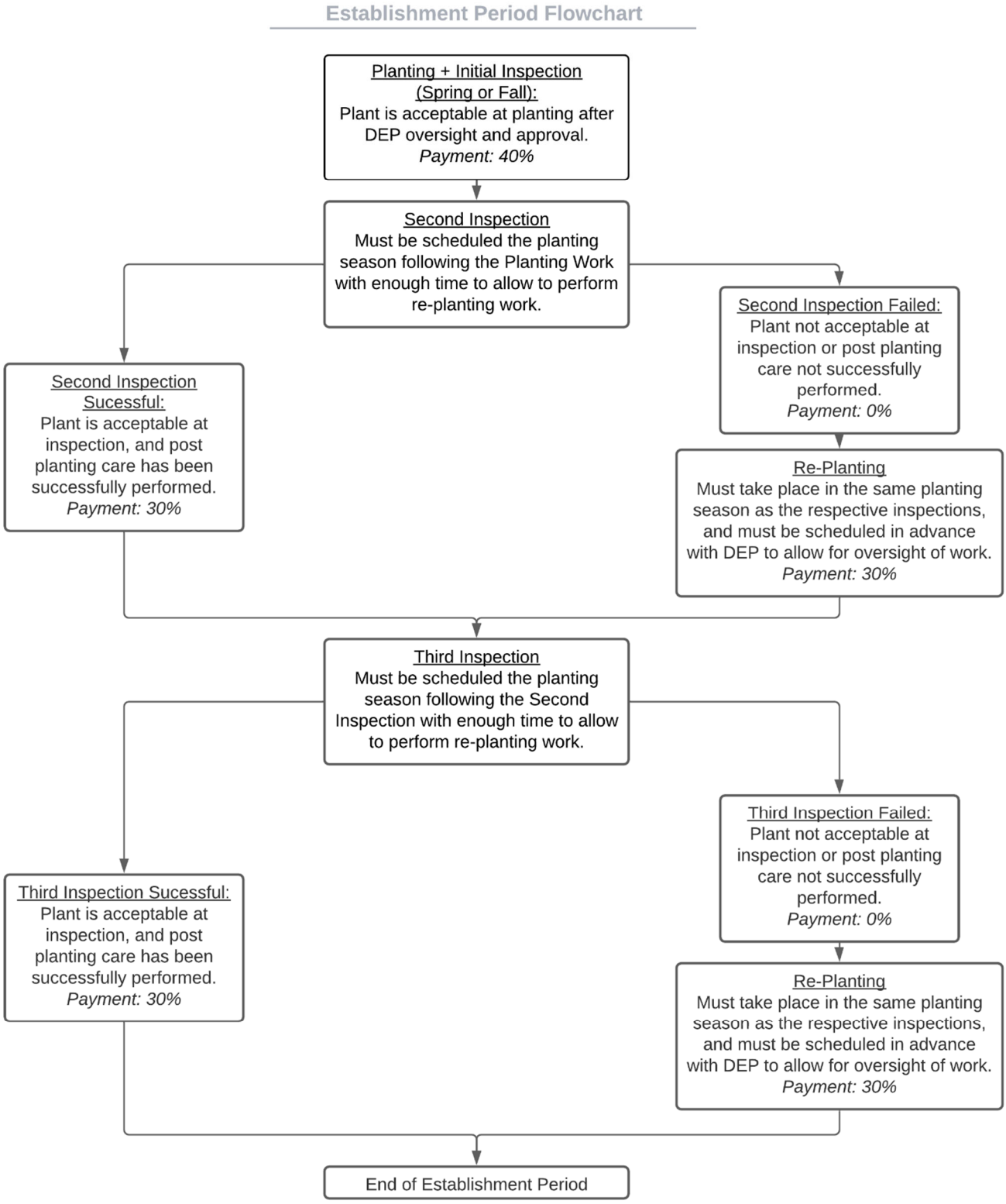
Successful completion of the Establishment Period will be determined by the Engineer.

For understory plantings, the Contractor must obtain a certificate of acceptance from the appropriate City Agency, either NYC DOT, NYC DEP or NYC DPR, as directed by the Engineer, and file the certificate with the Engineer.

Successful completion of Post Planting Care in the flowchart below requires complete compliance with Subsection GI-4.10.3(D) ESTABLISHMENT PERIOD TASKS (POST PLANTING CARE), below, including all required watering and approval of the watering log.

The initial, second, and third inspections in the flowchart below must meet the following requirements and correspond to payment percentage shown for ITEMS under Sections GI-4.16 and GI-4.17.:

Figure 4.10-1 Planting Inspection Chart



i. Planting Work must be scheduled for the beginning of either Spring or Fall Planting Season.

ii. The Initial Inspection must be scheduled for the same season as the Planting Work. The oversight of the planting Work will be considered the Initial Inspection.

iii. The Second Inspection must be scheduled for the planting season following the Planting Work and Initial Inspection with enough time to allow for time to perform re-planting Work.

iv. The Third Inspection must be scheduled for the planting season following the Second Inspection with enough time to allow for time to perform re-planting Work.

v. Initial planting Work and re-planting Work must be scheduled in advance with the Engineer and coordinated with DEP to allow for oversight of Work.

vi. Re-planting Work must take place in the same planting season as their respective inspections.

vii. Re-planting Work includes any landscape, or soil grading Work necessary to maintain the health of the plants and trees.

(B) REPAIRS OR REPLACEMENT

The Contractor must remove and replace all plant material under establishment which died or, in the opinion of the Engineer, seem unhealthy, stunted or unable to flourish, within the Establishment Period, except as otherwise provided, and replace said plant material with new plants of the same size and species as originally installed, or a substitution of species as approved by the Engineer.

Unless otherwise permitted or directed, defective trees, as determined by DPR, must be replaced with new trees by the Contractor for the full duration of the contract Guarantee Period, beyond the plants' Establishment Period. The furnishing and planting of trees as replacements for defective trees must comply, in all respects, with the contract requirements.

Where vandalism, theft or related causes are agreed upon by the Engineer as the cause for plants or tree replacement, the Contractor must be responsible for replacement for one time during the Establishment Period for plants, and the full duration of the Guarantee Period for trees.

All hardscape elements within the planting bed or tree pit must remain on site and be replaced neatly at no additional cost to the City. Plants or trees that died within the Establishment Period must be replaced as many times as necessary so that there is a live plant or tree at each location at the end of the Establishment Period.

All dead, missing or impaired plant material must be removed and replaced within fifteen (15) days of notification, or during the next appropriate planting time frame, as directed by the Engineer. The Contractor is advised that the preferred planting season is the Spring, which provides optimal conditions for plant establishment.

If, in the opinion of the Engineer, the weather is unsuitable for making repairs or replacements at the time of such determination, the Contractor must make the required repairs or replacements when permitted by the Engineer.

(C) COMPLETE REPAIRS PRIOR TO EXPIRATION OF GUARANTEE.

The contractor must not leave dead or unhealthy planted material without replacement beyond the time of expiration of the Guarantee Period.

The Contractor must include all repair or replacement Work on the weekly schedules submitted to the Engineer as required by Section 1.06.25 of the NYC DOT Standard Highway Specifications. Additionally, the time and place of such Work must be provided to the Engineer daily.

(D) ESTABLISHMENT PERIOD TASKS (POST PLANTING CARE).

Post-planting care must consist of watering, mulching, erosion control matting maintenance, weeding, integrated pest management, pruning, removal of dead branches, repair or removal of tree support systems if present, removal of sediment built up, removal of litter and debris, and other horticultural operations necessary for the proper growth of all plants, and for keeping the entire area within the contract limits neat in appearance as specified or directed by the Engineer. The Engineer may make interim assessments of the post planting care progress. Post-planting care shall be in effect from initial Planting and conclude upon a successful Third Inspection or Third Inspection Re-Planting, as applicable. (see Figure 4.10-1 Planting Inspection Chart)

The contractor must prepare and submit to the Engineer a post-planting care Work schedule for approval upon coordination of initial Planting Work.

(1) Watering

The Contractor must be responsible for setting up a regular schedule for weekly watering between April 1st and November 15th and for notifying the Engineer of any deviation from that schedule at least 2 (two) working days in advance of the regularly scheduled watering date. If watering is to occur other than standard working hours (7 AM – 4 PM weekdays), the Contractor must coordinate with the Engineer for inspection.

a. The Contractor must provide water without damage to plants, mulch, erosion control matting, stakes, plant saucers, sod or other areas to be watered. Each plant saucer must be carefully filled with water in a manner which does not erode the soil or the plant saucer. Watering must not cause uprooting or exposure of plant's roots to the air. Damage resulting from watering operations must be repaired at no additional cost to the City.

b. Watering must be applied at the following rates:

a. Wildflowers, Sod, Planting Beds. In the absence of 1 inch of rainfall within 5 consecutive calendar days the Contractor must apply a total of 1" of water to all wildflowers, sod and planting beds once a week. The Contractor must install witness sticks or use soil moisture sensors, installed to the desired watering depth, to assist the watering personnel in providing the required depth of water.

b. Trees and Planting Pits. Between April 1st and November 15th, in the absence of 1 inch of rainfall within 5 consecutive calendar days, the Contractor must apply water to trees and understory plants in planting pits once per week, except during July and August, when water must be applied twice per week, with a minimum of 2 days between applications. Soil saucers or portable drip irrigation systems must be filled once per watering. At least 10 gallons of water per tree caliper inch must be used per tree at each watering (for example, a 3" tree requires 30 gallons per watering). The Contractor must use a water meter (flow meter) to verify the volume of water applied.

c. Water applied to seeded or sodded areas, plants or planted areas must be free from oil, have a neutral pH and must be free from impurities injurious to vegetation. Unless otherwise directed, water may be drawn from mains owned by or supplying water to the City of New York.

d. Where water is supplied from City hydrants, the Contractor must obtain a no-cost hydrant permit from the DEP. Permits are issued for a 30-day period, and the Contractor is responsible for keeping the permits current. The Contractor must have all tools and permits necessary for using city hydrants in their possession. If conditions do not allow the use of New York City water sources, the Contractor must obtain their own source of water. No direct payment must be made for water obtained from other than city sources, but the cost thereof will be deemed included in various items of the contract.

e. During dry conditions as defined by the Engineer, the Contractor will add to water a wetting agent product that is meant to aerate soil and allow for more water to penetrate such as Yuccah® Wetting Agent, or DIEHARD™ Soluble Yucca Extract as manufactured by Plant Health Care, or Horticultural Alliance, Inc., or an approved equal. An anti-desiccant to help prevent loss of water through transpiration must also be used when directed by the Engineer. The anti-desiccant product, approved by the Engineer, must be mixed into water at appropriate ratios (Contractor must follow product instructions). Wetting agent, if required, must be provided at no additional cost.

f. Watering bags must be removed at the end of the watering season in October and replaced at the first watering in May during the establishment period.

g. The Contractor must maintain a watering log, which must be submitted monthly to the Engineer for approval. The watering log must:

i. Indicate the dates and times all watering was performed and the employee that performed the watering;

ii. Verify the depths that water was applied to wildflowers, sod, and planting beds;

iii. Verify the volume of water applied to trees and planting pits. This must include before and after readings from the water meter used.

h. If the Engineer determines, from inspection of the plants or by reviewing the watering logs, that the Contractor's watering effort is insufficient, the Engineer may direct the Contractor to increase the watering efforts, at no additional cost to the City.

(2) Mulching and Erosion Control Matting

a. The contractor must apply mulch in accordance with the requirements of Section GI-4.16 and **Section GI-4.17,** or rolled erosion control product, also known Erosion Control Blanket/Matting, if required by a special specification. Mulch (or Erosion Control Matting if required) must not cover plants or be in contact with tree root flare, tree trunks, and plant stems.

b. Shredded Bark Mulch (or Erosion Control Matting if required) must be applied as a ground cover to the surface of all planting beds at the time of planting, one year after planting when the tree stakes are removed, and at the start of each

watering season during the establishment period.

c. If necessary, the Contractor must add topsoil to planting beds prior to mulching or installing Erosion Control Matting if soil levels are below the grade of the surrounding sidewalk or pavement, or if soil levels do not match the grading shown on the plans.

(3) Weeding

The Contractor must remove and dispose of weeds including roots prior to flowering and seed formation by manual or mechanical means within the period from May 15th to October 31st, and such cultivating and weeding must be repeated at least every four (4) weeks or more frequently as required elsewhere in the Contract Documents. Any method of weed removal that leaves live roots in the soil will not be permitted. Under no conditions will weeds be allowed to attain more than six (6) inches of growth including weeds within planting beds where plants have died, are missing, or have been vandalized and are scheduled to be replaced. The Contractor must ensure the preservation of desirable vegetation. Desirable plants unintentionally killed or removed by the Contractor must be replaced at no cost to the City.

(4) Integrated Vegetation and Pest Management

In the event of threat of serious damage from insects or diseases the plants must be treated by preventative or remedial measures. The Contractor must control insects, fungus, and other diseases. Methods may include spraying with an approved insecticide or fungicide.

(5) Pruning

Tree Pruning must be done in accordance with the requirements of Section 4.18 and as directed by the Engineer. Pruning of all plants must comply with ANSI A300 (Part 1) standards and must be conducted a minimum of two (2) times during the Establishment Period to remove dead or damaged branches.

(6) Repair and/or Removal of Tree Support Systems

If tree support systems are present, the Contractor will be responsible for inspecting and adjusting or repairing the systems once every six months during the Establishment Period. The Contractor will also be responsible for removal of the tree support system, if present, at the end of the Establishment Period.

(E) TRANSFER TO MAINTENANCE PARTNER.

Where the City has identified a long-term maintenance partner (entity that will maintain the plantings after completion of the Establishment Period) for certain planting locations, and in the Engineer's sole discretion, the Contractor may be directed to turn over maintenance activities for such plantings to the City's identified maintenance partner prior to Final Acceptance of the Contract. The Engineer will be solely responsible for deciding to turn over maintenance activities, and requests from the Contractor will not be entertained. If the Engineer requests that maintenance activities will be turned over to the maintenance partner, the Engineer will provide such direction in writing and must include:

- Date for acceptance walkthrough with the maintenance partner;
- Date for turnover to the maintenance partner;
- Written confirmation from the maintenance partner for the turn over.

Where the Contractor has been directed to turn over maintenance of plantings to the City's identified maintenance partner prior to Final Acceptance:

- The City's maintenance partner will be responsible for completing the plant establishment tasks and maintenance.
- The Contractor will be responsible for fulfilling all NYC DPR permit requirements, and allowing the maintenance partner access, where necessary, to the plantings.

This provision will not be applicable to street trees. Nothing in this section will relieve the Contractor of its obligation to protect the Work, the plantings, or other property in accordance with Article 7 of the Standard Construction Contract.

GI-4.10.4. PRICE TO COVER. No separate payment will be made. The cost of furnishing all labor, materials, plant, equipment, insurance, and necessary incidentals required must be included in the unit price items bid for the various planting materials including, but not limited to Trees, Shrubs, Perennials, Grasses and Groundcovers.

SPECIAL SPECIFICATIONS
(FOR THE WORKS TO BE PAID)

SECTION GI-P1 – PHOTO DOCUMENTATION

GI-P1.1 GENERAL REQUIREMENTS

The Contractor must engage the services of an experienced professional photographer, approved by the City, to take color job photographs. The photographer will be required to take pre-construction, construction and post-construction photographs of the Work as directed by the Engineer.

(A) Pre-Construction Photographs

The photographer must visit the site prior to start of construction to take a total of five (5) photographs per Green Infrastructure Asset showing existing condition of the Green Infrastructure Asset site and any adjacent areas which could possibly be disturbed during construction.

(B) Construction Photographs

The Contractor in coordination with the Engineer must visit the site before the clean open graded stone is placed and take five (5) photographs per Green Infrastructure Asset to show the Work in progress, and any adjacent areas which were disturbed during construction. The Contractor must ensure all subsurface asset components in each asset are photographed at least once in coordination with the Engineer. Acceptance of subsurface elements is contingent on provided photographs.

(C) Post-Construction Photographs

The photographer must visit the site at the completion of construction to take a total of five (5) photographs showing the completed Work and any adjacent areas which were disturbed during construction.

GI-P1.2 PRODUCTS

(A) Photographs

(1) For the purposes of this Section, a photograph must be defined as one (1) exposure.

(2) Digital images must be submitted. They must be labeled with the information listed below.

a. Green Infrastructure Asset Number.

b. Project number.

c. Project name.

d. Contract number and description.

e. Photo number.

f. Date picture was taken.

g. View and description, indicating location of camera, general description of what photograph represents and whether this is a pre-construction, construction or post-construction photograph. (A plot plan must be submitted by the Contractor indicating location and photo number of all photographs.) The Contractor must transmit one digital copy of each photo to the Engineer for use in preparing descriptions. The photos with descriptions will be returned to the Contractor for printing description, mounting, etc.

h. Name of photographer.

i. Engineer or Engineer's Representative.

j. GPS coordinates.

(3) The Engineer will accompany the photographer for the taking of all photographs.

(4) Digital photographs must be created, indexed and transferred to the Department of Environmental Protection in accordance with the requirements of Section GI-R-1.13, 'Records in Electronic Formats'. The Contractor must provide the Engineer with updated images on a monthly basis.

(5) Digital Photographs must be named in the following format: "Contract ID"_"Asset ID"_"Photo number"_"Date".

a. Contract ID – DDC contract number. E.g. GCJA##-##

b. Asset ID - GI asset ID with prefix matching as-built asset type. For instance, if a ROWB 1234A was converted to IB during construction, "Asset ID" will be IB1234A.

c. Photo Number – Chronological number with the first photograph taken of an asset starting at "01".

d. Date – Date photo was taken.

GI-P1.3 EXECUTION

Use of Photographs

(1) All photographs, slides, prints and negatives, resulting from the Work under this Contract, will become the property of the City upon their approval by the Engineer and may be used in whole or in part and in such manner or for such purpose as the City may desire, without any additional compensation to the Contractor or photographer.

(2) All photographs, aerials, slides, prints, negatives, reports, documents, data, or other materials produced pursuant to this Agreement ("Copyrightable Materials") must be considered "work-made-for-hire" within the meaning and purview of Section 101 of the United States Copyright Act, 17 U.S.C. '101, and the City must be the copyright owner thereof and of all aspects, elements and components thereof in which copyright protection might subsist. To the extent that the Copyrightable Materials do not qualify as "work-made-for-hire," the Contractor and the photographer hereby irrevocably transfer, assign and convey exclusive copyright ownership in and to the Copyrightable Materials to the City, free and clear of any liens, claims, or other encumbrances. Neither the Contractor nor the photographer must retain any rights pertaining to the Copyrightable Materials, including any copyright or intellectual property interests, nor must they reproduce, publish,

disseminate or otherwise use any of the Copyrightable Materials without the prior written approval of the City.

The Contractor and the photographer acknowledge that the City may, in its sole discretion, register copyright in the Copyrightable Materials with the U.S. Copyright Office or any other government agency authorized to grant copyright registrations. The Contractor and the photographer must cooperate in this effort, and agree to provide any further documentation necessary to accomplish this.

(3) The Contractor must not retain any copy of any photograph taken for the project unless the Contractor specifically requests and receives written approval from the Engineer who in consultation with NYC DEP must allow the Contractor to retain specific construction photographs. The request for approval must be processed through the Resident Engineer. The Contractor must not request or procure copies for the Contractor's use of any photograph from the photographer without this written approval.

GI-P1.4 DIGITAL PHOTOGRAPHS

(A) See GI-R-1.15E for digital photograph file format.

GI-P1.5 PAYMENT

(A) All costs associated with this Section must be included as specified in Subsection GI- P1.6 the Measurement and Payment. The Contractor must produce one set of photographs for each Green Infrastructure Asset.

(B) A set of photographs includes all Pre-Construction, Construction and Post-Construction Photographs as required in this section.

(C) Should more than the specified number of photographs be required, the Contractor will be paid at a negotiated price for each photograph over the specified number requested in writing by the Engineer.

(D) The Engineer reserves the right to reject any photograph that is not clear or definitive. Any photograph so rejected must be subtracted from the total exposures before computations for payment or credit under this Section.

GI-P1.6 MEASUREMENT AND PAYMENT

The quantity to be measured for payment will be the number of SETS of Photographs furnished by the Contractor, to the satisfaction of the Engineer.

The contract price bid per set must cover the cost of furnishing all labor, materials, plant, equipment, insurance, and necessary incidentals required to completing the Work including, but not limited to, the cost of the photographer, and digital photographs; all in accordance with the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-P1	PHOTO DOCUMENTATION	SETS

SECTION GI-PPCP PRECAST POROUS CONCRETE PANEL

GI-PPCP.1 INTENT

This section describes the installation of the PRECAST POROUS CONCRETE PANEL (PPCP). The purpose of the precast porous concrete panel is to serve as a porous medium for infiltration of stormwater runoff through its surface and into a storage layer.

GI-PPCP.2 DESCRIPTION

Under this section, the Contractor must furnish and install the precast porous concrete panels and accessories in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

GI-PPCP.3 MATERIALS

(A) References

(1) American Society for Testing and Materials (ASTM) and other testing standards, the Current Edition will be the reference:

(2) ASTM C33 Standard Specification for Concrete Aggregates

(3) ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

(4) ASTM C78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

(5) ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

(6) ASTM C1116 Standard Specification for Fiber-Reinforced Concrete

(7) ASTM C1688 Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete

(8) ASTM C1701 Standard Test Method for Infiltration Rate of In-Place Pervious Concrete

(9) ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)

(10) ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

(B) Other sections are necessary to complete the Work of this section. Those sections include, but are not limited to:

(1) Section GI-2.07 CLEAN OPEN GRADED STONE

(2) Section GI-4.06 GI CONCRETE ELEMENTS

(3) Section GI-5.10 STONE COLUMN

(4) Section GI-5.10 OW OBSERVATION WELL

(5) Section GI-PPCP-CH CAST-IN-PLACE CONCRETE HEADER

(6) Section GI-PPCP-MG MICROGRID

(7) Section GI-PPCP-DC STACKED DRAINAGE CELLS

(8) Section GI-PPCP-BG BIAXIAL GEOGRID

(9) Section GI-PPCP-CCD CAST-IN-PLACE CONCRETE CHECK DAM

(10) Section GI-PPCP-CC CAST-IN-PLACE CONCRETE CURB

(C) Specifications from the City of New York Department of Transportation, Infrastructure Design Standards, Standard Highway Specifications current edition, are necessary to complete the Work of this item but not included herein and to be paid for separately include:

(1) Section 1.06.48 ADDITIONAL PROVISIONS PERTAINING TO STREET PAVING AND INSTALLATION OF SIDEWALKS, SECT. D

(2) Section 2.15 FILLER, EXPANSION JOINT, PREFORMED

(3) Section 4.08 CURB, CONCRETE

(4) Section 4.11 AS EARTH EXCAVATION FOR STRUCTURES

(D) PRECAST POROUS CONCRETE PANEL

(1) The precast porous concrete panels must be supplied by a manufacturer having at least five (5) years of experience in the production and sale of porous concrete panels.

(2) The manufacturer must provide a training program for the Contractor detailing handling and installation of the product.

(3) Refer to the Contract Drawings for precast porous concrete panel dimensions, thickness, and reinforcing requirements. The precast porous concrete panels supplied must be of the type(s) as shown in the Contract Drawings.

(4) Fiber reinforcement must be utilized as a means of reinforcement to achieve the panel design load requirements. Reinforcing must be a product on the New York State Department of Transportation *Approved Materials, Equipment, Methods and Procedures* List, Material Code 711-01.

(5) Smaller panel lengths must only be used where necessary and appropriate to accommodate utilities and overall alignment or as shown on the Contract Drawings. To eliminate cutting and to reduce the number of panels that are less than full length, minor adjustments of the limits of the Work may be made. Those adjustments must be submitted to the Engineer for approval before they are made.

(6) Installation of precast porous concrete panels must be in strict accordance with the manufacturer's recommendations, all information contained in this specification, and related Contract Drawings.

(7) Permanent lifting points must be embedded in the panel surface for unloading, handling, installation, maintenance, removal, and reinstallation purposes. Refer to the Contract Drawings for lifting point locations. Shop drawings are required. All panels must be provided with lifting point protection caps and approved lifting swivels for use in covering the embedded lifting points. Any altered unit must include a minimum of two (2) permanent lifting points.

(8) Precast porous concrete panels must have a minimum average Flexural Strength of 400 psi when tested in accordance with ASTM C78. Panels must not be shipped until they have achieved 85% of the minimum flexural strength or higher as determined by the lab test results submitted. The void content must be from 15% to 25%, conforming to ASTM C1688.

Concrete average unit weight must be 120 lb./ft.3 (+/- 4%). The average core compressive strength of the precast porous concrete panels must be a minimum of 2,000 psi at 28 days per ASTM C42. The manufacturer must cure the precast porous concrete panels. The precast porous concrete panels must have a minimum infiltration rate of 250 inch/hr when tested in accordance with ASTM D1701C1701.

(9) Each individual precast porous concrete panel must be weighed, and the unit must be labelled with the weight, size, and date of manufacture.

(10) All panels must be provided with spacers preventing slab to slab contact, as required by the Manufacturer.

(11) Concrete must be tinted when specified.

GI-PPCP.4 METHODS

(A) GENERAL

(1) Before panels are installed, the Contractor must ensure that all materials and preparation for subbase and edge restraints are installed in accordance with

Contract Drawings and specifications and is approved by the Engineer.

(2) Do not damage drainpipes, underdrains, observation wells, roadway boxes, manholes, or any other utilities during installation. Report any damage immediately to the Engineer. All damage must be replaced or repaired by the Contractor at no additional cost to the city.

(B) SUBGRADE PREPARATION

(1) The subgrade under the clean open graded stone course (subbase) must not be compacted.

(2) Prepared subgrades under all infiltration areas must not be compacted and must not be subjected to construction equipment traffic. Where erosion has caused accumulation of sediment or ponding on the subgrade, remove sediment with light equipment and/or manually. Scarify the underlying soils to a minimum depth of six-inches (6”) with a York-type rake or equivalent equipment to the satisfaction of the Engineer.

(3) Restore any subgrade areas damaged by erosion, ponding, or traffic compaction to design line and grades prior to installation of geogrid and clean open graded stone.

(4) Any excess thickness of material placed over the soil subgrade to trap sediment transported by runoff from adjacent construction areas must be removed before placement of geogrid and storage reservoir layer. Keep area where precast porous concrete panels are to be installed free of sediment during the entire construction period. Any materials that are contaminated with sediment must be removed and replaced with clean materials.

(C) CAST-IN-PLACE CONCRETE HEADER

Cast-in-place concrete header must comply with Section GI-PPCP-CH and must be placed prior to the placement of the geogrid or open graded stone base.

(D) CAST-IN-PLACE CONCRETE CHECK DAM

Cast-in-place concrete check dam must comply with Section GI-PPCP-CCD**.**

(E) CAST-IN-PLACE CONCRETE CURB

Cast-in-place concrete curb must comply with Section GI-PPCP-CC**.**

(F) MICROGRID

Microgrid must comply with Section GI-PPCP-MG.

(G) STACKED DRAINAGE CELLS

Stacked drainage cells must comply with Section GI-PPCP-DC.

(H) BIAXIAL GEOGRID

Biaxial Geogrid must comply with Section GI-PPCP-BG.

(I) CLEAN OPEN-GRADED STONE BASE

(1) Clean open-graded stone base must comply with Section GI-2.07.

(2) Clean open-graded stone base must be compacted to at least 95% Modified Proctor relative compaction per ASTM D1557. A minimum 200-pound walk-behind plate compactor must be used on each lift of six-inches (6”). Compaction using the plate compactor must include four (4) passes in each direction longitudinally along length of the trench.

(3) The surface tolerance of the compacted clean open-graded stone base must be a maximum of +/- three-quarter inch (¾") under a ten (10) foot straightedge in all directions.

(4) Verify that the open-graded stone base, as shown on the Contract Drawings, has been properly placed within the trench and compacted as approved and accepted by the Engineer before the leveling course is placed.

(5) Place and spread leveling course stone evenly over screed rails to achieve a thickness of two inches (2”) minimum. Level the surface of leveling course stone with a screed, it must not be compacted.

(6) The surface tolerance of the screed leveling course must be a maximum of a +/- one-quarter inch (¼") under a ten (10) foot straightedge in all directions. The cost of any additional stone beyond the limits must be borne by the Contractor at no additional cost to the city.

(7) Once installed, Contractor must not disturb screeded leveling course.

(J) PRECAST POROUS CONCRETE PANEL PLACEMENT

(1) Precast porous concrete panels must not be placed in heavy rain or snow or on a saturated or frozen base.

(2) Precast porous concrete panels must only be lifted and placed using swivels and spreader chains. Chains, cables, or slings should never be wrapped around the panel for lifting under any circumstances. Swivels must be securely bolted snug but not over-tightened to avoid damage to the surface of the panel.

(3) The Contractor must keep skid steer, forklift, and all other heavy equipment off all unrestrained panels.

(4) Lay panels in pattern(s) shown on approved shop drawings layout plan. Cut panels to complete installed length and pattern on approved shop drawings.

(5) The Contractor is responsible for installing precast porous concrete panels according to the Manufacturer's requirements for proper handling and installation.

To prevent any damage to panel edges, the Contractor must place panels with the joint size specified without using metal hammers, pry bars or drift pins. Horizontal adjustments to the placement of laid slabs must be made with wood wedges and levers, and rubber mallets as needed. Joint widths and lines must be continually evaluated and straightened as necessary as paving proceeds to the satisfaction of the Engineer.

(6) Panels must be placed parallel to the adjacent cast-in-place header as per approved shop drawings. Any adjustments must be made at the curb for irregular alignment.

(7) Unless otherwise directed, adjacent slabs must be separated from each other by one-eighth inch (1/8") to provide open joints between panel slabs of one-eighth inch (1/8") wide using spacers provided by the manufacturer of the panels to ensure proper joint spacing. No joints must exceed one-eighth inch (1/8") in width unless otherwise directed by the Engineer in writing.

(8) Panel to panel joints must be left open. No stone or sand is to be placed in joints.

(9) Horizontal joint lines along header must not deviate more than ± one-half inch (½") over 50 feet from reference string lines.

(10) The precast porous concrete panels must be installed so that there is no lippage or surface unevenness greater than one-eighth inch (1/8") difference in height between panels and adjacent surfaces.

(11) The Contractor must complete any gaps at the edges of the paved area with panels cut according to manufacturer's requirements for minimum panel dimensions. Cut panels to meet installation dimensions as indicated on the approved panel layout shop drawings. End panels to be placed along the edge or corners must be cut with a masonry saw. Cut units must be no shorter than one-quarter (1/4) of a whole panel length and must still retain the minimum number of lifting points required.

(12) The Contractor must protect adjacent panels' surfaces from dust infiltration when cutting panels.

(13) The Contractor must finish outside edge joints as indicated on the approved installation plan with approved joint filler material.

(14) After an area is completely paved, the Contractor must complete a final setting of the precast porous concrete panels into the screed leveling course layer by trafficking with light-weight rubber-tired equipment approved by the Engineer.

(15) The Contractor must remove and replace any panels cracked or damaged during installation with equivalent replacement panels. The Contractor must all reset panels not in conformance with specified installation tolerances to the satisfaction of the Engineer.

a) Hairline cracks (1/8” or smaller) with no vertical or horizontal displacement of panels shall be considered as to not interfere with the proper functioning or performance of the system and are acceptable when immediately repaired upon observation per manufacturers recommendation. Where approved by the Engineer, larger cracks (1/8” or larger) with no vertical displacement may be repaired under the direction of the manufacturer. Any cracked panels with horizontal displacement of greater than 1/4" or a vertical displacement of any size shall be replaced.

b) The repairs must be properly finished and cured. The color of the repair area must match as closely as possible with the rest of the panel color. Repairs shall be made with a mixture of self-leveling polyurethane sealant for horizontal applications and cement, as directed by the manufacturer.

(16) The Contractor must warranty as noted in Schedule A of the Contract from the date of the initial acceptance of the installation that all installed panels are free of rocking or pumping as evidenced by visible vertical movement. Any panels observed to be moving or displacing must be removed, the screeding leveling course re-screeded, and the panels reset and/or replaced if cracked.

(17) The Contractor must verify and report to the Engineer in writing that the final surface elevations of the set panels are in conformance with the Contract Drawings. The final surface tolerance from grade elevations must not deviate more than ± one-eighth inch (1/8”) under a ten-foot (10’) straightedge.

(18) The surface elevation of set panels must be flush with all manholes and the top of utility structures.

(K) EDGE RESTRAINT

Edge restraints installed at exterior sides of precast porous concrete panels pavement must be as follows:

(1) Edge restraints must be furnished and installed under other concrete items: Concrete Header, **Section GI-PPCP-CH**, Concrete Curb, **Section GI-PPCP-CC,** or GI Concrete Elements, Section GI-4.06, and as shown on the Contract Drawings, and must be paid under other contract items.

(2) Expansion joint material must be placed per Contract Drawing details between edge restraints and panels. Cost to be included in the cost of the panels.

(3) Manufacturer: Expansion Joint Material must be from a manufacturer listed in the current New York State Department of Transportation’s approved list of Pre-Molded Resilient Joint Fillers.

(4) Material Standards for Expansion Joint Material must comply with the requirements of **Section 2.15**, Type IV, in the New York City, Department of Transportation, Standard Highway Specification, current edition, and must be either one-quarter inch (¼") or one-half inch (½") thick, as directed by the Engineer.

(5) Backer rods and polyurethane joint filler must be provided on the curb side. Joint filler consisting of closed cell foam backer rod and polyurethane non-sag elastomeric sealant such as Sikaflex –2c NS TG, Akonaflex Expansion joint filler, or approved equal must be used.

(L) PROTECTION

(1) Immediately after precast porous concrete panels have been placed, insert plastic caps in lifter holes as provided.

(2) After the Work in this section is complete, the Contractor will be responsible for protecting the precast porous concrete panel system from damage and/or contamination during the remainder of Work on site. The surface of the precast porous concrete panels must be completely covered during the placement of adjacent soils or paving materials in a manner approved by the Engineer.

(M) ACCEPTANCE

(1) Prior to acceptance by the City for Substantial Completion, the Contractor must conduct percolation rate testing every hundred (100) linear feet of gutter but no less than three (3) per section of gutter in accordance with ASTM C1701. All testing must be done in coordination with and in the presence of the Engineer.

(2) Testing locations will be chosen at the Engineer's discretion and in accordance with the ASTM requirements.

(3) The Contractor must provide testing results to the City of New York within seven (7) days after the completion of testing. The Contractor must review testing results with the City of New York. Precast porous concrete panels with infiltration rates below the minimum infiltration rate of 150 inches per hour prior to Substantial Completion must undergo corrective action (such as cleaning the failed panel, or cleaning the entire gutter run, or replacement of the failed panel) prior to the City issuing Substantial Completion.

(4) After corrective action has taken place, then one other panel in the same contiguous length of porous gutter will be randomly selected by the Engineer and tested to ensure that the gutter meets the specified infiltration rate. If the selected panel fails to meet that rate, then the whole length of the gutter must be cleaned again, and the testing process repeated until passing results are obtained.

(N) MAINTENANCE

Infiltration rate testing, in lieu of cleaning and maintenance, during the guarantee period will not be acceptable. The Contractor must conduct periodic maintenance and cleaning for the duration of the guarantee period after substantial completion, at minimum, as described below:

- At the end of Spring, to remove pollen and flowers, typically May-June
- At the end of Autumn, to remove fallen leaves, typically November-December
- Just prior to end of the Guarantee Period, unless the porous concrete panels were last

cleaned within 120 calendar days.

(1) Procedures for Maintenance and Cleaning:

(A) The Contractor must remove all visible sediment deposits. Where sediment has accumulated in areas surrounding and/or upstream of the precast porous concrete panel system and may enter the porous concrete, the Contractor must also remove such visible sediment deposits.

(B) The Contractor must use vacuum cleaning, regenerative air machines equipped with a specialized vacuum head that includes high pressure water nozzles. Walk behind and handheld equipment are not acceptable for use. This maintenance must remove sediment and debris that has clogged or blocked voids in the precast porous concrete panel.

(C) Sediment and debris must be sufficiently removed after cleaning to allow the porous pavement to infiltrate stormwater runoff. This may require multiple passes of cleaning to meet the desired post-cleaning infiltration rate, as discussed below.

(D) After cleaning of the precast porous concrete panel system and no later than three calendar (3) days after cleaning, the Contractor must conduct percolation rate testing every hundred (100) linear feet of gutter but no less than two (2)) per section of gutter in accordance with ASTM C1701. All testing must be done in coordination with and in the presence of the Engineer.

(E) Testing locations will be chosen at the Engineer's discretion and in accordance with the ASTM requirements.

(F) The Contractor must provide testing results to the City of New York within seven (7) days after the completion of testing. The Contractor must review testing results with the City. Precast porous concrete panels with infiltration rates below the minimum infiltration rate of 150 inches per hour specified must undergo corrective action (such as further cleaning or replacement).

(G) After corrective action has taken place, then one other panel in the same contiguous length of porous gutter will be randomly selected by the Engineer and tested to ensure that the gutter meets the specified infiltration rate. If the selected panel fails to meet that rate, then the whole length of the gutter must be cleaned again, and the testing process repeated until passing results are obtained.

Cleaning will be deemed sufficient only if the minimum of 150 inch/hr infiltration rate required by the city has been met. The City will conduct field inspections to ensure the proper condition and performance of the precast porous concrete paving panel system. Visual inspections and infiltration tests will be used to determine the performance of porous concrete. If based on visual inspections and/or the test results reviewed by the Engineer, the City determines that the Contractor's performance of maintenance Work is insufficient, the Contractor will submit a revised method or schedule for the maintenance of precast porous

concrete paving panels. The Contractor must perform subsequent corrective maintenance Work at no additional cost to the City.

a. The Contractor must responsibly decant dirty water in accordance with DEP regulations.

b. The equipment information, operating procedures including disposal, and schedule for maintenance Work must be submitted to the City at least 45 calendar days prior to start of maintenance and cleaning. Maintenance and cleaning cannot begin until approved by the Engineer.

GI-PPCP.5 SUBMITTALS

(A) All materials requiring a submittal for review and approval must be submitted prior to purchase of those materials and must be made in accordance with the requirements of the NYC Department of Transportation Standard Highway Specifications, General Conditions, Subsections 1.06.13 and 1.06.31.

(B) Shop drawings that must be submitted prior to pre-construction meeting include:

(1) Installation plan showing layout of each precast porous concrete panel with identification mark intended for installation.

(2) Individual slab drawings detailing lifting points in surface, reinforcing, finishes, and all dimensions.

(3) Narrative of shipping, handling, and protection procedures.

(C) Test results performed by an independent AASHTO Materials Reference Laboratory (AMRL) accredited testing laboratory of the following:

(1) Density and void content results in accordance with ASTM C1688 Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete, and

(2) Flexural strength test results in accordance with ASTM C78 Flexural Strength of Concrete. Three (3) saw-cut concrete beams prepared specifically for testing purposes as per ASTM C78, with the same concrete mix and reinforcing characteristics would be representative of a full-size panel. Changes in reinforcement configuration for testing purposes will not be permitted. The Contractor must submit a drawing for approval of the concrete beams intended for testing with all the reinforcing and lifting hook placements indicated. No end caps on the beams intended for testing will be permitted. One percent (1%) of the total number of panels intended for the entire project will be tested for compliance with the specifications.

(3) Infiltration rate of Precast Porous Concrete Paving Panels in accordance with ASTM C1701 Standard Test Method for Infiltration Rate of In-Place Pervious Concrete. One percent (1%) of the total number of panels intended for the entire project will be tested for compliance with the specifications.

(D) Particle size analysis in accordance with ASTM C136 for the open-graded stone leveling course with approved source(s) of supply noted.

(E) Test method procedures to conduct percolation rate testing after installation in accordance with ASTM C1701 Test Method for Infiltration Rate of In-Place Pervious Concrete. The submittal must include information related to the testing apparatus being used (infiltration rings) for approval by the City.

GI-PPCP.6 QUALITY CONTROL

The Quality Control Plan must be furnished by the Contractor and must receive approval from the Engineer at least five (5) working days prior to commencing any Work.

The plan must include, but is not limited to, horizontal and vertical layout of the Work, methods for the installation of the edge restraints, the methods for placing of the broken stone leveling course (base) and the placing of the panels.

A review of the Contractor's Quality Control installation plan will be done at a pre-construction meeting with the Contractor, the Contractor's panel installer mechanic/subcontractor, the panel manufacturer's representative (if present on the site), the Engineer and the project's Design Engineer.

The installation Contractor must be responsible for reviewing and complying with the Manufacturer's installation requirements including any required trainings, if applicable. The Contractor will be responsible for reviewing and abiding by the Manufacturer's Handling and Installation instructions.

GI-PPCP.7 DELIVERY, HANDLING AND STORAGE

(A) Delivery of the precast porous concrete panels must be coordinated so as not to interfere with other construction in the project to avoid delays.

(B) Precast porous concrete panels must be handled per Manufacturer recommendations which were included in the approved submittal.

(C) Offloading of panels must be performed by trained and experienced equipment operators. Extra care must be taken while offloading the panels due to their unique structural characteristics. A forklift or similar machine with forks must be used to offload. Chains, cables, or slings must not be wrapped around slabs and only the lifting points must be utilized.

(D) Precast porous concrete panels must be visually inspected for completeness, texture, and consistency with the approved shop drawings and the installation drawings. Minor spalls and cracks will be the basis for rejection. Defective panels will be inspected by the Engineer and the decision will be made at his sole discretion.

(E) Panels must be stored such that they are kept free from mud, dirt, grass cuttings, accumulation of foliage and debris at all times.

(F) Panels must not be exposed unsecured to vehicular and pedestrian traffic. Skid steer and forklift equipment must be kept off unsecured paving panels.

(G) Geogrid, geofabrics, crushed stone, and liner materials must be kept clean and prepared for installation.

(H) Stored panels must be placed on a level or nearly level paved surface. In dusty environment, panels must be covered to prevent dust and debris from settling on panel surfaces.

GI-PPCP.8 MEASUREMENT

The quantity to be measured for GI-PPCP PRECAST POROUS CONCRETE PANEL must be the number of SQUARE FEET of gutter covered with precast porous concrete paving panels. Concrete installed around utility covers or other intrusions in the paved area, as shown in the corresponding details in the Contract Drawings and as directed by the Engineer, will not be measured toward this item.

GI-PPCP.9 PRICE TO COVER

The contract price bid for GI-PPCP — PRECAST POROUS CONCRETE PANEL must be a unit price bid per SQUARE FEET and must cover the cost of all labor, materials, plant, equipment, insurance, and all incidentals required to furnish and install all precast porous concrete panels including, but not limited to planning the Work, horizontal and vertical layout, fine grading of subgrades, placing and screeding leveling course (base), installation of joint sealant, expansion joint material, tinting, when applicable and placing precast porous concrete paving panels as shown on the Contract Drawings and as specified herein, and as directed by the Engineer, all in accordance with the Contract Drawings, the specifications, and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP	PRECAST POROUS CONCRETE PANEL SYSTEM	S.F.

SECTION GI-PPCP-BXG — BIAXIAL GEOGRID

GI-PPCP-BXG.1 INTENT

This section describes the installation of the BIAXIAL GEOGRID. The purpose of the biaxial geogrid is to improve the structural integrity of the precast porous concrete panels. This is accomplished by confining and distributing load forces by providing soil base reinforcement.

GI-PPCP-BXG.2 DESCRIPTION

Under this section, the Contractor must furnish and install the biaxial geogrid in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

GI-PPCP-BXG.3 SUBMITTALS

(A) The contractor, prior to the start of Work, must submit to the Engineer for approval two (2) partial panel section with all characteristics the same as a full-sized panel, 12”x12” square, with manufacturer’s name, labeled samples of the biaxial geogrid in accordance with the requirements of Sections 1.06.13 and 1.06.31 of the NYC DOT Standard Highway Specifications, current edition. The label must include the manufacturer’s product name, the type of fabric, and the weight of grade of the material. Biaxial geogrid used in the Work must conform to the approved samples.

(B) Certified material test reports showing that the biaxial geogrid meet the specified requirements must be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports must meet the requirements of the criteria outlined herein.

(C) The manufacturer must submit certified test date to cover each shipment of material.

GI-PPCP-BXG.4 MATERIALS

(A) References

(1) American Society for Testing and Materials (ASTM) and other testing standards, in any case the Current Edition will be the reference:

(2) ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus

(3) ASTM D4759-11 Standard Practice for Determining the Specification Conformance of Geosynthetics

(4) ASTM D5818-11 Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics

(5) ASTM D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

(6) ASTM D7748 Test Method for Flexural Rigidity of Geogrids, Geotextiles and Related Products

(7) ASTM D7864 Standard Test Method for Determining the Aperture Stability Modulus of Geogrids

(B) Chemical and Physical Requirements

(1) The biaxial geogrid must be defined as a system that allows for long-term, adequate liquid flow normal through the biaxial geogrid with limited flow loss across the plane of the grid. The biaxial geogrid must exhibit high tensile strength in both longitudinal and transverse directions.

(2) The biaxial geogrid must have a Mid-Rib Width of 0.14 inches and a minimum Radial Stiffness @ 0.5% Strain of 321 kN/m (22,000 lb./ft.) when tested in accordance with ASTM D6637 and a Flexural Rigidity of 2,100,000 mg-cm when tested in accordance with ASTM D7748.

(3) The biaxial geogrid must have an Ultraviolet Degradation of 100% when tested in accordance with ASTM D4355. Biaxial Geogrid must be manufactured using an extrusion process resulting in a polypropylene sheet that is specifically shaped to create a triplanar reinforcing structure that produces a large, concave-shape rib. High profile ribs and junctions must be so configured to interlock and distribute stress of the loads above the grid onto the base below.

(4) Minimum Average Roll Value (MARV): Property value calculated as typical minus two (2) standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported. Typical Roll Value is represented by (TRV).

(5) The biaxial geogrid must have no tears or defects which adversely alter its physical properties. The biaxial geogrid must be inert to biological degradation and must be resistant to naturally encountered chemicals, alkalis, and acids.

Table GI-PPCP-BXG – Biaxial Geogrid Technical Characteristic Requirements

Technical Characteristics	Units	MD Values[1]	XMD Values[1]
Rib Pitch[2]	mm (in)	32 (1.26)	32 (1.26)
Minimum Rib Thickness	mm (in)	2.5 (0.1)	2.1 (0.08)
Rib Shape		Inverted T Beam	Rectangular

Table GI-PPCP-BXG – Structural Integrity Requirements of Biaxial Geogrid

Description	Units	MD Values
Aperture Stability[3]	N-m/deg	0.45
Overall Flexural Rigidity[4]	mg-cm	2,100,000
Radial Stiffness at low strain @ 0.5% Strain[5]	kN/m (lb./ft.)	321 (22,000)

Table GI-PPCP-BXG – Durability Requirements of Biaxial Geogrid

Description	Units	MD Values
Resistance to Installation Damage[6]	%SC / %SW / %GP	95 / 96 / 90
Resistance to Long Term Degradation[7]	%	100
Resistance to UV Degradation[8]	%	100

(C) Table Notes:

(1) Unless indicated otherwise, values shown are minimum average roll values determined in accordance with ASTM D4759-11. Machine direction is presented as (MD). Cross machine direction is presented as (XMD).

(2) Nominal dimensions.

(3) Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2 m-N) movement to the central junction of a 9-IN x 9-IN specimen restrained at its perimeter in accordance with ASTM D7864

(4) Resistance to bending force determined in accordance with ASTM D7748, using specimens of width two (2) ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs, and of length sufficiently long to enable measurement of the overhang dimension.

(5) Radial stiffness is determined from tensile stiffness measured in any in-plane axis from testing in accordance with ASTM D6637/D6637M-15, tolerance +/- 2%.

(6) Resistance to loss of load capacity or structural integrity when subjected to mechanical installation stress in clayey sand (SC), well graded sand (SM), and crushed stone classified as poorly graded gravel (GP). The geogrid shall be sampled in accordance with ASTM D5818-11 and load capacity shall be determined in accordance with ASTM D6637.

(7) Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments.

(8) Resistance to loss of load capacity or structural integrity when subjected to ultraviolet light and aggressive weathering.

GI-PPCP-BXG.5 CONSTRUCTION METHODS

(A) Each biaxial geogrid roll must be wrapped with an overlaying material that will protect the material, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping must be maintained during periods of shipment and storage. During storage, rolls must be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, and any environmental condition that may damage the physical property values of the geogrid.

(B) Excavation must be made to dimensions enough to accommodate placement of the biaxial geogrid, clean open graded stone, drainage cells, microgrid geotextile and leveling course with precast porous concrete panels. Any overcut underlying soil must be removed from the excavation and the bottom must be compacted **only** as specified and required elsewhere. The extra depth will be filled with clean open graded stone materials as required after installation of geogrid. No additional payment will be made for extra clean open graded stone used to compensate for overcut subbase. Where applicable, temporary support must be provided for trench walls to prevent it collapse when directed by the Engineer. The contractor must protect the pavement section at the saw cut line along the roadside.

(C) Prior to installation of biaxial geogrid, the drainage cells must be set in their final configuration as approved by the Engineer. If the biaxial geogrid is damaged during installation, the damaged section(s) must be removed, and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12) inches in all directions. The Contractor must make such repair Work as directed by the Engineer at no extra cost to the city. Overlaying material must be placed within the same work shift whether the fabric is subject to damage from sunlight or not.

GI-PPCP-BXG.6 MEASUREMENT

The quantity of BIAXIAL GEOGRID to be measured for payment must be the number of SQUARE YARDS installed at the site, in its final position, to the satisfaction of the Engineer. Measurement must be made to the nearest square yard installed. No quantity will be included for material used for repair of tears or for material used to provide the overlaps.

GI-PPCP-BXG.7 PRICE TO COVER

The contract price for BIAXIAL GEOGRID must be a unit price bid per SQUARE YARD and must cover the cost of furnishing all labor, material, equipment, insurance, submittals, and incidental expenses required to complete the Work; all in accordance with the Contract Drawings, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-BXG	BIAXIAL GEOGRID	S.Y.

SECTION GI-PPCP-CC — PPCP SYSTEM CAST-IN-PLACE CONCRETE CURB

GI-PPCP-CC.1 INTENT

This section describes construction of a flared CAST-IN-PLACE CONCRETE CURB. The purpose of the concrete curb is to contain the precast porous concrete panel system.

GI-PPCP-CC.2 DESCRIPTION

Under this section, the Contractor must install the cast-in-place concrete curb in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

(A) Cast-in-place concrete curb must be:

(1) Dimensioned in accordance with specifications, Contract Drawings, and directions of the Engineer.

(2) Constructed to the lines and grades as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure.

(3) Installed over undisturbed subgrade or a well-compacted subgrade unless otherwise noted.

(4) Installed vertically and horizontally level with 0” reveal from the final finished adjacent asphalt grade. The top of the cast-in-place concrete curb must be a medium broom finish as directed.

(B) Cast-in-place concrete curb expansion joints must be spaced at ten (10) feet maximum spacing.

GI-PPCP-CC.3 MATERIALS AND METHODS

All materials and methods must comply with the requirements of **Sections 4.08** in the NYC Department of Transportation Standard Highway Specifications, current edition, except as follows:

(A) Curb dimensions as per Contract Drawings

(B) Depth as shown on Contract Drawings

(C) Omit 4.08.4 (J), instead use replace with the following:

Existing concrete sidewalks, adjacent to or abutting new PPCP curbs and shall be replaced up to first full flag, unless otherwise directed by the Engineer. The space between the new PPCP curb and undisturbed sidewalk shall be filled with concrete sidewalk colored to correspond to the adjacent walk. No additional concrete sidewalk shall be cut off or otherwise disturbed until the same has been examined by the Engineer.

GI-PPCP-CC.4 MEASUREMENT
The quantity to be measured for the PPCP SYSTEM CAST-IN-PLACE CONCRETE CURB must be the number of LINEAR FEET (installed length) of concrete curb constructed, complete, in place, measured along the top of the curb.

GI-PPCP-CC.5 PRICE TO COVER
The contract bid price for the PPCP SYSTEM CAST-IN-PLACE CONCRETE CURB must be a unit price bid per LINEAR FEET and must cover the cost of furnishing all labor, materials, plant, equipment, insurance, and incidentals required to construct the PPCP system concrete curb, complete, in place, and must include, but not be limited to, curing, furnishing samples for testing as may be required and maintaining the concrete curb and adjacent restored sidewalk flag in good condition as required in **Section 4.08** of the NYC Department of Transportation Standard Highway Specifications, current edition, all in full compliance with the Contract Drawings, the specifications and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-CC-31	PPCP SYSTEM CAST-IN-PLACE CONCRETE CURB – 24” to 31” DEPTH	L.F.

SECTION GI-PPCP-CCD — CAST-IN-PLACE CONCRETE CHECK DAM

GI-PPCP-CCD.1 INTENT

This section describes the construction of the CAST-IN-PLACE CONCRETE CHECK DAM. The purpose of the cast-in-place concrete check dam is to regulate the flow of water through the precast porous concrete panel system.

GI-PPCP-CCD.2 DESCRIPTION

(A) Under this section, the Contractor must construct the cast-in-place concrete check dam in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

(B) The cast-in-place concrete check dam must be:

(1) Dimensioned in accordance with specifications, Contract Drawings, and directions of the Engineer.

(2) Constructed to the lines and grades as shown on the New York City Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure, current edition.

GI-PPCP-CCD.3 MATERIALS AND METHODS

(A) Weep Holes: Weep holes must be as shown on the Contract Drawings. Weep holes must be Schedule 40 PVC pipe in the size(s) shown.

(B) All materials and methods must comply with the requirements of Subsections 6.09.3 and 6.09.4**,** as appropriate, in the New York City Department of Transportation, Standard Highway Specifications, current edition.

(C) Concrete must be tinted when specified.

GI-PPCP-CCD.4 MEASUREMENT

The quantity of CAST-IN-PLACE CONCRETE CHECK DAM to be measured for payment must be the number of SQUARE FEET installed at the site measured along the top of the check dam, in its final position, to the satisfaction of the Engineer. Measurement must be made to the nearest square feet installed.

GI-PPCP-CCD.5 PRICE TO COVER

The contract price for CAST-IN-PLACE CONCRETE CHECK DAM must cover the cost of furnishing all labor, materials, plant, equipment, insurance, and incidentals required to construct cast-in-place concrete check dam, complete, in place, and must include, but not be limited to, curing, furnishing samples for testing as may be required and maintaining the cast-in-place concrete check dam in good condition as required in Section 5.05 of the New York City Department of Transportation, Infrastructure Design Standards, Standard Highway Specifications, current edition, all in full compliance with the Contract Drawings, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-CCD	CAST-IN-PLACE CONCRETE CHECK DAM	S.F.

SECTION GI-PPCP-CH — PPCP SYSTEM CAST-IN-PLACE CONCRETE HEADER

GI-PPCP-CH.1 INTENT

This section describes construction of a flared CAST-IN-PLACE CONCRETE HEADER. The purpose of the concrete header is to contain the precast porous concrete panel system.

GI-PPCP-CH.2 DESCRIPTION

Under this section, the Contractor must install the flared cast-in-place concrete header in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

(A) Cast-in-place concrete header must be:

(1) Dimensioned in accordance with specifications, Contract Drawings, and directions of the Engineer.

(2) Constructed to the lines and grades as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure.

(3) Installed over a well-compacted subgrade unless otherwise noted.

(4) Installed vertically and horizontally level with 0” reveal from the final finished adjacent asphalt grade. The top of the cast-in-place concrete header must be a medium broom finish as directed.

(5) Concrete must be tinted when specified

(B) Cast-in-place concrete header expansion joints must be spaced at fifteen (15) feet maximum spacing.

GI-PPCP-CH.3 MATERIALS AND METHODS

All materials and methods must comply with the requirements of Sections 6.09.3 and 6.09.4, as appropriate, in the NYC Department of Transportation Standard Highway Specifications, current edition, except as follows:

(A) Header dimensions as per Contract Drawings

(B) Depth as shown on the Contract Drawings

GI-PPCP-CH.4 MEASUREMENT

The quantity to be measured for CAST-IN-PLACE CONCRETE HEADER must be the number of LINEAR FEET (installed length) of cast-in-place concrete header constructed, complete, in place, measured along the center line of the header.

GI-PPCP-CH.5 PRICE TO COVER

The contract bid price for CAST-IN-PLACE CONCRETE HEADER must be a unit price bid per

LINEAR FEET and must cover the cost of furnishing all labor, materials, plant, equipment, insurance, and incidentals required to construct the cast-in-place concrete header, complete, in place, and must include, but not be limited to, curing, furnishing samples for testing as may be required and maintaining the concrete header in good condition as required in Section 5.05 of the NYC Department of Transportation Standard Highway Specifications, current edition, all in full compliance with the Contract Drawings, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-CH-24	CAST-IN-PLACE CONCRETE HEADER –24" DEPTH	L.F.
GI-PPCP-CH-30	CAST-IN-PLACE CONCRETE HEADER - 30” DEPTH	L.F.
GI-PPCP-CH-36	CAST-IN-PLACE CONCRETE HEADER - 36” DEPTH	L.F.
GI-PPCP-CH-42	CAST-IN-PLACE CONCRETE HEADER - 42” DEPTH	L.F.

SECTION GI-PPCP-DC — STACKED DRAINAGE CELLS

GI-PPCP-DC.1 INTENT

This section describes the installation of the polyethylene STACKED DRAINAGE CELLS. The purpose of the STACKED DRAINAGE CELLS is to provide subsurface storage for stormwater management.

GI-PPCP-DC.2 DESCRIPTION

Under this section, the Contactor must furnish and install all STACKED DRAINAGE CELLS in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

GI-PPCP-DC.3 REFERENCES

(A) STACKED DRAINAGE CELLS must conform to the latest standards of the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), and the American Water Works Association (AWWA) as applicable.

(B) STACKED DRAINAGE CELLS must conform to the following ASTM standards:

(1) ASTM D1248 Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

(2) ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

(3) ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

(4) ASTM D6088 Standard Practice for Installation of Geocomposite Pavement Drains.

(5) ASTM D7001 Standard Specification for Geocomposites for Pavement Edge Drains and other High-Flow Applications

(6) ASTM F2418 Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers

(7) ASTM 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics

GI-PPCP-DC.4 QUALITY CONTROL

(A) Contractor must have manufacturer’s representative available for site review if requested by the Engineer.

GI-PPCP-DC.5 DELIVERY, STORAGE, AND HANDLING

(A) Protect STACKED DRAINAGE CELLS and other materials from damage during delivery,

and store UV sensitive materials under tarp to protect from sunlight when time from delivery to installation exceeds two (2) weeks. Storage of materials should be on smooth surfaces, free from dirt, mud, and debris.

(B) Handling is to be performed with equipment appropriate to the materials and site conditions, and may include hand, handcart, forklifts, and extension lifts.

(C) Cold weather:

(1) Care must be taken when handling plastics when air temperature is 40 degrees or below, as plastic becomes brittle.

(2) Contractor must not use frozen materials or materials mixed or coated with ice or frost.

(3) Contractor must not build on frozen ground or wet, saturated, or muddy subgrade.

GI-PPCP-DC.6 PRE-INSTALLATION CONFERENCE

(A) Prior to the start of the installation, a pre-installation conference must occur with the representatives of the Engineer, the Contractor, the excavation contractor, the STACKED DRAINAGE CELLS installation contractor, and the manufacturer's representative.

GI-PPCP-DC.7 PROJECT CONDITIONS

(A) Contractor must coordinate installation of the STACKED DRAINAGE CELLS with other on-site activities to eliminate all non-installation related construction traffic over the completed stacked drainage cell system. In no case at any time must loads heavier than the design loads of the panel type being installed be allowed over the system.

(B) Contractor must protect adjacent Work from damage during the installation of the STACKED DRAINAGE CELLS.

(C) Contractor is responsible for any damage to the system during construction.

GI-PPCP-DC.8 SUBMITTALS

(A) All submittals must be submitted prior to purchase and must be made in accordance with the requirements of Subsections 1.06.13 and 1.06.31 of the NYC Department of Transportation Standard Highway Specifications, General Conditions, current edition.

(B) Contractor must submit catalog data for STACKED DRAINAGE CELLS and other appurtenances.

(C) Drawings must include typical section details as well as the minimum cover requirements and STACKED DRAINAGE CELLS configuration.

(D) Contractor must submit manufacturer's product data, including compressive strength, service temperature and unit weight.

(E) Contractor must submit the manufacturer's protection recommendations and installation instructions.

(F) Contractor must submit product sample for review. Reviewed and accepted samples will be kept on site for comparison purposes and will not be returned to the Contractor.

GI-PPCP-DC.9 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Drainage cell units must be injection molded plastic cells stacked to form a minimum 85% void modular structure of predesigned height. The STACKED DRAINAGE CELLS must be as uniform as commercially practicable in color, capacity, density, and other physical properties.

Table GI-PPCP-DC – Stacked Drainage Cell Requirements

Property	Description	Value
Minimum Void Area	Minimum volume available for water storage	85%
Minimum Surface Void Area	Minimum percentage of exterior available for infiltration	85%
Minimum Compressive Strength	ASTM D2412 and ASTM F2418; or ASTM D1621	240.2 psi
*HS-20 Min. Cover	Cover required to support HS-20 loads	6 inches
*Maximum Cover	Max. allowable cover depth	11 feet or more
Unit Weight	Weight range of plastic per cubic foot	6.45 - 7.55 lb./cf
Service Temperature	Safe temperature range for use	-14ºF to 185ºF

* Cover measured from top of drainage cell to finished surface

(B) Visible defects, such as cracks, creases, warps, bends, crazing, non-uniformly pigmented areas, or undispersed raw materials must not be acceptable and will result in rejection of the STACKED DRAINAGE CELLS by the Engineer.

(C) Any fittings necessary must be manufactured to the requirements of ASTM D 3212 and this Specification.

GI-PPCP-DC.10 CONSTRUCTION METHODS

(A) Excavation

(1) Base of the excavation for the STACKED DRAINAGE CELLS must be uniform, level, and free of lumps, debris, or soft yielding subgrade areas.

(2) Unsuitable soils or conditions: All questions about the base of excavation shall be directed

to the Engineer, who shall approve the subgrade conditions prior to placement of stone.

1. If unsuitable soils are encountered at the subgrade, or if the subgrade is pumping or appears excessively soft, repair the area in accordance with the Contract Drawings and as directed by the Engineer.

2. If indications of the water table are observed during excavation, the Engineer must be contacted to provide recommendations.

3. Do not begin installation of STACKED DRAINAGE CELLS until unsatisfactory subgrade conditions are accepted by the Engineer.

(B) Base Preparation

1. Place a thin layer (3” unless otherwise specified) of clean open-graded stone base, over the subgrade to establish a level working platform for the STACKED DRAINAGE CELLS. Level to within ½” (+/- ¼”) or as shown on the plans. Bedding materials must be prepared in accordance with the contract documents.

(C) Installation

1. Geogrid must be in accordance with Section GI-PPCP-BXG Biaxial Geogrid.

2. Install STACKED DRAINAGE CELLS in layers in accordance with the contract drawings. STACKED DRAINAGE CELL components must be connected to all other components for each layer. Layers must stack on top of each preceding layer evenly. No vertical connection between layers is required. The panels are to be oriented and at the required depth as per the contract drawings.

3. Wrap the STACKED DRAINAGE CELLS top and sides in specified microgrid material in accordance with Section GI-PPCP-MG Microgrid, and/or as approved and directed by the Engineer. Use special care to avoid any damage to microgrid during installation.

(D) Backfilling

Backfill and fill with recommended materials as follows:

1. Place clean open graded stone base around the perimeter of STACKED DRAINAGE CELLS in lifts with a maximum thickness of 6”. Each lift must be placed around the entire perimeter such that each lift is no more than 24” higher than the side backfill along any other location on the perimeter of the STACKED DRAINAGE CELLS.

2. Open graded stone base shall be carefully placed and compacted in the perimeter spaces around the STACKED DRAINAGE CELLS. No fill shall be placed over top of STACKED DRAINAGE CELLS until the perimeter backfill has been completed.

3. Each lift must be compacted until no further densification is observed. The side lifts must be compacted by walk plate compactor.

4. Use special care to ensure the compaction process does not allow machinery to

come into contact with the STACKED DRAINAGE CELLS due to the potential for damage to the Microgrid and STACKED DRAINAGE CELLS.

5. No compaction equipment is permissible to operate directly on STACKED DRAINAGE CELLS.

6. During construction, keep the STACKED DRAINAGE CELLS free from foreign matter. The cells must be left thoroughly clean to the satisfaction of the Engineer.

GI-PPCP-DC.11 MEASUREMENT

The quantity to be measured for STACKED DRAINAGE CELLS must be the number of CUBIC YARDS of a single layer of drainage cell units installed multiplied by the number of stacked drainage cell layers that achieve the final height and area shown in the Contract Drawings or as directed by the Engineer.

GI-PPCP-DC.12 PRICE TO COVER

The price bid for STACKED DRAINAGE CELLS must be a unit price bid per CUBIC YARD and must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete the Work of furnishing and installing drainage cell as shown in the Contract Drawings including, but not limited to, furnishing and installing fittings, connecting and joining cells to other cells; all in accordance with the Contract Drawings, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-DC	STACKED DRAINAGE CELLS	C.Y.

SECTION GI-PPCP-MG — MICROGRID

GI-PPCP-MG.1 INTENT

This section describes the MICROGRID. The purpose of the microgrid is to prevent the clean open graded stone base from entering the stacked drainage cells, while allowing for the free flow of water within the system.

GI-PPCP-MG.2 DESCRIPTION

Under this section, the Contractor must furnish and install the microgrid in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, current edition, and as directed by the Engineer.

GI-PPCP-MG.3 SUBMITTALS

(A) The contractor, prior to the start of Work, must submit to the Engineer for approval two (2) labeled samples of the microgrid in accordance with the requirements of Sections 1.06.13 and 1.06.31 of the NYC DOT Standard Highway Specifications, current edition. The label must include the manufacturer's product name, the type of fabric, and the weight of grade of the material. Microgrid used in the Work must conform to the approved samples.

(B) Certified material test reports showing that the microgrid meet the specified requirements must be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports must meet the requirements of the criteria outlined herein.

(C) The manufacturer must submit certified test date to cover each shipment of material.

GI-PPCP-MG.4 MATERIALS

(A) Chemical and Physical Requirements

(1) The microgrid must be defined as a system that allows for long-term, adequate liquid flow normal through the microgrid with limited flow loss across the plane of the geotextile. The microgrid must be composed of high molecular weight, high tenacity multifilament polyester yarns woven into a stable network placed under tension. The high strength polyester yarns must be coated with polyvinyl chloride (PVC) material that retain their dimensional stability relative to each other, including selvages. The microgrid must have no tears or defects which adversely alter its physical properties. The microgrid must be inert to biological degradation and must be resistant to naturally encountered chemicals, alkalis, and acids.

(2) Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported. Typical Roll Value is represented by (TRV). Minimum Average Roll Values (MARVs) in the machine direction determined in accordance with ASTM D4759-02.

Table : Microgrid Requirements

Tensile Properties	Test Method	MARV lbs./ft
Ultimate Strength – Machine Direction (MD)	ASTM 4595	1,700 +/- 5%
Ultimate Strength – Cross Machine Direction (XMD)	ASTM 4595	1,400 +/- 5%
Creep Limited Strength - MD	ASTM 5262	1,070 +/- 5%
Creep Limited Strength - XMD	ASTM 5262	880 +/- 5%
T_{al} = Long Term Design Strength - MD	NCMA 97	900 +/- 5%
T_{al} = Long Term Design Strength - XMD	NCMA 97	730 +/- 5%
Aperture Size (inches)	Measured (inches)	0.08 +/- 5%
Ultraviolet Resistance (500 hours)	ASTM D4355	78%

GI-PPCP-MG.5 METHODS

(A) Each microgrid roll must be wrapped with an overlaying material that will protect the material, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping must be maintained during periods of shipment and storage. During storage, rolls must be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, and any environmental condition that may damage the physical property values of the microgrid.

(B) Excavation must be made to dimensions enough to accommodate placement of the clean open graded stone, stacked drainage cells, microgrid and leveling course for the precast porous concrete panels. Any overcut underlying soil must be removed from the excavation and the bottom must be compacted **only** as specified and required elsewhere. The extra depth will be filled with clean open graded stone materials as required after installation of geo-grid. No additional payment will be made for extra clean open graded stone used to compensate for overcut subbase. Where applicable, Temporary Support must be provided for trench walls to prevent it collapse when directed by the Engineer. The Contractor must protect the road pavement along the saw cut line.

Prior to installation of microgrid, the stacked drainage cells must be set in their final configuration and/or as directed and approved by the Engineer. If the microgrid is damaged during installation, the damaged section(s) must be removed, and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer at no extra cost to the city. Overlaying material must be placed within the same work shift whether the fabric is subject to damage from sunlight or not.

GI-PPCP-MG.6 MEASUREMENT

The quantity of MICROGRID to be measured for payment must be the number of square yards installed at the site, in its final position, to the satisfaction of the Engineer. Measurement must be made to the nearest square yard installed. No quantity will be included for material used for repair of tears or for material used to provide the overlaps.

GI-PPCP-MG.7 PRICE TO COVER

The contract price for MICROGRID must be a unit price bid per SQUARE YARD and must cover the cost of furnishing all labor, material, equipment, insurance, submittals, and incidental expenses required to complete the Work; all in accordance with the Contract Drawings, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-MG	MICROGRID	S.Y.

SECTION GI-PPCP-MSFC – PPCP SYSTEM MODIFIED STEEL FACED CURB

GI-PPCP-MSFC.1 INTENT

This section describes construction of a PPCP SYSTEM MODIFIED STEEL FACED CURB. The modified steel faced curb shall be installed within protected tree root zones as specified in the Tree Mitigation Table and/or as directed by the Engineer for the protection of existing tree root system(s).

GI-PPCP-MSFC.2 DESCRIPTION

Under this section, the Contractor shall install the modified steel faced curb in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as modified by the Contract Documents.

(A) Modified steel faced curb shall be:

a. Dimensioned in accordance with specifications, and contract drawings.

b. Constructed to the lines and grades as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure.

c. Installed over compacted subgrade unless otherwise noted.

d. Installed vertically and horizontally level, with a curb reveal as specified on the plans from the final finished adjacent asphalt grade. The top of the steel faced cast-in-place concrete curb must be finished by troweling and wood floating and shall pitch one-quarter (1/4”) inch downward toward the front face of curb.

(B) Steel facing shall be:

a. Placed within forms, upon suitable chairs, to the proper line and grade.

b. Steel curb facing, having less than two (2) welded anchors, shall be welded to adjacent steel curb facing.

GI-PPCP-MSFC.3 MATERIALS AND METHODS

All materials and methods shall comply with the requirements of Sections 4.09 in the NYC Department of Transportation Standard Highway Specifications, current edition, except as follows:

(A) Curb dimensions as per Contract Drawings

(B) Depth as shown on Contract Drawings

(C) Omit Subsection 4.09.4 (L), instead replace with the following: Existing concrete sidewalks, adjacent to or abutting new PPCP curbs and shall be replaced up to first full flag, unless otherwise directed by the Engineer. The space between the new PPCP curb and undisturbed sidewalk shall be filled with concrete sidewalk colored to correspond to

the adjacent walk. No additional concrete sidewalk shall be cut off or otherwise disturbed until the same has been examined by the Engineer.

(D) ½-inch dia. by 5-inch-long hot dip galvanized anchors shall be installed at a 12-inch maximum center spacing.

(E) Epoxy coated, #5 bent rebar, as specified in the contract documents shall be furnished and installed at 12-inch maximum spacing (on center).

(F) Prior to construction the Contractor shall perform Pneumatic Excavation Around Trees (test pits) prior to construction at the specified limits of the proposed PPCP SYSTEM MODIFIED STEEL FACED CURB, or as directed by the Engineer.

a. The licensed Arborist on site shall confirm that the limits of installation as appropriate for the existing root system(s) and provide recommendation(s) to the engineer for review and approval for the adjustment(s) of the specified MODIFIED STEEL FACED CURB.

b. Excavated test pits will not be permitted.

c. Measurement and payment for Pneumatic Excavation Around Trees shall be paid for under bid item# GI-6.02 PA, Pneumatic Excavation Around Trees.

d. Measurement and payment for the assessment by a licensed Arborist, shall be inclusive of bid item# GI-6.02 PA, Tree Consultant.

GI-PPCP-MSFC.4 MEASUREMENT

The quantity to be measured for the PPCP SYSTEM MODIFIED STEEL FACED CURB shall be the number of LINEAR FEET (installed length) of the PPCP system's modified steel faced concrete curb constructed, complete, in place, measured along the top of the exposed face of steel, and adjusted in accordance with NYC DOT Section 5.05.

GI-PPCP-MSFC.5 PRICE TO COVER

The contract price per LINEAR FOOT of PPCP SYSTEM MODIFIED STEEL FACED CURB for each type of steel faced curb shall cover the cost of all labor, materials, equipment, insurance, and incidentals required to construct the curb complete in place, including, but not limited to, excavation (other than rock excavation) and backfilling, in full compliance with the requirements of the specifications, to furnish such samples for testing and to provide such testing equipment, laboratory space and facilities as may be required, and maintaining the curb in good condition as specified in Section 5.05 of the NYC Department of Transportation Standard Highway Specifications, all in full compliance with the Contract Drawings, the specifications and directions of the Engineer.

1. PPCP-MSFC curbing furnished and installed at a total depth greater than 7-inches but equal to, or less than 14-inches shall be measured for payment and paid for under item number PPCP-MSFC.

Payment shall be made under:

Item No.	Item	Pay Unit
GI-PPCP-MSFC	PPCP SYSTEM MODIFIED STEEL FACED CURB 7” to 14” DEPTH	L.F.

SECTION GI-PPCP-PL – PPCP SYSTEM STAY-IN-PLACE PANEL

GI-PPCP-PL.1 INTENT

This section describes the use of the PPCP SYSTEM STAY-IN-PLACE PANEL which will be utilized when installing Precast Porous Concrete Panels (PPCP) along curbs that are specified to remain undisturbed. The purpose of the stay-in-place panels are to support the surrounding soil while forming the PPCP system adjacent to existing curb to remain.

GI-PPCP-PL.2 DESCRIPTION

Under this section, the Contractor must install the stay-in-place panel in accordance with the contract drawings and specifications.

(A) Stay-in-place panels shall be:

(1) Dimensioned in accordance with specifications and contract drawings.

(2) Furnished, stored, and installed the per manufacturer's specifications and guidelines.

GI-PPCP-PL.3 MATERIALS AND METHODS

All materials and methods must comply with the contract documents. Stay-in-place panel must comply with ASTM-A653 specifications.

(A) Stay-in-place panel shall be:

(1) Furnished and installed with minimum 3/4-inch v-ribs at 3-7/8-inch on center.
(2) Secured with 3/8-inch diameter, 3-inch-long hot dip galvanized concrete screws placed a maximum of 9-inches on center.
(3) Minimum galvanized 26-gauge steel and with 16-gauge galvanized tie wire or sheet metal screws,
(4) Furnish and installed with minimum 6-inch wire spacing and minimum 8-inch overlap.
(5) Furnished and installed with a 4-inch vertical overlap and 8-inch horizontal overlap between steel sheets.

(B) Supporting rebar shall be:

(1) Epoxy coated rebar shall be installed to support the stay in place concrete forming system.

(2) Minimum #3 bar epoxy coated rebar placed 3-feet horizontal spacing (on center) extending 12-inches below the bottom of the PPCP system.

GI-PPCP-PL.4 MEASUREMENT

The quantity shall be measured for the STAY-IN-PLACE PANEL FOR PPCP SYSTEM will be the number of square feet (installed area) of forming system used, complete, and in place.

GI -PPCP-PL.5 PRICE TO COVER

The contract price per SQUARE FOOT of the STAY-IN-PLACE PANEL FOR PPCP SYSTEM shall cover the cost of all labor, materials, equipment, insurance, and incidentals required to construct concrete structures and components in place, including, but not limited to, concrete screws, supporting rebars, excavation (other than rock excavation) and backfilling in full compliance with the requirements of the specifications and in full compliance with the Contract Drawings, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-PL	PPCP SYSTEM STAY-IN-PLACE PANEL	S.F.

SECTION GI-PPCP-SFCC — PPCP SYSTEM STEEL FACED CAST-IN-PLACE CONCRETE CURB

GI-PPCP-SFCC.1 INTENT

This section describes construction of a flared PPCP SYSTEM STEEL FACED CAST-IN-PLACE CONCRETE CURB. The Work shall consist of the construction of a PPCP cast-in-place concrete curb with steel facing at the locations shown in and in accordance with the contract documents or as directed by the Engineer.

GI-PPCP-SFCC.2 DESCRIPTION

Under this section, the Contractor must install the steel faced cast-in-place concrete curb in accordance with the Contract Drawings, the specifications, the New York City Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices, current edition, and as modified by the contract documents.

(A) Steel faced cast-in-place concrete curb must be:

a. Dimensioned in accordance with specifications, and contract drawings.

b. Constructed to the lines and grades as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure.

c. Installed over undisturbed subgrade or a well-compacted subgrade unless otherwise noted.

d. Installed vertically and horizontally level with a curb reveal as specified on the plans from the final finished adjacent asphalt grade. The top of the steel faced cast-in-place concrete curb must be finished by troweling and wood floating and must pitch one-quarter (1/4”) inch downward toward the front face of curb.

(B) Steel facing must be:

a. Placed within forms, upon suitable chairs, to the proper line and grade.

b. Steel curb facing, having less than two (2) welded anchors, must be welded to adjacent steel curb facing.

GI-PPCP-SFCC.3 MATERIALS AND METHODS

All materials and methods must comply with the requirements of Sections 4.09 in the NYC Department of Transportation Standard Highway Specifications, current edition, except as follows:

(A) Curb dimensions as per Contract Drawings

(B) Depth as shown on Contract Drawings

(C) **Omit Subsection** 4.09.4 (L), instead replace with the following:

Existing concrete sidewalks, adjacent to or abutting new PPCP curbs and shall be replaced up to first full flag, unless otherwise directed by the Engineer. The space between the new PPCP curb and undisturbed sidewalk shall be filled with concrete sidewalk colored to correspond to the adjacent walk. No additional concrete sidewalk shall be cut off or otherwise disturbed until the same has been examined by the Engineer.

(D) ½-inch dia. by 5-inch-long hot dip galvanized anchors shall be installed at a 12-inch maximum center spacing.

(E) Epoxy coated, #5 bent rebar, as specified in the contract documents shall be furnished and installed at 12-inch maximum spacing (on center).

(F) Steel facing shall be provided in conformance with NYC DOT Section 2.13.

GI-PPCP-SFCC.4 MEASUREMENT

The quantity to be measured for the PPCP SYSTEM STEEL FACED CAST-IN-PLACE CONCRETE CURB must be the number of LINEAR FEET (installed length) of the PPCP system's steel faced concrete curb constructed, complete, in place, measured along the top of the exposed face of steel, and adjusted in accordance with Section 5.05 of the NYC Department of Transportation Standard Highway Specifications, current edition.

GI-PPCP-SFCC.5 PRICE TO COVER

The contract price per LINEAR FOOT of the PPCP SYSTEM STEEL FACED CONCRETE CURB for each type of steel faced curb shall cover the cost of all labor, materials, equipment, insurance, and incidentals required to construct the curb complete in place, including, but not limited to, excavation (other than rock excavation) and backfilling, in full compliance with the requirements of the specifications, to furnish such samples for testing and to provide such testing equipment, laboratory space and facilities as may be required, and maintaining the curb in good condition as specified in Section 5.05 of the NYC Department of Transportation Standard Highway Specifications, current edition, all in full compliance with the Contract Drawings, the specifications and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-PPCP-SFCC-31	PPCP SYSTEM STEEL FACED CAST-IN-PLACE CONCRETE CURB – 24" to 31" DEPTH	L.F.

SECTION GI-2.06 – L-SHAPED EDGING

GI-2.06.1 INTENT

Under this section, the Contractor must furnish and install new landscape edging adjacent to the concrete strip in Green Infrastructure Practice as specified herein in accordance with the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.06.2 MATERIALS

Edging must consist of L-shaped PVC or aluminum edge restraint product, a minimum of five and a half (5 ½") inches high by five and a half (5 ½") inches wide, in up to ten (10) foot lengths. The thickness of the material must be a minimum of 0.12 inches. Nine (9) inch minimum length stakes must be installed a minimum of every two (2) feet on center. The color of the edging must be black.

GI-2.06.3 DESCRIPTION

The edging must be installed adjacent to the concrete strip in Green Infrastructure Asset where required, as shown on Contract Drawings and in accordance with the specifications and the directions of the Engineer.

GI-2.06.4 MANUFACTURERS

(A) Teco-Edg Specialty Edge Restraint manufactured by Oly Ola Edgings, Inc. Villa Park, IL
(B) GeoEdge Aluminum Green Building Edging manufactured by Permaloc Corporation in Holland, MI;
(C) or approved equivalent.

GI-2.06.5 SUBMITTALS

The Contractor, prior to the start of Work, must submit to the Engineer for approval catalog samples and cut sheets of the proposed material including certification that materials meet specified requirements and proposed dimensions of the Contract Drawings and NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

GI-2.06.6 METHODS

The edging must be installed true to line and grade in accordance with the drawings and as directed by the Engineer. The "L" of the edging must face towards the curb, and the top of the "L" must be at or below the concrete curb elevation. Precast concrete strip or Stone Strip at Stormwater Greenstreet Outlet must be placed on top of the edging as per the drawings and as directed by the Engineer.

GI-2.06.7 MEASUREMENT AND PAYMENT

The quantity of Landscape Edging to be measured for payment must be the number of linear feet of edging incorporated in the finished Work, to the satisfaction of the Engineer.

The contract price bid per linear foot of Landscape Edging must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to furnish and place approved

"L" shaped Edging at the site to complete the Work including, but not limited to, furnishing and installing 9" stakes, "H" clips and caps for joining lengths of edging; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.06	L-SHAPED EDGING	L.F.

SECTION GI-2.07 – CLEAN OPEN GRADED STONE

GI-2.07.1 INTENT

This section describes the types of clean open graded stone also described as stone cover or open-graded stone base in the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

All materials for this Work must comply with the latest New York State Department of Transportation, Standard Specifications, Coarse Aggregate, Section 703-02. The stone must be washed and 3/4", 3/8", 1 1/2" and 2" to 5" in sizes.

The thicknesses and locations of the clean open-graded stone must be as shown on the Contract Drawing Details, the NYC DEP Standard Designs and Guidelines for GI or as determined by field conditions and ordered by the Engineer.

GI-2.07.2 MATERIALS

Use of screened rounded gravel is prohibited.

All clean open graded stone material acceptable under this section must be sound, hard, durable, unweathered stone freshly broken. All open graded stone must be double-washed and clean and free of all fines and debris, not contaminated with clay, and free from any organic or other deleterious material.

Table GI-2.07-1 – Sizes of Open Graded Stone

Size	Nominal Size	US Standard Sieve Sizes (Percent Passing)													
		5 in	4 in	3½ in	3 in	2½ in	2 in	1½ in	1 in	¾ in	½ in	3/8 in	No. 4	No. 8	No. 16
A	3/8 in. to No. 8	-	-	-	-	-	-	-	-	-	100	85 to 100	10 to 30	0 to 10	0 to 5
B1	¾ in.	-	-	-	-	-	-	-	100	0 to15	-	-	-	-	-
B2	¾ in. to 3/8 in.	-	-	-	-	-	-	-	100	90 to100	20 to55	0 to15	0 to 5	-	-
C	1½ in.	-	-	-	-	-	100	0 to 15	-	-	-	-	-	-	-
D1*	2 in. to 5 in.	100	85 to 100	80 to100	0 to 90	0 to 35	0 to 25	0 to 10	0 to 5		-	-	-	-	-

*Type D Stone requires 50% minimum porosity

Clean open graded stone of all types must be aggregate size per **Table GI-2.07-1**. Thickness, widths and all dimensions must be as shown on the standard details and Contract Drawings or as otherwise directed by the Engineer. All open graded stone must be properly compacted. The types of aggregate used for each Green Infrastructure Asset will be as per the following **Table GI-2.07-2**:

Table GI-2.07-2 - Types of default clean open graded stone choices unless otherwise specified on drawings or as directed by the Engineer:

GI Use	Course	Stone Type
Precast Porous Concrete Panels	Screed / Leveling	A
	Base	B1
Porous Asphalt		
	Base	B1
Bioswales, & Infiltration Basins	Leveling	B1
	Base	D1
Rain Gardens & Green Strips	Leveling	B1
	Base	D1
Bio Filter Inlet	Broken Stone Berm	C
Stone Column	Infill	Match GI asset-type base material

GI-2.07.3 SUBMITTALS

(A) The Contractor, prior to the start of Work, must submit to the Engineer for approval samples of the clean open graded stone that have been sampled in accordance with the requirements of ASTM D 75. The minimum size of sample must be in accordance with the requirements of ASTM D 75 – TABLE 1 Minimum size of Field Samples.

Certified material test reports showing that the clean open graded stones meet the specified requirements must be submitted for each shipment and identified with specific lots prior to installing materials. Clean open graded stones used in the Work must conform to the approved samples.

(B) The manufacturer must submit certified test date to cover each shipment of the material.

(C) Results of the coarse aggregate gradation analyses, with full reporting of all information in AASHTO sieve sizes, in accordance with the ASTM C 136.

(D) Results of the porosity analyses, with full reporting of all information, in accordance with the ASTM C 29.

(1) The “% voids” calculation result of ASTM C29 denotes the volume of voids over the total volume of aggregate, which is porosity, and must be reported and illustrated as such in the respective submittals

(2) A minimum 50% porosity is required.

GI-2.07.4 CONSTRUCTION METHODS

(A) Weather Consideration

(1) Do not place and/or compact clean open graded stone subbase in rain or snow, or on saturated or frozen subgrade.

(2) Do not place and/or screed clean open graded stone base in rain or snow, or on saturated or frozen subbase.

(B) Stockpiling and Sampling of clean open graded stone Reservoir and Leveling Course Aggregate

(1) All material must be stockpiled, unless otherwise directed. Stockpile construction requirements, sampling, testing and acceptance/rejection procedures must be as stipulated in the New York State Department of Transportation Section 703-02 – Coarse Aggregate.

(2) No material must be added to a stockpile after the stockpile has been sampled for approval. Only material from approved stockpiles must be placed on the subgrade for this section. The presence of any oversize particles in the stockpile will be cause for rejection of the entire stockpile. No material must be removed for use from any stockpile until the stockpile has been sampled, tested, and approved in writing, by the Engineer, for placement on the subgrade. Contractor must furnish suitable and approved excavating equipment for such sampling. Approval of a stockpile for placement on the subgrade must not relieve, in any degree, the full responsibility of the Contractor to furnish, in its compacted position, a subbase course of select granular materials, the final condition of which conforms to all the requirements of the specifications for this section. In the event the Contractor must have a plant or procedure resulting in subbase course material of uniform quality, at a rate satisfactory to the Engineer, and such that satisfactory samples for tests can be obtained, the requirement for stockpiling may be waived. Prior approval of the Engineer must be obtained and the Work must be done in accordance with such conditions as may be imposed in the approval. Such waiver must remain in force only so long as a satisfactory material is produced.

(C) Subgrade Preparation

(1) The Subgrade under the clean open graded reservoir course (subbase) must not be compacted or permanently covered with geotextile, unless otherwise shown on the Contract Drawings or directed by the Engineer.

(2) Prepared subgrades must not be subject to construction equipment traffic.

(3) Where erosion has caused accumulation of sediment or ponding on the subgrade, remove sediment with light equipment and/or manually. Scarify the underlying soils to a minimum depth of 6 inches with a York type rake, or equivalent equipment.

(4) Restore any subgrade areas damaged by erosion, ponding, or traffic compaction to design line and grades prior to installation of storage reservoir course (layer).

(D) Installation of Reservoir Course (Subbase)

(1) The Reservoir Course Subbase will be installed per specification to the thicknesses and width shown on the contract drawings and as directed by Engineer.

(2) Place 1-1/2” (nominal) size open graded stone, over the prepared subgrade and spread and level evenly by raking to the dimensions shown on the Contract Drawing details. Do not disturb prepared subgrade or shift, wrinkle or fold the geotextile fabric and/or impermeable liner, and place as shown on the Contract Drawings.

(3) The open graded stone reservoir course material must be spread in equal thickness layers. The spreading of any layer of this material must be done with spreader equipment approved by the Engineer, and to such thickness that the

maximum depth of the layer, after compaction, will be 6 inches. Spreading from piles dumped on the roadway will not be permitted. No segregation of large or fine particles will be allowed, but the material, as spread, must be well graded, with no pockets of fine material. Water must be added in such amounts as the Engineer may consider necessary to obtain satisfactory compaction.

(4) Compact layers with an approved vibrating plate compactors or impact rammers until there is no visible movement, weaving or deflection in the surface of the clean open graded stone reservoir course. All the equipment must be approved by Engineer with regards to adjacent structures.

(5) The surface tolerance of the compacted clean open graded stone reservoir course must be + 3/4 in. under a 10-ft straightedge.

(6) The Contractor must assume full responsibility for any contamination and/or degradation of any part of this base during construction and must, at the Contractor's own expense, remove any and all portions of this base which do not conform to the requirements of these specifications and replace these portions with specified material.

(E) Installation of Open Graded Stone Base

(1) The Open Graded Stone Base will be installed per specification to the thicknesses and width shown on the Contract Drawings and as directed by Engineer.

(2) The Open Graded Stone Base must be placed in equal thickness layers. Prior to backfilling with Open Graded Stone Base the subgrade of the Green Infrastructure Asset must be scarified to ensure no compaction. The placing of any layer of this material must be done so by gravity with no additional compaction to ensure the required porosity, or void content, is maintained. No segregation of large or fine particles will be allowed, but the material, as placed, must be well graded, with no pockets of fine material.

(3) The Contractor must assume full responsibility for any contamination and/or degradation of any part of this base during construction and must, at the Contractor's own expense, remove any and all portions of this base which do not conform to the requirements of these specifications and replace these portions with specified material.

(F) Installation of Leveling Course (Screed Base Course)

Installation of all screed leveling courses with material specified above will be installed to the thicknesses and widths shown on contract drawings and Standard DEP GI Details.

Before installation of leveling course verify that the open graded stone base, as shown on the Contract Drawings, has been properly placed within the trench and compacted as approved and accepted by the Engineer.

In no case must a leveling course be less than two (2") inches thick for Precast Porous Panels and six (6") inches thick for pavers used in the roadway.

The cost of all leveling courses must be paid per the unit price herein.

GI-2.07.5 MEASUREMENTS

The quantity of CLEAN OPEN GRADED STONE to be measured for payment must be the number of CUBIC YARDS (CY) of open graded stone incorporated in the finished Work, measured in place in cubic yards. The thickness of the leveling course must NOT be included in this measurement.

GI-2.07.6 PRICE TO COVER

The contract price bid per cubic yard of CLEAN OPEN GRADED STONE must cover the cost of all labor, materials, equipment, insurance, and necessary incidentals required to complete the Work, including, but not limited to, excavating, furnishing, and laying open graded stone, subgrade preparation, compaction and furnishing and applying water; all in accordance with the Contract Drawings, the specifications, and the directions of the Engineer.

Payment for furnishing and installing GEOTEXTILE FABRIC FOR DRAINAGE will be made under GI-2.09DR-W or GI-2.09DR-NW.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.07A	3/8” CLEAN OPEN GRADED STONE	C.Y.
GI-2.07B1	3/4” CLEAN OPEN GRADED STONE (TYPE B1)	C.Y.
GI-2.07B2	3/4”-1/2“ CLEAN OPEN GRADED STONE (TYPE B2)	C.Y.
GI-2.07C	1-1/2” CLEAN OPEN GRADED STONE (TYPE C)	C.Y.
GI-2.07D1	2”-5” CLEAN OPEN GRADED STONE (TYPE D1)	C.Y.

SECTION GI-2.08 – HDPE BARRIER

GI-2.08.1 INTENT

This section describes the HDPE BARRIER. The purpose of the High Density Polyethylene (HDPE) Barrier is to provide an impermeable layer which does not allow water to pass through it. The HDPE barrier must be furnished and installed as specified herein in accordance with the Standard GI Drawings and as directed by the Engineer.

GI-2.08.2 MATERIALS

The HDPE barrier must consist of High Density Polyethylene (HDPE) Geomembrane sheets not less than 80 mil thickness, meeting or exceeding Geosynthetic Research Institute (GRI) Test Method GM13.

GI-2.08.3 SUBMITTALS

(A) The Contractor, prior to the start of Work, must submit to the Engineer for approval samples of the geomembrane in accordance with the requirements of Section 1.06.31 of the NYC DOT Standard Highway Specifications, current edition, and methods of splicing permitted at utility crossings when directed by the Engineer.

(B) Certified material test reports showing that the geomembrane meet the specified requirements must be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports must meet the requirements of the ASTM requirements listed in Section GI-2.08.4 below and GRI test method GRI GM 13.

(C) The manufacturer must submit certified test date to cover each shipment of the material.

GI-2.08.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) HDPE geomembrane sheets supplied for the project must meet or exceed all required physical characteristics as defined below:

(1) HDPE Geomembrane - High quality, high density polyethylene (HDPE) geomembrane specially formulated with virgin formulated polyethylene.

(2) Thickness - Thickness must not be less than (minimum average) 80 mil, measured in accordance with ASTM D5199.

(3) Density - The Density must not be less than 59 lb./ft3, measured in accordance with ASTM D1505.

(4) Tear resistance - Tear resistance must not be less than 40 lb., measured in accordance with ASTM D1004.

(5) Puncture Resistance - Puncture Resistance must not be less than 100 lb., measured in accordance with ASTM D4833.

(6) The HDPE Barrier must be strong enough to resist both rot and insects.

GI-2.08.5 METHODS

(A) Delivery - Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

(B) Storage - Store materials in clean, dry area in accordance with manufacturer's

instructions.

(C) Handling - Protect materials during handling and installation to prevent damage.

(D) Prior to the installation of the HDPE Barrier, the Contractor must excavate the Green Infrastructure Asset area to the satisfaction of the Engineer.

(E) Install HDPE Barrier as indicated on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure Practices drawings.

(F) The HDPE Barrier must be placed in one piece directly on the vertical face of the excavation. No splicing will be permitted, except at utility crossings.

(G) No equipment, materials or machinery must be placed on or be transported over exposed HDPE Barrier.

(H) HDPE Barrier must be placed as shown on the plans and as directed by the Engineer. Care must be taken in the placement of backfill under other items so as to prevent dislocation of the HDPE Barrier. If the HDPE Barrier is ruptured during installation, the rupture must be covered with a patch of new HDPE Barrier that will overlap the undamaged area by at least twelve (12”) inches in all directions and to be sealed with watertight sealant. No additional payment will be made for the repair.

GI-2.08.6 MEASUREMENT

The quantity of HDPE Barrier to be measured for payment must be the number of square feet of geomembrane installed at the site to the satisfaction of the Engineer. Measurement must be made to the nearest square foot installed at each Green Infrastructure Asset.

GI-2.08.7 PRICE TO COVER

The contract price for HDPE Barrier must be a unit price bid per square foot and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to furnish, handle, store, and install HDPE Barrier sheets, including, but not limited to excavation, sheeting and bracing, cutting holes in the sheets for utilities, furnishing and installing stainless steel anchor bars and fastenings at the top of the sheet and caulking bead along the top seam of the HDPE membrane and the concrete curb or header; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.08	HDPE BARRIER	S.F.

SECTION GI-2.08L – IMPERMEABLE LINER

GI-2.08L.1 INTENT

This section describes the IMPERMEABLE LINER. The purpose of the Impermeable Liner is to be utilized as a barrier in between the leveling course and the GI concrete element for Hydraulically Connected Right-of-Way Greenstrips and Right-of-Way Infiltration Basin Green Infrastructure Practices. The Impermeable Liner must be furnished and installed as specified herein in accordance with the NYC Department of Environmental Protection Standard GI Drawings and as directed by the Engineer.

GI-2.08L.2 MATERIALS

(A) The Impermeable Liner must be made of Polyvinyl Chloride (PVC) geomembrane of 10 mil thickness, meeting or exceeding the requirements of ASTM D7176 Standard Specification for PVC geomembranes used in buried applications.

(B) Each geomembrane liner roll must be wrapped with a material that will protect the liner, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping must be maintained during periods of shipment and storage in accordance to ASTM D4873 and ASTM D7865.

(C) During storage, geomembrane liner rolls must be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, and any environmental condition that may damage the physical property values of the liner.

(D) If the geomembrane is damaged, the GEOSYNTHETICS CONTRACTOR must make all repairs and replacements in a timely manner, so as to prevent delays in the progress of the Work

(E) The finished liner must be free of pinholes, blisters, and contaminants.

(F) Adhesive at field seams must meet ASTM D2564 standards, and be either HH-66 Vinyl Cement, low VOC Vinyl Cement, or engineer approved equal.

GI-2.08L.3 SUBMITTALS

(A) The Contractor, prior to the start of Work, must submit to the Engineer for approval samples of the impermeable liner in accordance with the requirements of Section 1.06.31 of the NYC Department of Transportation Standard Highway Specifications, and methods of splicing permitted at utility crossings.

(B) Certified material test reports showing that the geomembrane meet the specified requirements must be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports must meet the requirements of the ASTM standards listed in Section GI-2.08L.2 and GRI test method GRI GM 13.

(C) The data submitted must include, where applicable, manufacturer’s descriptive literature and installation instructions.

GI-2.08L.4 METHODS

(A) Delivery - Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

(B) Storage - Store materials in clean, dry area in accordance with manufacturer's

instructions.

(C) Handling - Protect materials during handling and installation to prevent damage.

(D) Contractor must verify that there are no sharp objects that may rupture the impermeable liner prior to installation. The impermeable liner must be installed in between the leveling course and open-graded stone base.

(E) The impermeable liner will be sized, cut and installed in accordance with the approved shop drawings and specifications. The impermeable liner will cover the entire footprint of which concrete is intended to be poured.

(F) The impermeable liner will cover the inner walls of the concrete header as well as the back side of the curb and between the leveling course and the GI concrete elements. The contractor is to ensure that cast-in-place concrete does not penetrate or bypass the impermeable liner.

(G) Excess liner trim will be cut flushed to the cast-in-place concrete surface.

GI-2.08L.5 MEASUREMENT

The quantity of Impermeable Liner to be measured for payment must be the number of square feet of liner installed at the site to the satisfaction of the Engineer. Measurement must be made to the nearest square foot installed at each Green Infrastructure Asset.

GI-2.08L.6 PRICE TO COVER

The contract price for IMPERMEABLE LINER must be a unit price bid per SQUARE FOOT and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to furnish, handle, store, and install Impermeable Liner sheets, including, but not limited to, sheeting and bracing, cutting holes in the sheets for utilities, furnishing and installing stainless steel anchor bars and fastenings at the top of the sheet and caulking bead along the top seam of the impermeable liner and the concrete element; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.08L	IMPERMEABLE LINER	S.F.

SECTION GI-2.09DR – GEOTEXTILE FABRICS FOR DRAINAGE

GI-2.09DR.1 INTENT

This section describes two types of geotextile fabric. The Contractor must furnish and install geotextile - drainage fabric as specified herein in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.09DR.2 SUBMITTALS

(A) All submittals must be submitted prior to purchase and must be made in accordance with the requirements of the NYC Department of Transportation Standard Highway Specifications, General Conditions, Subsection 1.06.31.

(B) Samples: The Contractor must furnish two (2) labeled samples of the geotextiles intended for use in the Work for approval and the Engineer's use. The label must include the manufacturer's product name, the type of fabric, and the weight of grade of the material. Geotextiles used in the Work must conform to the approved samples.

(C) Certified laboratory test results meeting or exceeding the below criteria must be supplied with the submittal information.

GI-2.09DR.3 MATERIALS

(A) Chemical and Physical Requirements

(1) Drainage application is defined as a soil to geotextile system that allows for long-term, adequate liquid flow normal to the geotextile with limited soil loss across the plane of the geotextile.

(2) Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported. Typical Roll Value is represented by (TRV).

(3) Fibers used in the manufacture of drainage geotextiles, and super high-tenacity polypropylene yarns with a weave pattern to maximize strength, water flow, soil interaction and soil retention. The yarns used must consist of long-chain, synthetic polymers, composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. They must be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages. The geotextile must have no tears or defects which adversely alter its physical properties.

Geotextiles used in permeable pavement drainage applications must conform to the following properties for Woven Geotextile Drainage:

Table GR-2.09DR-1 - Woven Geotextile Drainage Requirements

Property	**ASTM Test**	**Requirements**
Structure		Woven
Flow Rate (Min. @ MARV)	ASTM D4491	2852 L/min/sm (70 gal/min/sf)
Tensile Strength @ 2% (Min.)	ASTM D4595	8.8 kN/m (600 LBS/ft)
Tensile @ 5% Strength (Min.)	ASTM D4595	23.6 kN/m (1620 LBS/ft)
Interaction Coefficient (Min.)	ASTM D6706	0.89
Permittivity (Min.)	ASTM D4491	0.9 /sec
Apparent Opening Size (Max.)	ASTM D4751	0.425 mm (0.0167 inch) Std. No. 40

Geotextiles used in drainage applications must conform to the following properties for Non-Woven Geotextile Drainage:

Table GR-2.09DR-2 – Non-Woven Geotextile Drainage Requirements

Property	**ASTM Test**	**Requirements**
Structure		Non-Woven
Elongation	ASTM D4595	> 50%
Grab Strength (Min.)	ASTM D4632	700N (157 LBS)
Tear Strength (Min.)	ASTM D4533	250N (56 LBS)
Puncture Strength (Min.)	ASTM D4833	250N (56 LBS)
Permittivity (Min.)	ASTM D4491	0.21 / sec.
Apparent Opening Size (Max.)	ASTM D4751	0.25 mm (0.0098 inch) Std. No. 60 sieve

GI-2.09DR.4 CONSTRUCTION METHODS

Each geotextile roll must be wrapped with an overlaying material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping must be maintained during periods of shipment and storage. During storage, geotextile rolls must be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended

ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, and any environmental condition that may damage the physical property values of the geotextile.

(A) PERMEABLE PAVEMENTS

(1) Excavation must be made to dimensions enough to accommodate placement of the WOVEN GEOTEXTILE (GI-2.09DR-W), clean open graded stone base course material, geo-grid and pavement (leveling course with porous panels or permeable pavers). The overcut underlying soil must be removed from the excavation and the bottom must be compacted as required. The extra depth will be filled with clean open graded stone materials as required after installation of woven geotextile. No additional payment will be made for extra clean open graded stone used to compensate for overcut subbase. If applicable, Temporary Support should be provided for trench walls to prevent it collapse. The contractor must protect the pavement section at the saw cut line along the road side.

(2) Prior to installation of woven geotextile, the ground must be prepared by removing stumps and other organic material, along with any large boulders and sharp objects which may tear or damage the fabric. Install woven geotextile at elevations and alignments as indicated on the drawings or as directed by the Engineer. The drainage woven geotextile must be placed loosely with no wrinkles or folds. Overlap woven geotextile edges a minimum of 12 inches in the direction of drainage flow. Care will be taken to place the woven geotextile in intimate contact with the soil so that no void spaces occur between the woven geotextile and trench or ground. If the woven geotextile is damaged during installation, the rupture must be removed, and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer is done at no extra cost to the City.

(B) GABION [WITH CLEAN OPEN GRADED STONE]

The NON-WOVEN GEOTEXTILE (GI-2.09DR-NW) must be placed on the side where the gabion abuts both the existing soil under the roadway and the Engineered Soil and clean open graded stone base; and on the top side of the gabion; the bottom of the gabion must have no non-woven geotextile drainage fabric. Prior to placement of the non-woven geotextile fabric, the area must be free of stumps and other organic material, along with any large boulders or sharp objects which may tear or damage the fabric. The drainage non-woven geotextile must be placed loosely with no wrinkles or folds. Overlap non-woven geotextile edges a minimum of 12 inches in the direction of drainage flow. If the non-woven geotextile is damaged during installation, the rupture must be removed and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer at no extra cost to the City.

(C) CLEAN OPEN GRADED STONE BASE

The NON-WOVEN GEOTEXTILE (GI-2.09DR-NW) must be placed on the sides of the clean open graded stone base, where it abuts either existing soil under the roadway or sidewalk and at the top of the open graded stone base where it abuts the Engineered Soil. Prior to placement of the non-woven geotextile fabric, the area must be free of stumps and other organic material, along with any large boulders or sharp objects which may tear or damage the fabric. The drainage non-woven

geotextile must be placed loosely with no wrinkles or folds. Overlap non-woven geotextile edges a minimum of 12 inches in the direction of drainage flow. Care will be taken to place the non-woven geotextile in intimate contact with the soil so that no void spaces occur between the non-woven geotextile and trench or ground. If the non-woven geotextile is damaged during installation, the rupture must be removed and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer is done at no extra cost to the City. Overlaying material must be placed within the same work shift whether the fabric is subject to damage from sunlight or not.

(D) STONE COLUMNS

The NON-WOVEN GEOTEXTILE (GI-2.09DR-NW) must be placed on sides of the perforated PVC pipe where it abuts the select granular fill that is placed in the annular space during stone column installation. Prior to placement of the non-woven geotextile fabric, the area must be free of stumps and other organic material, along with any large boulders or sharp objects which may tear or damage the fabric. The drainage non- woven geotextile must be wrapped around the perforated PVC pipe prior to placing the non-woven geotextile wrapped perforated PVC pipe into the eighteen (18) inch diameter casing installed in the ground. Overlap non-woven geotextile edges a minimum of twelve (12”) inches in the direction of drainage flow. If the non-woven geotextile is damaged during installation, the rupture must be removed and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer is done at no extra cost to the City.

(E) HDPE Piping

The NON-WOVEN GEOTEXTILE (GI-2.09DR-NW) must be placed on sides of the perforated/slotted HDPE pipe where it abuts the Engineered Soil. Prior to placement of the non-woven geotextile fabric, the area must be free of stumps and other organic material, along with any large boulders or sharp objects which may tear or damage the fabric. The drainage non-woven geotextile must be wrapped around the perforated/slotted HDPE pipe prior to placing the non-woven geotextile wrapped perforated/slotted HDPE pipe into the trench. Overlap non-woven geotextile edges a minimum of 12 inches in the direction of drainage flow. If the non-woven geotextile is damaged during installation, the rupture must be removed and the damaged area must be covered with a patch of new fabric which will overlap the undamaged fabric with twelve (12”) inches in all directions. The Contractor must make such repair Work as directed by Engineer is done at no extra cost to the City.

GI-2.09DR.5 MANUFACTURER

(A) terrafix® Geosynthetics Inc. (Nonwoven only) 455 Horner Avenue

Toronto, ON M8W 4W9
E-mail: info@terrafixgeo.com Phone: (416) 674-0363
http://terrafixgeo.com/contact/

(B) Carthage Mills 4243 Hunt Road
Cincinnati, OH 45242
Phone: (513) 794-1600
https://carthagemills.com/

(C) TenCate Geosynthetics Americas (Mirafi) 365 South Holland Drive
Pendergrass, Georgia 30567
Tel: +1 706-693-2226
Email: spec@tencategeo.com https://www.tencategeo.us/

(D) Or Approved Equivalent

GI-2.09DR.6 MEASUREMENT

The quantity of GEOTEXTILE FABRIC to be measured for payment must be the number of SQUARE YARDS actually installed at the site, in its final position, to the satisfaction of the Engineer. No quantity will be included for material used for repair of tears or for material used to provide the overlaps.

GI-2.09DR.7 PRICE TO COVER

The unit price bid per SQUARE YARD for GEOTEXTILE FABRIC must cover the cost of furnishing all labor, material, equipment, insurance, submittals, and incidental expenses required to complete the Work; all in accordance with the Contract Drawings, the specifications and directions of the Engineer.

Payment for the following will be made under other contract items: Clean Open Graded Stone Base (GI-2.07A to GI-2.07D1), Gabion with Clean Open Graded Stone (GI 2.17A) and Engineered Soil (GI-2.13). Payment for furnishing and installing GEOTEXTILE FABRIC for STONE COLUMNS and HDPE PIPE will be made under item Stone Column (GI-5.10) and under items High Density Polyethylene (HDPE) Pipe (GI-2.16S, GI-2.16P, GI-2.16SA, GI-2.16FPA and GI-2.16HPA) respectively.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.09DR-NW	NON-WOVEN GEOTEXTILE FABRIC FOR DRAINAGE	S.Y.
GI-2.09DR-W	WOVEN GEOTEXTILE FABRIC FOR DRAINAGE	S.Y.

SECTION GI-2.10PC – STEEL TREE GUARDS (POWDER COATED)

GI-2.10PC.1. INTENT

This section describes steel tree guards (powder coated). The Contractor must furnish and install Steel Tree Guards (Powder Coated) in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.10PC.2. MATERIALS

Steel tree guards (powder coated) must conform to Specifications C1015 of the American Iron and Steel Institute (AISI) and must be of solid steel and not hollow.

Concrete must be Class B-32, Type I/IA and comply with the requirements of Sections 3.05 and 4.06 in the NYC Department of Transportation Standard Highway Specifications.

GI-2.10PC.3. SUBMITTALS

(A) The Contractor must submit for the approval of the Engineer finished samples of parts of the steel tree guards (powder coated). The workmanship and finish of the final product must be equal to the approved samples. Also, the Contractor must submit detailed shop drawings of steel tree guards (powder coated) for the approval of the Engineer.

(B) All surfaces of the steel tree pit guard bars, posts, and rails must be powder coated with an electrostatically sprayed, lead-free, TGIC (triglycidyl isocynanurate) polyester powder coating applied to a minimum of 3 to 4 mils by electrostatic spray process and bake finished per the manufacturer's directions. Powder coating must be applied to the thermal zinc or iron phosphate coated metal in such a manner that the coating will not peel off. The manufacturer must perform all processes required to achieve a smooth material bond. Ensure surfaces to be coated are clean and dry and free of grease, dust, rust, etc. All surfaces must first receive phosphating and chromatizing treatments to improve the adhesion of the surface coating.

(C) Colors must be "black" unless otherwise shown on the drawings. Material surfaces must be protected during shipment so as to arrive mar and scratch free in the field.

GI-2.10PC.4. CHEMICAL AND PHYSICAL REQUIREMENTS

Steel Tree Guards (Powder Coated) must be constructed of bars, posts, and rails of the sizes shown on the NYC Department of Environmental Protection Standard Designs and Guidelines for Green Infrastructure Practices drawings. All material must conform to Specifications C1015 of the AISI.

The TGIC polyester powder coating must be similar to Secural by Spraylat, Tiger Dry lac Series 49 as manufactured by Tiger Drylac U.S.A., Reading, PA; TGIC Polyester as manufactured by Sherwin Williams, Ohio, CL, TGIC Polyester as manufactured by Americoats, Franklin Park, IL, or approved equal and must comply with ASTM standards as follows:

Table GI-2.10PC-1 - Powder Coating Acceptance Criteria

PHYSICAL PROPERTIES	TEST METHODS	ACCEPTANCE CRITERIA
Adhesion cross hatching	D-3359B	5B (0% area removed)
Flexibility conical mandrel	D-522	Pass 3/8” mandrel
Pencil hardness	D-3363	Pencil hardness 2H minimum
Impact resistance	D-2794	140 inch pounds minimum
Overbake resistance- Adhesion	D-2454	5B
Overbake resistance- Hardness	D-2454	Pencil hardness 2H minimum
Overbake resistance- Direct Impact	D-2454	140 inch pounds minimum
Humidity resistance-250 hours	D-4585	No visible change to surface
Weatherability	D-822	No visible change to surface

GI-2.10PC.5. MATERIALS

All material for the steel tree guards (powder coated) must conform to Specifications C1015 of the AISI.

GI-2.10PC.6. CONSTRUCTION METHODS

(A) Steel tree guards (powder coated) must be fabricated in strict accordance with the NYC DEP Standard Designs and Guidelines for Green Infrastructure Practices drawings and approved shop drawings. Posts, pickets, bars, and rails must be formed into panels of the shapes shown on DEP Standard Designs and Guidelines for Green Infrastructure Practices. Connections must be provided as indicated on the plans.

(B) All welding must be performed in accordance with ANSI/AWS D1.1 and ANSI/AWS D1.4. Welding must not be performed when the base metal temperature is lower than 32 degrees Fahrenheit. Joints must be fully seam welded with welds of proper size and shape. Stitch welds and tack welds are not acceptable as final welds for the joints. All welds must be ground smooth to a neat finish.

(C) Steel spike must be concrete encased as shown on the plans or as per Standard Design and Guidelines for Green Infrastructure Practices.

(D) Posts and pickets must, in all cases, be truly vertical as shown on the plans. Rails and bars must be parallel to grade as shown on the Contract Drawings. Panels must be curved as required by the Work. Dimensions of individual steel tree guards (powder coated) may vary as required by existing site conditions, in accordance with the directions of the Engineer.

(E) The powder coating must be applied without voids, tears or cuts that reveal the substrate and must thoroughly adhere to the metal without peeling when scratched with a pick device or knife blade point. All visible nuts, washers, and ends of all bolts must be painted with touch-up paint as described below.

(1) Touch-up and Repair: For minor damage caused by installation or transportation, touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of six (6') feet.

(F) Laboratory Test for TGIC-Polyester Powder coat: At the discretion of the Engineer, a sample TGICPolyester powder coated metal bar may be laboratory tested for bonding

of the powder coating to the metal. Test must be the Cross Hatch test per ASTM D3359, method B. Failure to satisfactorily pass this test must be a basis for rejection.

(G) The steel tree guards (powder coated) must be erected in soil only, inside the ROW GI. The posts must be set in place and properly supported to hold them to line and grade. The lowest portion of the steel band at the bottom of all side rails set 1” above the finished grade of the sidewalk. Any guards not set plumb and true to line and grade must be removed and replaced at the Contractor’s expense.

GI-2.10PC.7. MEASUREMENT

The quantity of each type of STEEL TREE GUARD (POWDER COATED) to be measured for payment must be the number of LINEAR FEET of steel tree guards erected, complete, in place to the satisfaction of the Engineer, measured along the top rail.

GI-2.10PC.8. PRICES TO COVER

The unit price bid per LINEAR FOOT of each type of STEEL TREE GUARD (POWDER COATED) must cover the cost of all labor, material, equipment, insurance, and incidentals required to fabricate, furnish and erect tree pit guards including, but not limited to, welding and painting, furnishing, placing and trimming the 6” diameter tube forms, excavating, and furnishing and placing concrete for encasement of the steel tree pit guard spikes; all in accordance with the Contract Drawings, the specifications and as directed by the Engineer.

The unit price bid per LINEAR FOOT of each type of STEEL TREE GUARD (POWDER COATED) (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.10PC-B1	STEEL TREE PIT GUARD - POWDER COATED – TYPE ‘B1’ – BOLTED	L.F.
GI-2.10PC-B1-S	STEEL TREE PIT GUARD - POWDER COATED – TYPE ‘B1’ – BOLTED (SPARE)	L.F.

SECTION GI-2.10TS – TREE GUARD EDUCATIONAL SIGN

GI-2.10TS.1. INTENT

This section describes tree guard signs. The Contractor must furnish and install tree guard signs in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.10TS.2. MATERIALS

Tree guard signs must be made out if Custom High-Pressure Laminate (CHPL) material.

GI-2.10TS.3. SUBMITTALS

The Contractor must submit for the approval of the Engineer finished samples of the tree guard signs. The workmanship and finish of the final product must be equal to the approved samples. In addition, the Contractor must submit detailed shop drawings of tree guard sign for the approval of the Engineer.

GI-2.10TS.4. CHEMICAL AND PHYSICAL REQUIREMENTS

Tree guard signs must be made out of CHPL material with a matte finish. Tree guard signs must meet NEMA LD3 standards for resistance to wear, boiling water, high temperature, cigarette burns, fading, dimensional stability, staining, appearance, and formability (bending and post forming grades). Product must also meet LC50 Protocol toxicity test requirements. Equal to and no more toxic than wood or paper.

GI-2.10TS.5. CONSTRUCTION/ INSTALLATION METHODS

(A) Tree Guard Signs must be fabricated in accordance with the plans and approved shop drawings. Tree guard signs must be formed into the detailed shape shown in the NYC DEP Green Infrastructure Standards. Connections and Screw holes must be provided as indicated on the plans.

(B) The tree guard signs must be mounted onto the tree guard sign mounts. They must be set in place and properly screwed down to hold them to the tree guard sign mount. Any tree guard signs not secured to the tree guard sign mount properly must be re-secured at the Contractor's expense and at DEP's direction.

GI-2.10TS.6. MANUFACTURER

(A) iZone Imaging, Inc.
2526 Charter Oak Drive Suite 100 Temple, TX 76502, USA
E-mail: lblair@izoneimaging.com Phone: (254) 314-8257
https://izoneimaging.com/contact-us-2/

(B) Fossil Industries, Inc. 44 Jefryn Boulevard
Deer Park, NY 11729 Phone: (631) 254-9200
E-mail: info@fossilgraphics.com https://fossilgraphics.com/other/contact-us

(C) A.J Iron Works 466 Carrol Street
Brooklyn, NY 11215
Email: ajironwork@aol.com http://ajironwork.com/contact/

(D) Or Approved Equivalent

GI-2.10TS.7. MEASUREMENT

The quantity of TREE GUARD EDUCATIONAL SIGNS to be measured for payment must be

EACH tree guard signs Installed correctly in place to the satisfaction of the Engineer.

Spare TREE GUARD EDUCATIONAL SIGNS may be requested. Measurement for payment must be EACH tree guard sign delivered to DEP.

GI-2.10TS.8. PRICES TO COVER

The unit price bid of EACH TREE GUARD EDUCATIONAL SIGN must cover the cost of all labor, material, equipment, insurance, and incidentals required to fabricate, furnish and install tree guard signs including, but not limited to furnishing and placing in the correct location; all in accordance with the Contract Drawings, the specifications and as directed by the Engineer.

The unit price bid of EACH TREE GUARD EDUCATIONAL SIGN (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.10TS	TREE GUARD EDUCATIONAL SIGN	EACH
GI-2.10TS-S	TREE GUARD EDUCATIONAL SIGN (SPARE)	EACH

SECTION GI-2.10SM – STEEL TREE GUARD MOUNT

GI-2.10SM.1 INTENT

This section describes tree guard sign mounts. The Contractor must furnish and install tree guard sign mounts in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.10SM.2 MATERIALS

Tree guard sign mounts must conform to Specifications ASTM A-36 “Carbon Structural Steel” standard specifications and must be made of plate steel and not hollow. The Screws/Bolts used must be made of 18-8-SS hardware.

GI-2.10SM.3 SUBMITTALS

(A) The Contractor must submit for the approval of the Engineer finished samples of the tree guard sign mounts. The workmanship and finish of the final product must be equal to the approved samples. In addition, the Contractor must submit detailed shop drawings of tree guard sign mounts for the approval of the Engineer.

(B) Paint Substitution: A written request for paint substitution must be submitted to the Engineer for approval. Contractor must submit this request, along with manufacturer's data sheets for approval, a minimum of two weeks prior to the intended date of paint application. All paint substitutes must be approved in writing prior to use.

GI-2.10SM.4 CHEMICAL AND PHYSICAL REQUIREMENTS

Material must conform to ASTM A-36 “Carbon Structural Steel” Specifications.

GI-2.10SM.5 CONSTRUCTION METHODS

(A) Tree Guard Sign Mounts must be fabricated in strict accordance with the plans and approved shop drawings. Steel plates and screw holes must be formed into the detailed shapes shown in the NYC DEP Standards. Connections and Screw holes must be provided as indicated on the plans.

(B) All welding must be performed in accordance with ANSI/AWS D1.1 and ANSI/AWS D1.4. Welding must not be performed when the base metal temperature is lower than 32 degrees Fahrenheit. Joints must be fully seam welded with welds of proper size and shape. Stitch welds and tack welds are not acceptable as final welds for the joints. All welds must be ground smooth to a neat finish.

(C) Tree Guard Sign Mounts must receive three (3) shop applied coats of paint. A field applied touch-up coat must be applied at the discretion of the Engineer. Immediately prior to painting, all surfaces of framework must be thoroughly cleaned free of debris. All surfaces that are rust free must be treated in accordance with SP-1, Solvent Cleaning. Treatment must be performed with a solvent such as mineral spirits, xylol, or turpentine to remove all dirt, grease, and foreign matter. Surfaces that show evidence of scale and rust must be cleaned in accordance with SP-2, Hand Tool Cleaning, a method generally confined to wire brushes, sandpaper, hand scrapers, or hand impact tools or SP-3, Power Tool Cleaning, a method generally confined to power wire brushes, impact tools, power sanders, and grinders in order to achieve a sound substrate. After the tree guard sign mounts have been cleaned and prepared, they must be painted as follows:

(1) First Coat (Shop Applied): Sherwin Williams # E41N1 Metal Primer, Brown, or

approved equivalent. Primer is an alkyd oil, flat finish coating having a dry film thickness of 3 to 4 mils. Paint requires twenty-four (24) hours drying time before recoating. Performance must meet or exceed the standards of Federal Specification TT-P-86H.

(2) Second Coat (Shop Applied): Sherwin Williams High Solids Alkyd Metal Primer, B50 Series, Reddish Brown, or approved equivalent. Primer is an alkyd, low luster coating having a dry film thickness of 3-5 mils. Paint requires four (4) hours drying time before recoating (with alkyds)

(3) Third Coat (Shop Applied): Sherwin Williams Silicone Alkyd Low VOC B56Z Black, or approved equivalent. Topcoat is a silicon alkyd, high gloss coating having a dry film thickness of 2 -4 mils. Paint requires sixteen (16) hours drying time @ 45° F; eight (8) hours @ 77°F. (tack free)

Alternative paint manufacturers must be Devoe and Reynolds, Co.; Pratt and Lambert, Inc.; Pittsburgh Plate Glass Company; Sapolin; or an approved equivalent. All paints used must be compatible and the product of the same manufacturer.

(E) All paints must be applied when ambient air temperature is forty-five (45) degrees F and rising and when surfaces to be painted are moisture free. No painting will be allowed below the minimum ambient air temperature, or within 5 degrees of the dew point.

(F) The tree guard sign mounts must be mounted onto the steel tree guards only, where designated by the Engineer as approved by DEP. They must be set in place and properly screwed down to hold them to the tree guard. Any tree guard sign mount not secured to the tree guard properly or placed in the incorrect location on the tree guard must be moved and re-secured at the Contractor's expense and at DEP's direction.

GI-2.10SM.6 MANUFACTURER

(A) General Foundries, Inc. 1 Progress Road
North Brunswick, NJ 08902
E-mail:Sales@generalfoundaries.com Phone: (732) 951-9001
http://www.generalfoundries.com/contact-us.php

(B) A & T Iron Works, Inc. 25 Cliff Street
New Rochelle, NY 10801 Phone: (800) 523-0973
E-mail: info@atironworks.com http://www.atironworks.com/pages/contact/

(C) A.J Iron Works 466 Carrol Street
Brooklyn, NY 11215
Email: ajironwork@aol.com http://ajironwork.com/contact/

(D) Or Approved Equivalent

GI-2.10SM.7 MEASUREMENT

The quantity of STEEL TREE GUARD MOUNTS to be measured for payment must be EACH tree guard sign mount Installed correctly in place to the satisfaction of the Engineer.

GI-2.10SM.8 PRICES TO COVER

The unit price bid of EACH STEEL TREE GUARD MOUNT must cover the cost of all labor, material, equipment, insurance, and incidentals required to fabricate, furnish and install tree guard sign mounts including, but not limited to, welding and painting, furnishing, placing in the correct location; all in accordance with the Contract Drawings, the specifications and as

directed by the Engineer.

The unit price bid of EACH STEEL TREE GUARD MOUNT (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.10SM	STEEL TREE GUARD MOUNT	EACH
GI-2.10SM-S	STEEL TREE GUARD MOUNT (SPARE)	EACH

SECTION GI-2.11 – INLET SCREEN BOX

GI-2.11.1 INTENT

This section describes the installation of Inlet Screen Box and accessories to facilitate the collection of debris and sediment in the concrete inlet chambers of R.O.W. Infiltration Basins, where directed.

GI-2.11.2 DESCRIPTION

Under this section, the Contractor must install Inlet Screen Box and accessories in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices - current edition, and as directed by the Engineer.

GI-2.11.3 MATERIALS

Inlet Screen Box and accessories must be composed of fully welded aluminum supporting frame, screen unit affixed with two (2) lifting tabs designed to accept a standard grate/manhole lifting hook and two (2) supporting brackets.

Inlet Screen Box and accessories must comply with the following requirements:

(A) Aluminum must comply with the requirements of ASTM standard:

(1) ASTM B209 - 14 “Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate”.

(2) Aluminum for the screen unit must be 14-gauge aluminum alloy, 3000 series or equal.

(B) The Inlet Screen Box must meet, at a minimum, the following performance requirements:

(1) The calculated filtered flow rate: 1.70 CFS.

(2) The calculated bypass flow rate: 0.86 CFS.

(3) The debris capacity: 0.88 CFT.

(C) The screen unit must have ½” diameter openings with 60 degree staggered on center locations and a 48% open area.

(D) The filter unit must include a hooded bypass to prevent resuspension of floatables.

(E) The lifting tabs must be able to support a combined load of not less than 150 -lbs. using a factor of safety of 4.

(F) “NYCDEP” logo must be suitably located and cut through the final frame assembly to help eliminate the scrap value of this basket unit.

GI-2.11.4 CONSTRUCTION METHODS

(A) General

The Contractor must take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the Work.

(B) Furnishing and Installing the Inlet Screen Box

(1) Prior to installation, the Contractor must inspect and test the Inlet Screen Box, support brackets and screening unit for correct alignment, conditions for proper

attachment, damages or defects.

- Lifting tabs for the Inlet Screen Box must be inspected and tested for any defects or deficiencies that may lead to premature failure and to verify that the components are manufactured to meet the loading requirements specified herein. Load testing must be performed by evenly loading the box with a weight of 400lb, steadily lifting the device by the Lifting Tabs and verify box is completely suspended for a minimum of 1 minute, and lowering the box to finalize the test.
- Load Test will be considered as successful if there is no sign of material separation, cracking, splitting, or excessing beding of the Lifting Tabs. Excessive bending is defined as a permanent deformation greater than 1/8" offset from the vertical axis.

(2) The Contractor must install the Inlet Screen Box in accordance with shop drawings and standard installation practices as provided by the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, current edition.

(3) Supporting brackets must be affixed to the inlet chamber wall using concrete strike anchors. Locations of anchor holes must be determined prior to drilling with careful measurement and/or the use of a hole location template. Anchor hole location must be selected in such a way that ensures the Inlet Screen Box rests ~1/8" below the Concrete Chamber Inlet Opening

(4) After the supporting brackets have been installed, the inlet screen box must be lowered onto the brackets as shown on the contract drawings.

GI-2.11.5 SUBMITTALS

The data submitted must include, where applicable, manufacturer's descriptive literature, cut-sheets, hardware specifications, and installation instructions including hole location template.

GI-2.11.6 MEASUREMENT

The quantities to be measured for payment under each item must be the number of Inlet Screen Boxes satisfactorily installed.

GI-2.11.7 PRICE TO COVER

The contract price bid must be a unit price per EACH Inlet Screen Box and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to install the Inlet Screen Box, all in accordance with the Contract Drawings, the specifications required under this Section, and the directions of the Engineer.

The unit price bid of EACH INLET SCREEN BOX (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.11	INLET SCREEN BOX	EACH
GI-2.11-S	INLET SCREEN BOX (SPARE)	EACH

SECTION GI-2.13 – ENGINEERED SOIL

GI-2.13.1 INTENT

This section describes Engineered Soil. The Contractor must furnish, amend (if required), place and prepare the Engineered Soil and/or plant material as specified herein in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.13.2 MATERIALS

Engineered Soil must conform to the following standards:

(A) Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011 or latest.

(B) USDA Kellogg Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014.

GI-2.13.3 SUBMITTALS

(A) Prior to the procurement of Engineered Soil, the following information and samples for each source must be submitted to the Engineer for review and approval:

(1) Proposed material source and vendor.

(2) A sample of the proposed material, in presence of the Engineer, indicating the method of sampling and location of the sample.

(3) The Contractor must submit to the Engineer the name and location of the borrow (source) or stockpile site(s) and the estimated quantity of material available. The Contractor must provide a notarized letter from the owner(s) of the proposed borrow site and/or stockpile site(s) indicating ownership of the proposed site(s) and a commitment to supply a specified minimum quantity of material for the project. Additionally, the supplier must provide a certificate of clean fill and/or source materials for topsoil, signed by a NYS licensed PE/RLA or RA. To avoid delays in planting the Contractor must immediately begin to secure and test Engineered Soil at least one month in advance of the material actually being needed on site. This will allow sufficient time to blend the specified soil mix and make all the necessary adjustments in the mixing process.

(4) Loss-on-ignition results of the organic content analyses conducted in accordance with the referenced standard, *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011* or latest.

Results of the USCS soil texture gradation (gravel, sand, silt and clay) analyses and sand sieve analyses, with full reporting of all information in AASHTO sieve sizes, in accordance with the AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates and ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) or results of the USDA textural soil classification method, conducted in accordance with *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014.*

(5) Results of the pH tests conducted in accordance with the referenced standard, *USDA Soil Survey Laboratory Methods Manual Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011* or latest.

(6) Results of the soluble salts or electrical conductivity test conducted in accordance with the following standard, *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011* or latest.

(7) Results of the Nutrient analyses test conducted in accordance with the above referenced standard, *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011* or latest.

(8) Results of the Inorganic nitrogen and total nitrogen tests conducted in accordance with the following standard, *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014*.

(9) Results of the acid-producing (iron sulfide) test conducted in accordance with the methodologies utilized by the *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014*; or the latest

(10) Results of the cation exchange capacity test conducted in accordance with methodologies utilized by the *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014*

NOTE: Due to the agricultural nature of some of the Quality Control testing the Contractor is notified that both Rutgers University and Cornell University can perform nearly all agricultural testing required, one exception may be the acid-producing test. Turnaround times for results may vary from standard soils testing. However, all agricultural testing procedures must be performed in accordance with the above referenced standards and the USDA Soil Survey Laboratory Methods Manual (No. 42, 2014) AASHTO T 27 Sieve Analysis of Fine and Coarse Aggregates and the Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011 or latest. If another lab is proposed, the Contractor can submit written certification from the proposed lab certifying that the lab will utilize the same methodologies for soil testing as outlined in these specifications. Approval of the laboratory for Contractor's Quality Control testing will be by the Engineer. As delivery of Engineered Soil to the site progresses, additional testing must be conducted by the Contractor on the Engineered Soil brought to the site. Frequency of testing is one for every 50 CY delivered. Results of tests must be submitted to Engineer for review and approval, as noted in Section GI-2.13.3.A.

(B) The Contractor must submit to Engineer the materials and procedures for amending soil, if appropriate. Amendment of soil is only permitted to meet the nutrient and organic requirements of the specifications. Nutrient modifications are only permitted through the use of the approved contract specified non-toxic organic fertilizer and the organic amendment permitted is leaf compost, no other organic amendment is

permitted. Note that significant additions of leaf compost to increase organic matter content is also likely to change the soil pH, usually increasing soil pH.

(C) The Contractor must submit quantity records on a weekly basis to Engineer.

(D) Material failing the frequency testing must not be incorporated into the Work and must be removed from the site at the Contractor's expense.

GI-2.13.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Engineered Soil is an integral part of the Green Infrastructure system; as such, certification of its material properties is subject to the testing protocols of the Contractor's Quality Control (QC) plan and quality assurance testing by NYC DDC's Quality Assurance and Construction Safety (QACS) Bureau. The QC requirements relative to Engineered Soil are detailed below. **The Contractor must strictly comply with all requirements of its QC plan**. Sufficient lead time is required to develop an appropriate plan for mixing methodologies and ratios that will provide reliable results to meet the parameters listed below.

(B) Engineered Soil must be predominately sand (80-85% sand) as classified by the USDA Classification System. Based on test results, a determination will be made to ensure that the sand fraction analysis results are capable of supporting proposed vegetation. Engineered Soil must be free of refuse, hard clods, woody vegetation, stiff clay, construction debris (of any kind), boulders, stones larger than 1-1/2 inches, chemicals, or other deleterious material toxic to any vegetation used on the project.

The gradation of Engineered Soil must be determined by a laboratory using the methods of the ASTM alternative sieve designations:

Ranges:

0-10% gravel (2-25mm)
80-85% sand *of which:*
- 55-75% coarse sand (.5mm – 2mm)
- 20-40% medium and fine sand (.1mm-.5)
- 0-5% fine sand (.05 - .1mm)

5-10% silt
5-10% clay

Engineered Soil must have a minimum organic content of 3.0 percent and a maximum of 8.0 percent. If the source soil requires amendment to meet the Engineered Soil organic content requirement, leaf compost will be the only approved admixture. No soil mixing must be permitted during or after Engineered Soil placement. Engineered Soil must be tested for compliance with Contract specifications and submitted for approval prior to delivery to the site. The organic content of soils must be determined by a laboratory using the loss on ignition method as described in the *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011* or latest.

(C) The pH value of Engineered Soil must be 6-7.0 as determined by an approved laboratory using soil pH (Water (1:1. V:V)) procedures as described in Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware. Bulletin #493, Revised July 2011 or latest.. Amendment of soil to lower pH to meet Contract requirements is not permitted.

(D) The soluble salt value of the Engineered Soil must be up to-.4mmhos cm-1, but greater than 0, as determined by an approved laboratory using the soluble salt (1:2(V:V)) procedures as described in the *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, Revised July 2011* or latest.

Alternatively, electrical conductivity can be tested and must be between 0.38-0.75 mmhos/cm using the 1:2 dilution method or 1-2 mmhos using the Saturated Media Extract method.

(E) The value for Total Nitrogen must be as outlined below as determined by an approved laboratory using the Dry Combustion methodology, in accordance with the *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014*. Total Nitrogen should be based on total Carbon, where C:N = 10 to 20.

Total N Acceptable range is 0.09% to 0.35% (with nitrate (NO-3) form of nitrogen not to exceed 20 ppm).

(F) The value for Macro (P, K) Nutrients must be determined by an approved laboratory using the procedures as described in the *Recommended Soil Testing Procedures for The Northeastern United States, 3rd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, Revised July 2011* or latest. Ideal values for macro nutrients must be at least

P: 80 lbs/acre, and
K: 100 lbs/acre

Nutrients should be in a range that has been shown to be adequate to grow plants, as recommended by Cornell or Rutgers (or approved equal) Laboratory's Soil Health Test.

(G) The value for cation exchange capacity must be determined by an approved laboratory using the procedures as described in USDA Kellogg Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014 . Acceptable levels fall above 10. A CAC level below 10 may require soil amendments such as the addition iron humate and zeolites, with the approval of the Engineer.

(I) An acid-producing soil test is required to determine the potential for decreases in soil pH after oxidation. The pH value of the solution must be greater than 4.5 as determined by the *USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 Version 5.0, Issued 2014*.

(J) The Engineered Soil mix must be weed seed free and must not contain any traces of hydrocarbons, petroleum products, chemically prohibited substances.. It must not smell of petroleum or give off other unnatural or toxic odors. The Engineer must check for discoloration and evidence of unacceptable contents. Regardless of prior acceptance of sample material, should the Engineered Soil delivered to the site seem suspicious in any way, the Engineer must reject the material and the Contractor must immediately remove the material off the project site at no additional cost to the City.

Refer to the NYSDEC Policy, "*CP-51/Soil Cleanup Guidance*" (Revised 10/21/2010), for appropriate levels of soil cleanup. If the Engineered Soil has already been placed

in-situ, the Contractor must be responsible for:

(1) Removal and legal disposal of unacceptable fill;
(2) Replacement with acceptable fill; and,
(3) All other expenses, as well as potential fines that may be incurred.

(K) Dry Screened SAND must consist of uniformly graded coarse sand consisting clean, inert rounded grains of quartz or other durable rock, free of organic material, loam, surface coatings, mica, debris, frozen soil or other deleterious material which may be compressible Limestone sand is not acceptable. The sand must be of uniform quality, friable, free from hard clods, stiff clay, hard pan, partially disintegrated stone, stones, lime, cement, ashes, slag, concrete, tar residues, tarred paper, gasoline, motor oil, or other petroleum hydrocarbons, boards, brush, weeds, stalks, roots, sods, chips, sticks or any other undesirable material. Invasive, nonnative seed must not be allowed in the clean sand material.

Clean sand should conform to the following gradation requirements: U.S. Standard Sieve Size No. 10 sieve for washed sieving, with Percent Passing by Weight: 100%

GI-2.13.5 MANUFACTURER

(A) Natures' Choice Corp.
25 Baler Blvd.
Kearny, NJ 07032
Phone: 973-969-3299 ext. 201
Fax: 732-469-0054
www.natureschoicecorp.com

(B) Advanced Soil Technologies
990 Cedar Bridge Ave.
Suite B7 – Unit 175
Brick, NJ 08723

Blending facility:
276 Deans Rhode Hall Road
Monroe, NJ 08831
Phone: 732-840-1700
Fax: 732-840-6794
www.advancedsoiltechnologies.com

(C) East Coast Mines & Materials Corp.
41 Lewis Rd,
East Quogue, NY 11942
Phone: 631-653-5445

(D) Liberty Stone & Aggregates, LLC
1 Caven Point Ave,
Jersey City, NJ 07305
Phone: 201-984-0650
https://www.libertystonenj.com/

(E) Or approved equivalent.

GI-2.13.6 CONSTRUCTION METHODS

(A) Prior to procurement and starting delivery of Engineered Soil, all approvals for those items required in Section GI-2.13.3 entitled "SUBMITTALS" must have been given

in writing to and accepted by the Engineer.

(B) Prior to the placement of Engineered Soil, the preparation of the subgrade must be accepted by the Engineer. Engineered Soil must be evenly placed to the thickness and configuration as directed by the Engineer or as shown on the plans. Engineered Soil must not be placed when the subgrade or Engineered Soil is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the proposed planting or soil structure.

(C) Engineered Soil must be placed by gravity with no additional compaction and no use of mechanical equipment. After Engineered Soil placement and initial grading, the Green Infrastructure will be fully saturated, allowed to drain down and then fully saturated again. Then more Engineered Soil will be placed as necessary to bring to final grade. After final grading, no heavy equipment, pickup trucks, or other construction vehicles will be permitted to travel on these completed areas. The Contractor must, through hand grading with rakes and shovels, grade all areas around fences, pipes and other structures in preparation for planting.

(D) The Contractor must, as part of the Engineered Soil spreading operation, mechanically rake and clean all undesirable materials from the Engineered Soil prior to planting operations. The Contractor must dispose of all undesirable materials from the Engineered Soil.

(E) The Contractor must pay all costs to rectify any deficiencies in placement of the Engineered Soil layer, to the acceptance of the Engineer.

(F) Upon placement of soil, Contractor must immediately protect newly placed soil from erosion, compaction, and contamination from weed seeds. If asset is to be planted within 3 months, or if soil placement is during winter months, soil must be covered with secured filter fabric (or approved equal); in all other cases, GI Asset must otherwise be seeded with an interim cover crop and secured with erosion control blanket, in accordance with Section GI-4.20, until asset can receive final design planting.

GI-2.13.7 MEASUREMENT

The quantity of Engineered Soil to be measured for payment under this item must be the number of cubic yards of Engineered Soil actually incorporated in the finished Work, measured in trucks used for delivery at the proposed site(s), in accordance with the plans and specifications, and to the satisfaction of the Engineer.

GI-2.13.8 PRICE TO COVER

Payment per cubic yard of Engineered Soil must cover the cost of all labor, materials, plant, equipment, insurance, and incidentals required to furnish and incorporate the Engineered Soil in full compliance with the requirements of the specifications and must include, but not limited to, testing of materials and furnishing such samples for testing as may be required, all in accordance with the plans, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.13	ENGINEERED SOIL	C.Y.

SECTION GI-2.16 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE

GI-2.16.1 INTENT

This section describes High Density Polyethylene (HDPE) pipe, fittings, flanges, unions, couplings, as specified in the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings, or as required for a complete installation. Furnish and install all HDPE pipe and fittings in accordance with the specifications, the manufacturers' recommendations, and as directed by the Engineer.

GI-2.16.2 REFERENCES

(A) HDPE pipe must conform to the latest standards of the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the American Water Works Association (AWWA) and the National Sanitation Foundation (NSF).

(B) HDPE pipe and fittings must conform to the following ASTM and AASHTO standards:

(1) ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

(2) ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

(3) AASHTO M 252 - Standard Specification for Corrugated Polyethylene Drainage Pipe

(4) ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

(5) ASTM D7001 - Standard Specification for Geocomposites for Pavement Edge Drains and other High-Flow Applications

(6) ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

GI-2.16.3 SUBMITTALS

Submit catalog data for pipe, couplings, and other appurtenances.

GI-2.16.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) The pipe must be uniform in color, capacity, density, and other physical properties.

(B) The pipe must be manufactured from high density polyethylene resin in accordance with ASTM D3350 and PPI TR4. The pipe must conform to cell classification PE424420C for PE42 under ASTM D 3350. The pipe material must conform to the following cell classification requirements:

Table GI-2.16-1 – HDPE Cell Classification Requirements

Property	Value	ASTM Designation
Density	0.955 gm/cm^3	D 1505
Melt Flow Index	1.0	D 1238
Flexural Modulus	80,000 psi	D 790
Tensile Strength @ Yield	3,200 psi	D 638
ESCR	Max Failure = 50%	D1693
Hydraulic Design Basis	Not Pressure Rated	D 2837
UV Stabilizer	C, Black with 2-3% carbon black	D 3350

(C) The pipe must contain no recycled materials or compounds.

(D) HDPE pipe must be marked either continuously or on intervals not to exceed five (5) feet by indirect printing with the following information:

(1) Name and/or trademark of the manufacturer.

(2) Nominal pipe size.

(3) Dimension Ratio (DR).

(4) The letters PE followed by the polyethylene grade per ASTM D 1248, followed by the Hydrostatic Design Basis.

(5) Manufacturing Standard Reference.

(6) Production Code from which time and date of manufacture can be determined.

(E) Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas or undispersed raw materials must not be acceptable and will result in rejection of the pipe by the Engineer.

(F) HDPE fittings must be manufactured to the requirements of ASTM D 3212 and this Specification. Fabricated fittings must be pressure rated to match the system piping.

(G) Perforations for the 8” HDPE pipes used for the Infiltration Basins, ROWBs with Stormwater Inlet (Type B), and Type D ROWBs must comply with the following guidelines:

(1) The total water inlet area per linear foot of the pipe must be 3.3 in^2 minimum.

(2) The individual perforation must be minimally sized 1” by 0.09”, spaced 120 degrees apart radially O.C., and spaced 0.96” O.C. longitudinally along the pipe, or as approved by the engineer.

GI-2.16.5 MANUFACTURERS

(A) Advanced Drainage Systems, Inc. (ADS) 4640 Trueman Blvd. Hilliard, OH 43026
1-800-821-6710
http://www.ads-pipe.com

(B) Hancor, Inc.
12370 Jacksontown Rd. #172
Findlay, OH 45840
1-888-367-7473
http://www.hancor.com

(C) LANE Enterprises, Inc.
3905 Hartzdale Drive, Suite 514 Camp Hill, PA 17011
717-761-8175
www.lane-enterprises.com

(D) Or Approved Equivalent.

GI-2.16.6 CONSTRUCTION METHODS

(A) Utilize care when lowering unit into the trench. Handle using nylon slings and two pick points.

(B) When the unit consists of two sections, place the downstream section first. Properly lube the bell and spigot to connect and home the remaining section.

(C) All connections to stormwater manholes, stormwater inlets, junctions, and/or inlets should be grouted and water/soil tight.

(D) Only use couplings to join standard lengths of pipe and as required to complete a straight run of pipe. Do not use couplings to join random lengths of pipe and cuttings from standard lengths.

(E) Use reducing fittings for all changes in pipe size. Do not use bushings.

(F) During construction, keep the lines free from foreign matter. The piping must be left thoroughly clean to the satisfaction of the Engineer.

(G) For Right-of-Way Infiltration Basins, use 90-degree bend or tee fittings to join pipes that are shown as perpendicular to each other in the drawings.

(H) Perforations must only be made at the manufacturing plant.

GI-2.16.7 MEASUREMENT

The quantities to be measured for payment under these Items must be the number of linear feet (installed length) of each type HDPE PIPE actually placed in their final position, to the satisfaction of the Engineer, measured horizontally or vertically along the centerline of pipe and fittings as installed.

GI-2.16.8 PRICES TO COVER

The price bid for each type of HDPE PIPE must be a unit price per linear foot and must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete the Work of furnishing and installing HDPE Pipe of all types (solid, including single wall & dual wall, and perforated, also referenced to as slotted, etc.), including, but not limited to, excavating, furnishing and installing fittings, flanges, unions, couplings, end caps, sand, and cleanouts including covers, and excavation, connecting and joining pipe to other pipes or drainage structures; staking, furnishing and wrapping geotextile fabric for drainage around perforated/slotted HDPE pipe; all in accordance with the Contract Drawings, the specifications and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.16S	SOLID HDPE PIPE (6” DIA.)	L.F.
GI-2.16P	PERFORATED HDPE PIPE (6” DIA.)	L.F.
GI-2.16FPA	FULL PERFORATED HDPE PIPE (8” DIA.)	L.F.
GI-2.16HPA	HALF-PERFORATED HDPE PIPE (8” DIA.)	L.F.
GI-2.16SA	SOLID HDPE PIPE (8” DIA.)	L.F.
GI-2.16S30	SOLID HDPE PIPE (30” DIA.)	L.F.

SECTION GI-2.16 AC – DEBRIS SCREEN FOR PIPE

GI-2.16AC.1 INTENT

This section describes the installation of an aluminum debris screen, also known as a perforated pipe cover, and accessories to provide protection for subsurface piping systems in R.O.W. Green Infrastructure Assets where directed.

GI-2.16AC.2 DESCRIPTION

Under this section, the Contractor must install the debris screen and accessories in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, and as directed by the Engineer.

GI-2.16AC.3 MATERIALS

The Debris Screen for Pipes must be a fully welded aluminum assembly and must be composed of a frame, a perforated debris shield, one (1) pull handle to allow removal with one hand or accept a standard grate/manhole lifting hook, and four (4) rubber feet attached via four (4) spring tabs welded to the frame.

The debris screen and accessories must comply with the following requirements:

(A) Aluminum must comply with the requirements of ASTM standard:

(1) ASTM B209 - 14 “Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate”.

(2) Aluminum for support frame, handle and spring tabs must be 1/8 inch thick aluminum alloy sheet with bend radiuses not less than 1/8” (5000 series).

(3) Aluminum for the debris shield must be 14-guage aluminum alloy (3000 series).

(B) Rubber feet must be styrene-butadiene rubber (SBR) Durometer 70A or equal.

(C) The Debris Screen for Pipes frame must be 9 inches in diameter and friction-fit into a standard 8-inch diameter corrugated drain pipe.

(D) The debris shield must meet at a minimum the following performance requirement:

(1) The minimum calculated filtered flow rate must be 0.26 CFS.

(2) The particle size retention must be less than 0.188 inch.

(E) The screen must have 3/16 inch diameter perforations with 60 degree staggered on center locations and a 51% open area.

(F) The Debris Screen for Pipes must be manufactured to be clear of any free sharp edges and the frame must be cut through with “NYCDEP” logo at a suitable location to eliminate the scrap value of the unit.

(G) When installed, the handle of the Debris Screen must not interfere with any other features of the R.O.W. Green Infrastructure Asset.

(H) The rubber feet must be securely fastened to the spring tabs via stainless steel rivet hardware.

GI-2.16AC.4 CONSTRUCTION

(A) All Work must be done in accordance with the directions of the Engineer.

The Contractor must take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the Work.

(B) Furnishing and Installing the Debris Screen for Pipe

(1) Prior to installation, the Contractor must inspect the Debris Screen for Pipe assembly for correct alignment, conditions for proper attachment, damages or defects. Any inconsistencies between contract drawings deemed detrimental to Perforated Pipe Cover placement must be reported in writing to the Engineer or owner's agent prior to placement.

(2) The Contractor must install the Debris Screen for Pipe in accordance with shop drawings and standard installation practices as recommended by the New York City Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure Practices, current edition.

(3) The Debris Screen for Pipe must be installed by pushing the spring tabs inside the drain pipe until the unit is flush with the outer pipe wall. Ensure that Perforated Pipe Cover unit fits snugly via friction between the rubber feet and the inside wall of the corrugated pipe.

GI-2.16AC.5 SUBMITTALS

Submission must include, where applicable, manufacturer's descriptive literature, cut-sheets, proposed hardware, and installation instructions.

GI-2.16AC.6 MEASUREMENT

The quantities to be measured for payment under each item must be the number of Perforated Pipe Covers satisfactorily installed.

GI-2.16AC.7 PRICE TO COVER

The contract price bid must be a unit price per EACH Debris Screen for Pipe and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to install the Debris Screen for Pipe, all in accordance with the Contract Drawings, the specifications required under this Section, and the directions of the Engineer.

The contract price bid must be a unit price per EACH Debris Screen for Pipe (SPARE) and must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.16 AC9	DEBRIS SCREEN FOR PIPE (9" DIA.)	EACH
GI-2.16 AC9-S	DEBRIS SCREEN FOR PIPE (9" DIA.) (SPARE)	EACH

SECTION GI-2.17A – GABION (WITH CLEAN OPEN GRADED STONE)

GI-2.17A.1 INTENT

This section describes gabions (with clean open graded stone) also described as stone gabions in the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings. Gabions (with clean open graded stone) must be installed where required, as specified herein in accordance with the Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-2.17A.2 MATERIALS

(A) A gabion is a wire mesh container filled with stone at the project site to form a stable stone basket. The gabion must have the shape and dimensions as shown on the Contract Drawings and as directed by the Engineer. Wire mesh must conform to ASTM A975 standards for PVC coated gabions and openings must be of the necessary size to contain the clean open graded stone.

(B) The wire mesh must be non-raveling mesh made of twisting continuous pairs of wires to form hexagonal shaped openings which are interconnected to adjacent wires. The wire mesh must be of sufficient strength to hold the open graded stone in place, and rigid enough to hold the shape as shown on the contract drawings. The wire must be coated with PVC and must be free from any cracks or breaks after the fabrication of the mesh. Fasteners used to assemble and interconnect the individual units must be made of stainless steel.

(C) The clean open graded stones for the gabion must meet the specifications of GI-2.07D1 3”– 5” Clean Open Graded Stone.

GI-2.17A.3 CONSTRUCTION METHODS

(A) Gabions must be filled with clean open graded stone on site and installed as per the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings, Contract Drawings, and as directed by the Engineer.

(B) Gabions must be supplied, as specified in the contract drawings, in various lengths and heights. All gabions furnished by a manufacturer must be uniform width. Dimensions for height, lengths and widths are subject to a tolerance limit of +/- 5% of manufacturer’s stated sizes.

(C) Gabions must be fabricated in such a manner that the front, back, sides, ends, lid and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions must be of single-unit construction. The base, lid, ends, front and back must be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

The gabion must be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. All perimeter edges of the mesh forming the gabion must be securely selvedge so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh.

GI-2.17A.4 MEASUREMENT

The quantity to be measured for payment must be the cubic yards of Gabions actually installed at the site filled with clean open graded stone, to the satisfaction of the Engineer.

GI-2.17A.5 PRICE TO COVER

The contract price bid must be a unit price per CUBIC YARD of GABION (WITH CLEAN OPEN GRADED STONE) and must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete the Work including, but not limited to, furnishing and placing stones within the gabion cage, and tying the gabion lid in place; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment for furnishing and wrapping GEOTEXTILE FABRIC FOR DRAINAGE around gabions will be made separately under item GI-2.09DR-NW, unless otherwise specified.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.17A	GABION (WITH CLEAN OPEN GRADED STONE)	C.Y.

SECTION GI-2.19 – HDPE STORMWATER CHAMBER

GI-2.19.1. INTENT

This section describes HDPE STORMWATER CHAMBER. The purpose of the HDPE STORMWATER CHAMBER is to provide increased storm runoff detention capacity in a Right of Way Green Infrastructure Practice.

The Contractor must furnish and install the HDPE stormwater chamber in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings, specifications, and directions of the Engineer.

GI-2.19.2. MATERIAL

The HDPE stormwater chamber will be manufactured with an open bottom and side walls, must be a corrugated product that is joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings. Chambers will be arched in shape and manufactured with an open bottom. If approved by the manufacturer, the units may be trimmed to custom length. The HDPE stormwater chamber should conform to the dimensions as shown in the Contract Drawings and the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings with placement on bedding and backfill as shown. The minimum acceptable storage volume with the HDPE stormwater chamber must be 2 cubic feet per linear foot.

For a HDPE stormwater chamber, it must be manufactured of high molecular weight high density polyethylene in an ISO-9001certified manufacturing facility and meet ASTM D 3350 Cell Class 324420C

GI-2.19.3. SUBMITTALS

The Contractor, prior to the start of Work, must submit to the Engineer for approval catalog samples and cut sheets of the proposed material including certification that materials meet specified requirements and proposed dimensions of the Contract Drawings and NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

GI-2.19.4. CONSTRUCTION METHODS

(A) Delivery – Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

(B) Storage – Store materials in clean, dry area in accordance with manufacturer's instructions.

(C) Handling – Protect materials during handling and installation to prevent damage.

(D) Prior to the installation of the HDPE stormwater chamber, the Contractor must excavate the Green Infrastructure Asset area as directed by the Engineer.

(E) Install stone base, stormwater chamber, and backfill as indicated on the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

GI-2.19.5. MANUFACTURERS

(A) CULTEC Inc.
P.O. Box 280 878 Federal Rd.
Brookfield, CT 06804
203-775-4416
www.cultech.com

(B) Stormtech StormTech LLC
20 Beaver Road, Suite 104
Wethersfield, CT 06109
PH: 860-529-8188
www.stormtech.com

(C) Infiltrator Water Technologies, LLC 4 Business Park Road
P.O. Box 768
Old Saybrook, CT 06475
www.infiltratorwater.com

(D) Or approved equivalent

GI-2.19.6. MEASUREMENT.

The quantity to be measured for payment must be the number of linear feet of the HDPE STORMWATER CHAMBER installed to the satisfaction of the Engineer, measured along the centerline of the chamber from end to end.

GI-2.19.7. PRICE TO COVER.

The contract price bid for the HDPE STORMWATER CHAMBER must be a unit price per linear foot and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to excavate, furnish, handle, store, and install a HDPE stormwater chamber within a Green Infrastructure Asset, including, but not limited to, end caps, cutting holes in the sheets for utilities; all in accordance with the Contract Drawings, the specifications, manufacturers installation instructions, and the directions of the Engineer.

Clean open graded stone (Item No. GI-2.07D1) where called for on the Contract Drawings, will be paid under their respective items, unless otherwise specified.

Payment will be made under:

Item No.	Item	Pay Unit
GI-2.19	HDPE STORMWATER CHAMBER	L.F.

SECTION GI-4.06 – GI CONCRETE ELEMENTS

GI-4.06.1 INTENT

This section describes the concrete elements associated with Green Infrastructure Practice. The Contractor must install concrete as shown on the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings. The GI Concrete Elements may be either Precast or Poured In Place.

GI-4.06.2 PHYSICAL REQUIREMENTS

(A) Concrete elements must comply with the requirements of NYC Department of Transportation Standard Highway Specifications, current edition, Subsections 4.05.3, 4.05.4. and 4.05.5, and Section 4.14.

(B) Unless otherwise specified grout must be Cement Grout composed of neat cement and water and must comply with the requirements of Section 3.06 of the NYC Department of Transportation Standard Highway Specifications.

(C) The minimum acceptable average compressive strength of three samples is 4000 psi, with no individual less than 4000 psi. The maximum acceptable average freeze/thaw loss of five- block samples, subjected to 42 freeze/thaw cycles in a 3% NaCl solution, must not exceed 1.0%, with no individual sample exceeding 1.5%.

(D) Batching, mixing and placing of concrete must conform to ASTM C94 “Specification for Ready-Mix Concrete” and ACI 304 “Guide for Measuring, Mixing, Transporting and Placing Concrete”. All materials must be pre-weighed prior to mixing. Concrete must obtain a minimum compressive strength of 4,000 psi at 28 days of age. Concrete must contain 6% entrained air by volume (plus or minus 1%).

(E) Fabrication and placement must conform to ACI-318 “Building Code Requirements for Structural Concrete and Commentary”.

GI-4.06.3 METHODS

(A) All concrete elements must be furnished and installed as per the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings. It must be designed and constructed to fit as shown in the plans and to conform to site conditions, so that no gaps or hazards exist once the concrete is installed.

(B) All equipment and methods of construction must comply with the requirements of the NYC Department of Standard Highway Specifications, Subsections 4.05.4. and 4.05.5, and Section 4.14 with the following modifications and additions:

(1) For installations in existing pavement, the Contractor must be required to first full- depth saw cut and remove the pavement to the dimensions of the concrete elements shown on the Contract Drawings and directed by the Engineer. The Contractor must then backfill the excavated area to ensure that the concrete element will be placed to its proper elevation with foundation material which must comply with the requirements of Subsection 4.05.2(A) of the NYC Department of Transportation Standard Highway Specifications.

The earth subgrade, immediately before foundation material is placed on it, must be compacted to a minimum of 95 percent of Standard Proctor Maximum Density, smooth, parallel to and at the required depth below the finished concrete element surface and be dampened with water sufficient only to be absorbed by the subgrade. The subgrade must not be in a muddy or frozen condition and unsuitable material must be removed and replaced with acceptable material

thoroughly compacted.

The foundation material must be placed on the prepared subgrade, in a manner to minimize segregation, using equipment and procedures approved by the Engineer. Uncontrolled spreading from piles dumped on the grade resulting in segregation will not be permitted. Foundation material must then be wetted to the optimum moisture content, based on a laboratory Proctor density test, and thoroughly compacted using an approved plate compactor. Compaction of foundation material must range between 90% and 95% of the Standard Proctor Maximum Density, as directed by the Engineer, depending upon material used. Unsatisfactory subgrade material must be removed and replaced with acceptable material thoroughly compacted to a minimum of 95% of Standard Proctor Maximum Density. The top surface of the foundation material must be parallel to the finished grade and at a distance below the grade equal to the specified thickness of concrete.

(2) Following the placing and spreading of concrete, it must be struck-off and finished to conform to the cross-sections shown on the Contract Drawings. The final finish must be made by brooming after the water sheen has disappeared as per the requirements for Bus Stop Pavements, Section 4.05.5(K)(2) of the NYC Department of Transportation's Standard Highway Specifications.

(3) Contractor must furnish and install a welded wire fabric as per the NYC Department of Environmental Protection's Standard Design and Guidelines for Green Infrastructure Practices. The welded steel wire fabric must be laid in sheets which are straight and true to form and must be securely held in position by approved methods so that they will be in their prescribed position after the concrete has been placed.

(C) Dimensions must be as required in the contract documents. Dimensions must not vary by more than 1/4 inch from those specified. Concrete elements must be sound and free from cracks or other defects that would interfere with their proper placement or performance.

(D) Prior to installation, the subgrade must be compacted and carefully graded such that the concrete element will be seated flush on the subgrade, at the proper elevation and slope as shown on the Contract Drawings.

(E) Joint filler must comply with Section 2.15 of the NYC Department of Transportation Standard Highway Specifications.

GI-4.06.4 PRECAST CONCRETE ELEMENTS

Where shown in the NYC DEP Standard Design and Guidelines for Green Infrastructure, the precast concrete must be constructed in accordance with the following requirements:

(A) Fabrication

(1) Precast concrete elements must be fabricated to conform to the shapes and sizes shown on the Contract Drawings.

(2) The Contractor must provide the Engineer with shop drawings and detailed construction procedures for the concrete element. Shop drawings must show the form dimensions and location and type of reinforcement in the precast concrete elements. The drawings must be delivered to the Engineer for approval ten (10) working days before fabrication is to begin. No Work must

begin until the drawings are approved.

(3) The tolerance on placement of welded steel wire fabric in the concrete element must be ± 1 inch. The chairs, spacers or other devices used to maintain the welded steel wire fabric in position must have rust resistant tips. The cost of any welded steel wire fabric required to transport the precast concrete elements must be included in the cost of these items.

(4) Concrete must be consolidated in the forms by internal vibrators. Exposed surfaces must be free from objectionable imperfections, such as honeycomb and air voids as determined by the Engineer. If air voids collect at the interface of the concrete and forms, the forms must be tapped on the outside with rubber mallets or similar devices to displace the entrapped air.

(B) Curing

(1) The precast concrete elements may be cured as per the requirements for cast in place concrete.

(2) If the concrete elements are steam cured, the elements must be cured in an enclosure free from outside drafts, and cured in a moist atmosphere. The temperature must be maintained at a temperature between 125 degrees and 160 degrees F. by the injection of steam for a period of not less than 12 hours. Steam curing must not begin less than 2 hours from the time that the last concrete was placed. Care must be taken by the Contractor to prevent localized "hot spots" caused by the steam lines. A continuous temperature time recorder is required for each enclosure. The temperature of the curing atmosphere for any method must not be increased or decreased at a greater rate than 40 degrees F. per hour.

(C) Repair

(1) Where approved by the Engineer, occasional imperfections in manufacture or those caused by mishandling may be repaired. The repairs must be properly finished and cured. The color of the repaired area must match as closely as possible with the rest of the element color. Repairs may be made with a mixture of sand and cement, and must be made to the satisfaction of the Engineer.

(D) Basis of Acceptance

The precast concrete element must be accepted at the job site based on all of the following:

(1) The manufacturer's name must appear on the NYS Department of Transportation's Approved List of "Precast Concrete Manufacturers Approved for QC/QA Production" for either Product Group 1, 2, or 4.

(2) A manufacturer's certification.

(3) An acceptable product evaluation made by the Engineer.

GI-4.06.5 SUBMITTALS

(A) Manufacturer must have experience in design and fabrication of similar products and with facilities for fabricating the concrete elements with the quality specified herein and without delay to the specified schedule.

For Precast Concrete Elements, the Contractor must furnish: Shop drawings, in

accordance with the requirements of Subsection 1.06.13. of the NYC Department of Transportation Standard Highway Specifications. Engineering layout drawings will be provided for approval and to assist field installation. The drawings will include dimensions, identification and location of each trench part in the trench layout along with a bill of material.

GI-4.06.6 PRICE TO COVER

The contract price bid per concrete elements must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete the Work including, but not limited to, excavation and sawcutting of existing pavement, concrete, brick and mortar, welded steel wire fabric, grout, backfilling, and restoration of any disturbed adjacent pavement, as may be required, to satisfactorily complete the Work; preparation and submission of shop drawings and concrete mix design criteria; supports, forms, joint filler, and joint sealer; leveling course material; foundation materials in accordance with Subsection 4.13.4.B of the NYC Department of Transportation Standard Highway Specifications; curing; damping of the subgrade; to furnish samples for testing; and to maintain the reinforced concrete elements in good condition as specified in Section 5.05 of the NYC Department of Transportation Standard Highway Specifications; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.06 A	REINFORCED CONCRETE APRON	S.F.
GI-4.06 CC-A	CONCRETE CHAMBER (TRENCH) AT INLET	EACH
GI-4.06 CC-B	CONCRETE CHAMBER (TRENCH) AT OUTLET	EACH
GI-4.06 CO	CONCRETE WALKWAY AND FOOTER FOR HYDRAULICALLY CONNECTED GREEN INFRASTRUCTURE PRACTICES	L.F.
GI-4.06 CU	REINFORCED CONCRETE CULVERT AND COVER	L.F.
GI-4.06 CG	REINFORCED CONCRETE GUTTER	L.F.
GI-4.06 CS	CONCRETE STRIP	L.F.
GI-4.06 CT	5-INCH-THICK CONCRETE TOP	S.F

SECTION GI-4.15 – TOPSOIL

GI-4.15.1. INTENT.

Under this section, the Contractor must furnish and install Topsoil in accordance with the specifications, Contract Documents, and directions of the Engineer.

GI-4.15.2 GENERAL REQUIREMENTS

Topsoil may be from natural sources or may be manufactured. Natural topsoil and manufactured topsoil must meet the same requirements, except as noted below.

Topsoil must meet the following requirements:

1) Must be of uniform quality;
2) Must be from a verifiable source;
3) Must be a loam topsoil with the addition of humus only and no added sand or clay;
4) Must be free of undesirable materials and materials toxic or otherwise deleterious to plant growth, including, but not limited to:
   a. Natural materials: hard clods, stiff clay, clay lumps, hardpan, sods, stones, and partially disintegrated stone;
   b. Foreign materials: lime, cement, concrete, ashes, slag, tar residues, asphalt, trash, refuse, and wood;
   c. Plant materials: plant growth, seeds, viable propagules of invasive plants, woody vegetation, stumps, roots, brush;
5) Must not be delivered in a frozen or muddy condition;
6) Natural topsoil must be obtained from an area that has never been stripped and must be removed to the lesser of 1 foot or until subsoil is encountered.

GI-4.15.3 ANALYTICAL REQUIREMENTS

Topsoil must be tested for:

- Sieve analysis (particle size)
- pH
- Organic matter
- Salinity
- Nutrient Content

(A) SIEVE ANALYSIS (PARTICLE SIZE)

Sieve analysis and classification must be performed per ASTM D2487, and meet the following requirements:

Table GI-4.15-1 Sieve Analysis Requirements

Component	Description	Percent of total, by weight
Coarse	2” or larger	0.0%
Gravel	≥ 2.0mm	3% maximum
Sand	0.05mm to 2mm	40% to 70%
Silt	0.002mm to 0.05mm	15% - 65%
Clay	< 0.002mm	20% maximum

(B) pH VALUE:

pH must be between 6.0 to 7.5, inclusive, per ASTM D4972.

For median plantings where the bed has a footing, closed bottom, or base between the subgrade and the planting, pH must be between 5.5 to 7.2, inclusive, per ASTM D4972.

(C) ORGANIC MATTER

Organic matter is to be tested per ASTM D2974, using the ignition item method on dried moisture-free samples. The organic matter must meet the following requirements:

- Where the planting bed is open to the subgrade (i.e., street trees):3% to 12%
- Where the topsoil is for seeding or sodding: 3% to 8%
- Where the planting bed has a footing, closed bottom, or base between the subgrade and the planting (i.e., planters or raised median beds): 5% to 8%

(D) SALINITY

Soil salinity must not exceed 1.0 millimohs per centimeter at 25C, per USDA circular No. 892, using the electrical conductivity method.

(E) NUTRIENT CONTENT

Nutrient contents, measured in parts per million (PPM), must meet the requirements below:

Table GI-4.15-2 Nutrient Content Requirements

Nutrient	Requirement	Note
Nitrogen (N)	25 PPM minimum	NO-3 not to exceed 20ppm
Phosphorus (P)	5 PPM minimum	
Potassium (K)	20 PPM minimum	

Topsoil test results must show recommendations for soil additives or non-toxic fertilizers to correct nutrient deficiencies, as necessary.

GI-4.15.4 SAMPLING AND TESTING

The Contractor must submit the following to the Engineer for approval:

1) Intended source of topsoil
2) Test reports, from an accredited 3rd party laboratory. The test reports must include the results of all tests in Section GI-4.15.3, and verify conformance. Acceptable 3rd party laboratories include state Cooperative Extension Laboratories, such as those operated by Cornell and Rutgers.
3) If requested by the Engineer, a representative sample of topsoil. The sample size must be at least 2 gallons, or as directed by the Engineer.

The above required submittals must be provided no less than 21 days prior to the scheduled delivery of topsoil. No delivery of topsoil will be allowed until the submittals are approved by the Engineer.

The initial sampling and testing for approval listed above is in addition to the sampling and testing of installed materials per Section 5.03 of NYSDOT STANDARD SPECIFICATIONS (1 sample per 50 CY of topsoil installed). If the testing shows deficiencies in the installed material, the contractor may propose correcting the installed material (i.e., using additives to adjust pH) instead of replacement, if approved by the Engineer.

GI-4.15.5 INSTALLATION

Topsoil in an unworkable condition due to excessive moisture, frost, or other conditions must not be placed until it is suitable for spreading.

If geotechnical fabrics and/or drainage layers have been specified or are present, the condition of these items must be intact and free of holes, tears, or defects.

Before placing topsoil, the subgrade must be trimmed to a smooth uniform surface at the required distance below the finished grade. All hollows, depressions and gullies must be filled with acceptable material free from stones over two (2") inches in diameter, rubbish and other material which is unsuitable in the opinion of the Engineer.

After topsoil is spread, all large stiff clods, rocks, roots, or other foreign matter must be cleared and disposed of by the Contractor as approved so that the finished surface will be acceptable for mulching, erosion control matting, or planting.

Topsoil must be satisfactorily compacted, as directed by the Engineer.

The Contractor must be responsible for repairing any damage caused during the removal and replacement of topsoil, which includes, but is not limited to, plant material, irrigation systems, water proofing membrane, adjacent sidewalk, curb and gutter, pavements, planters, etc.

Upon placement of soil, Contractor must immediately protect newly placed soil from erosion, compaction, and contamination from weed seeds. If asset is to be planted within 3 months, or if soil placement is during winter months, soil must be covered with secured filter fabric (or approved equal); in all other cases, Asset must otherwise be seeded with an interim cover crop and secured with erosion control blanket, in accordance with Section GI-4.20, until asset can receive final design planting or seeding.

GI-4.15.6 MEASUREMENT

The quantity of TOPSOIL will be the number of cubic yards measured in place after compaction, to be paid ***ONLY*** used for Type D Bioswales and Grass Top Infiltration Basins, in accordance with the plans and specifications, and to the satisfaction of the Engineer.

NOTE: THE COST OF FURNISHING AND INSTALLING TOPSOIL IN AREAS WITHIN THE PROJECT LIMITS OTHER THAN THE TYPE D BIOSWALE OR THE GRASS TOP INFILTRATION BASIN, MUST BE INCLUDED IN THE UNIT PRICES BID FOR ALL SCHEDULED ITEMS.

GI-4.15.7 PRICE TO COVER

Payment per cubic yard of Topsoil must cover the cost of all labor, materials, plants, equipment, insurance, and incidentals required to furnish and incorporate the Topsoil in Type D Bioswales or Grass Top I.B.'s in full compliance with the requirements of the specifications and must include, but not limited to, testing of materials and furnishing such samples for testing as may be required, all in accordance with the plans, the specifications, and directions of the Engineer.

NOTE: THE COST OF FURNISHING AND INSTALLING TOPSOIL IN AREAS WITHIN THE PROJECT LIMITS OTHER THAN THE TYPE D BIOSWALE OR THE GRASS TOP INFILTRATION BASIN, MUST BE INCLUDED IN THE UNIT PRICES BID FOR ALL SCHEDULED ITEMS.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.15	TOPSOIL FOR TYPE D BIOSWALE OR INFILTRATION BASIN	C.Y.

SECTION GI-4.15P – RETRIEVING, STORING AND INSTALLING CITY PROVIDED TOPSOIL

GI-4.15.1P INTENT

Under this section, the Contractor must retrieve and transport the City pre-approved topsoil from the recommended Mayor's Office of Environmental Remediation (MOER) stockpile location. Contractor must store and install topsoil in accordance with the specifications, Contract Documents, and directions of the Engineer.

GI-4.15.2P GENERAL REQUIREMENTS

City Provided Topsoil must meet the requirements of Section GI-4.15 and the following additional requirements:

1. Topsoil will be provided by the City.
2. The Engineer will connect the MOER soil source with the Contractor.
3. The Contractor's trucks will be loaded by MOER.

GI-4.15.3P ANALYTICAL REQUIREMENTS

The City provided topsoil must meet the requirements of Subsection GI-4.15.3.

The Engineer will review the soil analysis testing results provided by the MOER and confirm the topsoil meets all required analytical requirements. The Engineer will provide topsoil information and retrieval information to the Contractor.

GI-4.15.4P SAMPLING AND TESTING

No Text.

GI-4.15.5P INSTALLATION

The Contractor must meet the requirements of Subsection GI-4.15.5.

GI-4.15.6P MEASUREMENT

The quantity of TOPSOIL will be the number of cubic yards measured in place after compaction, to be paid ***ONLY*** used when in accordance with the plans and specifications, and to the satisfaction of the Engineer.

GI-4.15.7P PRICE TO COVER

Payment per cubic yard of City Provided Topsoil must cover the cost of all labor, equipment, insurance, and incidentals required to receive, store and install the City Provided Topsoil in full compliance with the requirements of the specifications and in accordance with the plans, the specifications, and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.15P	RETRIEVING, STORING AND INSTALLING CITY PROVIDED TOPSOIL	C.Y.

SECTION GI-4.16 – PLANTING TREES WITHIN GI ASSETS (TRANSPLANTING, PLANTING)

GI-4.16.1. INTENT. This section describes the removal, transplanting and planting of trees within Green Infrastructure (GI) assets.

GI-4.16.2. DESCRIPTION

The Contractor must comply with all Federal, State, and Local regulations for plant pest and disease control. NYS Department of Agriculture and NYS Department of Environmental Conservation require contractors operating in pest infested or disease infected areas to thoroughly clean all equipment units before moving equipment to non-infested or infected areas.

The Contractor and/or subcontractors who will perform tree Work of any kind within a quarantine or protective zone is required to abide by all existing and any new or revisions to legislation and orders regarding quarantines and protective zones while working on this contract. Tree Work includes, but is not limited to planting, transplanting, pruning, fertilizing, and removing trees; removing stumps; clearing and grubbing of trees or roots; and the transportation and disposal of plant material and vegetative debris.

The Contractor and/or subcontractors must be certified by the New York State Department of Agriculture & Markets to perform Work within any designated Quarantine Zone. The Contractor must review and abide by the description of the quarantine and compliance agreements as presented in the publication entitled Part 139 of the New York State, Department of Agriculture & Markets law. Full information can be obtained from Federal and State Pest Control personnel. Quarantine areas, for the purpose of this contract must be defined as all five Boroughs of the New York City.

The Contractor must comply with all Federal, State, and City laws pursuant to the handling and disposal of woody organic material that is host material for the Asian Longhorned Beetle, Emerald Ash Borer, Spotted Lantern Fly or any other state or federally monitored pest. Please refer to Section 163 (Prevention of Introduction of injurious insects, noxious weeds, and plant diseases Part 139 of the New York State Department of Agriculture and Markets law and contact State personnel for further details.

In addition, Nurseries located within the quarantine zone must comply with State and Federal Law and all Contractors and/or Subcontractors must be certified by the New York State Department of Agriculture and Markets to perform Work within the Quarantine Zone.

(A) TRANSPLANTING (up to four (4”) inch caliper)

Transplanting must consist of the excavation of existing trees; re-planting at new locations; establishing trees at new locations as provided in Section GI-4.10; storing on the site for later replanting; or delivering removed trees to such locations, away from the site, as the Engineer must direct.

Transplanting must include all necessary digging, balling, burlapping, platforming, hauling, handling and heeling-in; and, when necessary or directed, re-digging, re-balling, re-burlapping, re-hauling and re-handling of trees designated to be transplanted and establishing said trees as provided in Section GI-4.10**.**

Trees larger than 4” caliper are not suitable for transplanting within a GI asset.

(B) PLANTING

Planting must consist of furnishing, when required; delivering; hauling; handling and

planting; and establishing of new trees at locations shown on the Contract Drawings or directed by the Engineer.

Planting must include, but not be limited to, all labor, materials, plant and equipment required for excavation of all materials of whatever nature encountered; furnishing specified soil; placing specified soil in new tree pits; staking, spraying, pruning, protecting and establishing all trees; and furnishing and installing all other incidentals required for the proper performance of the Work; all, in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

The Contractor must obtain and submit to the Engineer the required NYCDPR permit for trees planted in the Right-Of-Way.

All references to tree pits will also include Green Infrastructure Assets, where applicable.

GI-4.16.3. GENERAL

(A) LANDSCAPE CONTRACTOR

All Work must be done by competent Landscape Contractors acceptable to the Engineer.

(B) PLANTING OPERATIONS

(1) A permit must be obtained from the Department of Parks and Recreation (NYCDPR) prior to the planting of any tree. Tree planting must commence at the first available planting season, upon placement of specified soil. For GI Assets, tree planting must occur before the planting of all other plant material within a given asset. Trees must be transplanted and/or planted only while dormant in the season as the Engineer may direct, or, with prior written approval of the Engineer in consultation with NYCDPR and the sponsor agency. Tree planting operations must be done in accordance with the following specifications. Spring planting must commence no earlier than March 1st and finish no later than May 15th. Fall planting must proceed from October 1st through December 15th, unless otherwise directed by the Engineer and permitted by NYCDPR. Some species, such as the B&B evergreens, should not be planted later than November 1st, unless treated with an anti-transpirant, as specified below. The Contractor should be aware of any tree species in use that have fall planting hazards, and schedule planting accordingly.

(2) Upon the Engineer's determination that it is impracticable or impossible to plant all required new trees or transplant all required existing trees or any smaller number of them within a planting season which falls within the contract time, the Contractor will be required to place soil in accordance with the requirements of the specifications, and protect the asset as identified in Sections GI-4.15.5 Topsoil and GI-2.13.6 Engineered Soil. Tree pits should not be dug until the tree is on site, to ensure proper hole depth.

GI-4.16.4. MATERIALS.

(A) TREES

(1) Plant Schedule

Type and size of trees to be planted must be as specified in the Bid Schedule or as shown on the Contract Drawings. All trees, except as otherwise permitted by the Engineer due to non-availability in certain species, must have single straight trunks

with leader intact, and symmetrical, well-branched tops.

Trees having limb cuts over three-quarters (3/4) of an inch on nursery-grown trees or over one and one-half (1-1/2”) inches on collected trees which have not completely calloused over will not be accepted.

Heavy fibrous root system is essential. Heavy crown shearing will not be accepted, and no shearing is preferred.

(2) NAMES

Plant names must agree with the nomenclature of “Standardized Plant Names” as adopted by the American Joint Committee on Horticultural Nomenclature 1942 edition: size and grading standards must conform to those of the American Association of Nurserymen *American Standards for Nursery Stock*, current edition, at the time of bid, unless otherwise specified. No substitutions will be permitted except by written permission of the Engineer. The Contractor must provide the Engineer with written confirmation of availability by the supplying nursery or the request for similarly confirmed substitutes two months before intended planting season. All tree cultivars, patented or otherwise, must be certified by the supplying nursery. All nurseries must be required to have a registration certificate from the New York State Department of Agriculture & Markets, Division of Plant Industry, certifying that plant material is free from injurious insect and plant diseases. A similar certificate must be required from other states where plant material is obtained.

(3) QUALITY

All trees must be typical of their species or variety. They must have normal well-developed branches and a vigorous fibrous root system. They must be sound, healthy, vigorous trees, free from defects, disfiguring knots, sunscald injuries, abrasions of the bark, plant diseases, insect eggs, borers and all forms of infestations. Material must be free from girdling roots. Trees must not have damaged or missing leaders, multiple leaders, Y-crotches, or indications of topping or heading back. All trees including replacement trees must be inspected and tagged at the nursery prior to digging and planting. All trees must be nursery grown and must have been growing under the same climatic conditions as those occurring in New York City for at least two (2) years prior to date of the contract. Trees held in storage must be rejected if they show signs of growth during storage. All trees must be limbed up to a minimum of five feet (5’) from the ground. The Contractor is responsible for ensuring that trees have been grown at the proper depth. Evergreens should be container-grown when possible.

(4) DIMENSIONING

A tree must be dimensioned as it stands in the nursery, and must be calipered at a point six (6”) inches above the ground for trees six (6”) inches or less in diameter. The stock furnished must be a fair average of the minimum and maximum sizes specified.

No nursery material larger than 3 ½" caliper, or transplanted material larger than 4” caliper will be permitted within GI assets.

(5) PREPARATION FOR SHIPPING

Care must be exercised in digging and precautions customary in good trade practice must be taken in preparing trees for shipment and transplanting. Workmanship that

fails to meet the highest standards will be rejected and the Contractor must replace the damaged or rejected stock with acceptable material at no additional cost to The City. Trees must be dug to retain as many fibrous roots as possible and immediately before moving, unless otherwise specified. Balled and burlapped trees must have a solid ball of earth securely held in place with biodegradable burlap and stout rope or wire baskets. No manufactured balls will be accepted. If the specified tree size is unavailable, oversize trees may be substituted at no extra cost to the City. The root flare must not be covered with soil when the tree is balled and burlapped. Ball diameters must be not less than the following:

Table 4.16-1 Tree Caliper Minimum Root Ball Diameters

Tree Caliper	Minimum Root Ball Diameter
from 2-1/2” to under 3”	32”
from 3” to under 3-1/2”	36”
from 3-1/2” to under 4”	42”

(6) SHIPMENTS AND CERTIFICATION

All plants must be packed, transported and handled with utmost care and in such manner as to ensure adequate protection against desiccation, climatic, seasonal and other injuries. When transported in closed vehicles, plants must receive adequate ventilation to prevent sweating. When transported in open vehicles, plants must be protected by tarpaulins or other suitable cover material. Unloading must be carefully done to prevent injury to plants. Balled and burlapped trees must be set on the ground and balls covered with mulch if not immediately planted. Until planted, all materials must be properly maintained and kept adequately watered. Each shipment must be certified by the State and Federal Authorities to be free from disease and infestation. Any inspection certificates required by law to this effect must accompany each shipping invoice or order of stock and on arrival, the certificate must be filed with the Engineer. Plants from areas infested with Anthracnose or Canker must be accompanied by a certificate stating that the trees are free from these infestations.

Trees pre-tagged at the nursery by NYC DPR or by an ISA Certified Arborist prior to planting, will be preferred for street trees.

(7) INSPECTION

Inspection of plants may be made before digging if the Engineer directs but no shipment of plant materials must be planted by the Contractor until such material has been inspected by the Engineer at the site of the Work. All rejected material must be immediately removed from the site and replaced with acceptable material at no additional cost. Inspection of trees will be made by NYC DPR designated inspector upon completion of planting and at the end of the Guarantee Period.

Note: Inspection for Trees is conducted separately from inspection of understory planting.

(B) SOIL

Topsoil must comply with the requirements of Section GI-4.15**.** All references in this Section to topsoil will include a different planting medium, such as engineered soil or

sand, where applicable.

Engineered Soil must comply with the requirements of Section GI-2.13.

(C) MULCH

Shredded bark mulch must be a natural forest product composed of shredded bark or wood not exceeding three inches (3") in length and one inch (1") in width, Mulch shall be derived from tree material, not from wood waste or by-products like sawdust, shredded palettes, or other debris. Mulch shall be natural in color and not dyed. It shall be of a uniform grade with no additives or any other treatment. Mulch with leaves, twigs, and/or debris shall not be acceptable. The pH factor should range from 5.8 to 6.2.When available, the Contractor must use locally sourced mulch from NYC DPR which fulfills the above requirements.

Shredded bark mulch must be applied to the surface of entire asset, as shown on the Contract Drawings and as directed by the Engineer. Mulch must be applied to a uniform depth of two (2) to three (3) inches over entire asset and must be so distributed as to create a smooth level cover over the exposed soil, but must be kept 2” away from the trunk flare.

(D) EROSION CONTROL FABRIC

Erosion control fabric, when specified in the Contract Drawings or DEP GI Standards will be used in place of mulch and installed over entire asset in accordance with Section GI-4.20.

(E) WATER

If conditions do not allow the use of New York City water sources, the Contractor must obtain its own source of water.

(F) MYCORRHIZAL FUNGI INOCULANT

Mycorrhizal fungi inoculant must be applied by means of a three ounce (3 oz.) premeasured dry formulation packet, such as Mycor Tree Saver Transplant®, as manufactured by Plant Health Care, Inc., Pittsburgh, PA; Rhizanova Tree Transplant, as manufactured by Becker Underwood, Inc., Ames, IA; DIEHARD®, as manufactured by Horticultural Alliance and distributed through Atlantic Irrigation, White Plains, NY; or, an approved equivalent. Packets must contain, as a minimum: one thousand (1,000) live spores of Vesicular-Arbuscularfungi, including: *Entrephosphora columbianaGlomus clarum*, *Glomus etunicatum*, and *Glomus sp.;* seventeen million five hundred thousand (17,500,000) live spores of Ectomycorrhizal fungi, including: *Pisolithus tinctorius*; biostimulants including *Yucca schidigera* extract; soluble sea kelp extract derived from *Ascophylum nodosum*; humic acids; and acrylamide copolymer gel as a water absorbent medium.

Inoculant must be added after the trees have been placed in their hole. Three (3) packets for each 2-1/2” to 3” caliper tree and four (4) packets for each 3-1/2” to 4” caliper tree must be added to the top six to eight inches (6 to 8”) of backfill soil added to each pit and thoroughly mixed to distribute the inoculant. The opened packets must be given to the Engineer at the end of each day. Mycorrhizal inoculant is a dated material and must be used before it expires. The material must be applied according to the following table:

Table 4.16-1 Mycorrhizal Inoculant Requirements for Trees

Size of rootball or container	Ounces per plant
30” B&B	9
36” B&B	12
42” B&B	12

(G) WATER RETENTION ADDITIVE

Water retention additives must be a granular polyacrylamide polymer of a potassium base and not a sodium base that slowly releases water into the root zone such as Terra Sorb®, as manufactured by Plant Health Care, Inc., Pittsburgh, PA; Soil Moist™ as manufactured by JRM Chemical, Inc., Cleveland, OH; or, an approved equivalent. The water retention additive must be applied at the time of planting during a dry planting season as defined by the Department of Parks and Recreation. Each tree must receive three (3) ounces or an amount specified by the product instructions. When planting shrubs, perennials or annuals, apply as per product instructions.

(H) BURLAP

Burlap must be a natural bio-degradable fabric. No nylon or other synthetic burlap will be permitted.

(I) CORD OR ROPE

Cord or rope must be natural, bio-degradable sisal twine. Nylon or other synthetic rope will not be permitted.

GI-4.16.5. METHODS.

(A) TRANSPLANTING

(1) The Contractor will transplant trees, establish, and replace all trees as specified, in accordance with the plans, the specifications, and directions of the Engineer. All transplanting must be completed by a tree company approved by NYCDPR, and said company must obtain the necessary permits from NYCDPR before undertaking any removal Work. The Contractor will be liable for any damages to property by transplanting operations and all areas disturbed must be restored to their original condition, to the satisfaction of the Engineer.

(2) PREPARATION OF PLANTS: All precautions customary in good trade practice will be taken in preparing plants for moving, and workmanship that fails to meet the highest standards will be rejected. All plants must be dug immediately before moving unless otherwise directed. All plants must be dug to retain as many fibrous roots as possible. Plants must be balled and burlapped having a solid ball of earth of minimum specified size according to the American Association of Nurserymen Standards (November 1996) securely held in place by burlap and sisal twine. Root balls require Drum Lacing and must be laced with three (3) ply sisal. All root balls must be inspected by the Engineer before moving. Loose, broken, and wire caged balls will be rejected. All rejected material must be immediately removed from the site and replaced with acceptable material at no additional cost.

(3) Removal and transplanting of trees within planted GI assets must be done with the most care feasible not to disturb other established planting within asset. Any Shrubs or Herbaceous plants which inadvertently become uprooted or damaged

during removal of tree process must be re-planted in accordance with Section GI-4.17.

(4) TIME OF TRANSPLANTING: Unless otherwise approved by the Engineer, transplanting will be in the following timeframes:

Table 4.16-2 Tree Transplanting Time Frames

Season	Tree Transplanting
Spring	March 1 to May 15
Fall	October 1 to December 15

(5) EXCAVATION OF PLANTING PITS: Sizes of planting pits must be determined by the Engineer, in consultation with the Contractor's Tree Consultant.

(6) PLANTING: Transplanting must be done in the presence of the Engineer or approved Tree Consultant.

(7) REPLACEMENT: The Contractor must replace in accordance with the contract plans and specifications any transplanted trees that are dead or, in the opinion of the Engineer in consultation with the Tree Consultant, are in an unhealthy or unsightly condition, and/or have lost their natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or other causes.

Care must be exercised in digging and preparing trees for transplanting. Each tree must be dug with sufficient roots and must have a solid ball of earth securely held in place by burlap and stout rope and must be platformed. No manufactured balls will be accepted. Each tree must be dug with a ball of earth not less in diameter than that specified for new trees. The root ball must be moist before digging, and at a minimum be watered by the Contractor no later than the day before digging.

(8) Trees to be stored on the site for later replanting must be prepared as in the preceding paragraph, hauled to a location to be designated by the Engineer and heeled-in at such location to the satisfaction of the Engineer until replanting may be progressed. At the time of replanting, heeled-in trees must be dug up and hauled to the replanting or delivery location. When required by the Engineer, heeled-in trees must be re-balled, re-burlapped or re-platformed before hauling to the replanting location or delivery point.

(9) The Contractor must haul and deliver designated trees, prepared for transplanting or replanting as above, to such locations on or away from the site at the direction of the Engineer.

(10) Trees designated to be transplanted, damaged due to the Contractor's operations, must be replaced with new trees, by the Contractor, to the satisfaction of the Engineer at no additional cost to The City.

(11) Hauling and unloading of trees to be transplanted, must be carefully done to prevent injury. All trees transplanted, or to be transplanted, must be protected by the Contractor and such trees as are injured or removed before the acceptance of the Work must be replaced with new trees at the expense of the Contractor.

(12) At the time of transplanting and as described in Section GI-4.10, the soil around each tree must be thoroughly saturated with water during the Establishment

Period. Trees that are not watered the day of transplanting to the satisfaction of the Engineer will be rejected. Precipitation is not an acceptable substitute for watering on the day of transplanting.

(13) The Contractor must perform all services described in Section GI-4.10 to establish the trees during the Establishment Period.

(14) The Work of planting trees designated to be transplanted and trees furnished as replacements for injured trees must be as specified in (B), below.

(15) Transplanting and replacement of trees within planted GI assets must be done with the most care feasible not to disturb other established planting within asset. Any other plants which were inadvertently uprooted during removal of tree process must be re-planted in accordance with Section GI-4.17, or replaced at no expense to the City.

(B) PLANTING

All tree planting must be completed by a tree company approved by NYCDPR, and said company must obtain the necessary permits from NYCDPR before undertaking any removal Work.

Unless otherwise approved by NYCDPR, timing of tree planting follows the Transplanting Schedule as identified above in Table 4.16-2, and NYCDPR Street Tree Planting Standards for New York City.

(1) EXCAVATION FOR ROW GI

Plant material must be delivered, accepted, and ready for planting prior to excavation, unless otherwise directed by the Engineer.

The Contractor must excavate tree pits by hand to a minimum depth of twenty-four (24”) inches, but not more than the depth of the root ball, so that the hole depth matches the actual depth from the bottom of the root ball and the top of the root flare. Care must be taken not to compromise geotextile which separates soil from stone. Any damage to geotextile which allow soil to enter stone layer will be considered compromised and repair to asset must be directed by engineer and be at no additional cost to the City.

Trees pits must be made as large as possible as determined by the Engineer, in accordance with NYCDPR Street Tree Planting Standards for New York City , unless otherwise shown on the Contract Drawings, and the items provided in the Bid Schedule.

All pits must have vertical sides unless otherwise directed.

Plant pits must be dug in the center of the asset unless otherwise indicated in contract drawings; plant pits must not be backfilled until approved by the Engineer. The area is to be made safe and secure at the end of the work day.

(2) BACKFILLING FOR TREE PITS

Backfill for tree pits must consist of soil specified by contract drawing. Fertilizer (when specified) and mycorrhizal inoculant must be incorporated into backfill.

(3) BARRICADES

During excavation and planting operations, adjacent existing trees, and planting materials must be protected carefully with strong, well-constructed temporary

barricades, where required, to the satisfaction of the Engineer, or as required by DPR. Any material which for any cause is damaged during operations must be replaced by the Contractor at no cost to the City, with the same size, type and quality approved by the Engineer.

(4) PLANTING

Planting must be done in the presence of the Engineer or the Engineer's authorized representative. All trees must stand, after settlement, at the same levels at which they have grown, i.e., at the base of the trunk flare. Care must be exercised in setting the trees plumb. Ropes, stones, etc., must be removed from the holes before backfilling; and all topsoil for backfilling must be loose and friable and not frozen.

All girdling roots must be removed. Circling roots must be separated and spread out to not impede future growth. Place balled and burlapped material in the prepared planting pit by lifting, and carry it by the rootball so that the ball will not be loosened. Set the tree straight and in the center of the pit with the most desirable side facing toward the predominant view, and so that the majority of lateral branches are parallel with the street, neither obstructing sidewalk traffic nor car traffic. All trees must set, after settlement, at the level of the base of the trunk and the beginning of the roots known as the "trunk flare." If the top of the rootball is not consistent with this area, soil will be added or removed to make it so, and the depth of the planting site adjusted accordingly. Care must be exercised in setting the trees plumb.

Cut and remove rope or wire from the top two-thirds (2/3) of the rootball. Remove as much woven product and twine as possible. Remaining lateral wires must be cut to prevent future root interference. Wire must not be galvanized or aluminum wire.

At least two-thirds (2/3) of the burlap must be removed from the tree pit and the remaining burlap pulled back and adjusted to prevent the formation of air pockets. Where directed by the Engineer, in consultation with the Contractor's Tree Consultant, the burlap must be entirely removed. All ropes, stones, etc. must be removed from the planting site before backfilling. Backfilling mixture must be loose and friable, and not frozen. Soil must be firmed at six (6) to eight (8") inch intervals and thoroughly settled with water.

(5) TREE WRAP

Tree trunks must not be wrapped. The Contractor must remove all nursery tags and protective wrapping prior to planting to allow inspection by the Engineer.

(6) STAKING OF TREES

All staking must be done during the planting operation and must be maintained throughout the first year of the Guarantee Period. After the first year, the stakes must be removed. Trees must stand plumb after staking.

All trees must be supported by two (2) stakes. Stakes for street trees must be parallel to the curb. Stakes must be eight (8') feet long of white cedar with bark attached and must show no sign of cracking or decay. They must have a maximum allowable deflection of ten (10%) percent. If the stakes are not long enough to produce secure supports, the Contractor must, when so directed by the Engineer, furnish and install longer stakes for the purpose, at no additional cost to the City. Stakes must have a diameter at the middle of not less than two (2") inches nor more than two and three-quarter (2-3/4") inches and a diameter of not less than one and three-quarter (1-3/4") inches at the tip nor more than three (3") inches at the butt.

Stakes must be driven into the ground and fastened securely to the trees with a suitable length of three-quarter (3/4") inches wide, flat, woven polypropylene material such as Arbortie™ as manufactured by DeepRoot®, San Francisco, CA; Arborbrace Tree-tie Webbing as manufactured by Arborbrace Staking Systems, Inc., Miami, Fl. 33156, tel. (305) 992-4104; TreeTie™ as manufactured by Nelco, 22 Riverside Dr., Pembroke, MA. 02359, tel. (800) 491-2812; or, an approved equivalent that is knotted or nailed to the stakes with one (1") inch galvanized roofing nails as directed by the Engineer. No wire or hose is to be used to stake trees.

All stakes must be driven about one (1') foot away from the trunk face, taking care to stay clear the root ball.

(7) PRUNING

Only dead, crossing, broken or badly bruised branches, or branches protruding into sidewalk at eye level, must be removed by pruning with a clean cut. All pruning must be done with sharp tools. At the time of planting, pruning cuts must be made at the base of the branch at such a point and angle that neither the branch collar nor the bark of the stem is damaged, and that no branch stub extends from the collar. Crowns of young trees must not be cut back to compensate root loss. No leaders must be cut. All pruning must be done in the presence of and at the direction of the Tree Consultant.

(8) WATERING

At the time of planting, the soil around each tree must be thoroughly saturated with at least twenty (20) gallons of water. Soil must be firmed at six (6) to eight (8") inch intervals and thoroughly settled with water. During the Establishment and Guarantee Period, watering must conform to the specifications provided under Section GI-4.10. Water must be free from oil, have a pH not less than 6.0 nor greater than 8.9 and must be free from impurities injurious to vegetation. Unless otherwise directed, water may be drawn from mains owned by or supplying water to the City of New York.

Water must not be applied in a manner which damages plants, plant saucers, stakes or adjacent areas. Each plant saucer must be carefully filled with water in a manner which does not erode the soil or the plant saucer. Watering must not cause uprooting

or exposure of plant's roots to the air.

(9) ROW GI Cover

ROWB Type D: Shredded bark mulch, where applicable, must be applied to the surface of the beds, as shown on the Contract Drawings or as directed by the Engineer. Mulch must be applied to a uniform depth of three (3) to four (4) inches, and must be so distributed as to create a smooth level cover over the exposed soil, but must be kept 2" away from the trunk flare.

ROWB, ROWRG, ROWGS: Erosion control matting must be installed, where applicable, and maintained, according to manufacturer's recommendations in rain gardens without mulch. Likewise, erosion control matting must remain 2" from the trunk flare of the tree.

GI-4.16.6. ESTABLISHMENT.

The Contractor must establish planted or transplanted trees as provided under Section GI-4.10.

GI-4.16.7 REPLACEMENT.

The Contractor must replace trees as required by NYCDPR inspections.

GI-4.16.8 MEASUREMENT

(A) TRANSPLANTING

The quantity to be measured for payment hereunder will be the number of existing trees transplanted and established in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

(B) PLANTING

The quantity to be measured for payment hereunder will be the number of new trees, of each size, furnished, planted and established in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

GI-4.16.9 PRICES TO COVER.

(A) TRANSPLANTING

The contract price for transplanting will be a unit price per tree and will cover the cost of all labor, material, plant, equipment, insurance, and incidentals necessary to complete the Work of transplanting existing trees, including their establishment, as shown on the Contract Drawings, as specified and as directed by the Engineer.

The cost of furnishing and incorporating specified soil in GI assets, and spreading mulch or an erosion control blanket around tree is also included in the unit price bid for each transplanting item.

(B) PLANTING

The contract price for planting will be a unit price per tree and will cover the cost of all labor, materials, plant, equipment, inspections, insurance, and incidentals necessary to complete the Work of planting new trees, including their establishment, as shown on the Contract Drawings, as specified and as directed by the Engineer.

The cost of furnishing and incorporating specified soil in assets and spreading mulch or erosion blanket around tree is also included in the unit price bid for each planting item.

The Contractor will be paid the unit price for planting in the following percentage increments:

(1) 40% - Successful Planting & Initial Inspection
(2) 30% - Successful Second Inspection
(3) 30% - Successful Third Inspection or Successful Guaranteed Period Inspection, whichever comes first

The Contractor will only be paid for the Work completed.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.16 AAT	TREES TRANSPLANTED, UP TO 4" CALIPER, ALL TYPES	EACH
GI-4.16 BA	TREES PLANTED, 2-1/2” TO 3” CALIPER, ALL TYPES	EACH
GI-4.16 CA	TREES PLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES	EACH
GI-4.16 DA	TREES PLANTED 3-1/2” TO 4” CALIPER, ALL TYPES	EACH
GI-4.16 xxxxxx	TREES PLANTED, (*Size and type of tree and tree pit size as* specified in Bid Pages)	EACH
GI-4.16 *xxxxxx*	TREES TRANSPLANTED, (*Size and type of tree and tree pit size* as specified in Bid Pages)	EACH

Note: *xxxxxx* denotes serialized pay item.

SECTION GI-4.17 – WOODY AND HERBACEOUS PLANTS WITHIN GI ASSETS

GI-4.17.1 INTENT. This section describes the planting of woody and herbaceous plant material (shrubs and groundcovers) within Green Infrastructure (GI) Assets.

GI-4.17.2 DESCRIPTION.

Planting will consist of the furnishing, delivering, hauling, storage and subsequent care, handling and planting, and establishing of new woody and herbaceous plants at locations shown on the Contract Drawings or directed by the Engineer.

Planting must include all labor, materials, plant and equipment required for all excavation of all materials of whatever nature encountered ; furnishing soil amendments and topsoil or engineered soil as specified; incorporating soil amendments into soil; placing soil and incorporated soil amendments in new shrub and groundcover beds; fertilizing; spraying, pruning, protecting and establishing all plants; and furnishing and installing all other incidentals required for the proper performance of the Work; all, in accordance with the Contract Drawings, the specifications and the direction of the Engineer.

GI-4.17.3 GENERAL. Plant names, size, and grading standards for woody and herbaceous plant material must conform to those prepared by the American Association of Nurserymen Horticultural Standards, 2014 Edition, unless otherwise specified. No substitutions are permitted, except with the written permission of the Engineer. The Contractor must provide the Engineer with written confirmation of availability by the supplying nursery or the request for similarly confirmed substitutes two (2) months before intended planting season.

GI-4.17.4 MATERIALS

(A) PLANT MATERIAL

(1) Type and size of plants must be as specified in the Bid Schedule or as shown on the Contract Drawings.

(2) Where applicable, the Contractor must provide freshly dug plant material. Cold storage or previously dug plants will not be acceptable. The Contractor must not prune prior to delivery unless otherwise directed and approved by the Engineer or representative. Plants that are pruned without authorization from the Engineer will be rejected. To protect plant material from desiccation, the Contractor must, when deemed appropriate and only on appropriate plant material, apply an approved anti-desiccant forty-eight (48) hours prior to transporting and fully cover plant material during transportation to the planting Site. Plants must be packed, transported, and handled with utmost care to ensure adequate protection against injury.

(3) Plant material must not be dropped or in any way be mishandled during unloading. Plants damaged during transportation to the Site will be immediately rejected. All plants must be typical of their species or variety and nursery-grown, unless otherwise stated. They must have normal, well-developed branches and vigorous fibrous root systems. They must be sound, healthy, vigorous plants free from defects, disfiguring knots, sun scald injuries, dead or broken branches, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plant material must be delivered in pots, pans, or other containers, or balled and burlapped. Containerized material must be free from girdling roots. Bare root plant material, as well as any other plant material not meeting the above

requirements, delivered to the site will be rejected. All rejected material must be removed from the site and replaced with acceptable material at no additional cost to the City.

(4) All plants must have been grown in a hardiness zone no warmer than Zone 7 or colder than Zone 5 as determined by the USDA Agricultural Research Service, Plant Hardiness Zone Map. Plant quality must be typical of their species. Plant material should exhibit the range of variation typical of local genotypes of the species as determined by the Engineer.

(5) All shrubs must have been grown under similar climatic conditions as the project site approximately two (2) years prior to the date of the project. Plants held in storage will be rejected if they show signs of growth during storage. All shrubs must be full, taking the form of multistem, unless otherwise specified, and must have well-developed root systems. Collected plants must be taken from a soil favorable to good root development. All collected materials must be clean sound stock, free for decaying stumps.

(6) Herbaceous plants, and groundcover must be vigorous healthy plants, approximately two (2) years old, from cuttings, seed, or division, with well-developed root systems and crowns, as specified in the Plant Schedule.

(7) Bulbs, corms, tubers and rhizomes must be firm, non-desiccated, and certified free of disease and viral infection, of the sizes, grades, and varieties indicated in the Plant Schedule.

(8) Native plant stock must be used when specified on designs and should be used whenever possible and appropriate. Native plant material must be derived from the local genotypes of the native plants specified. For purposes of this native plant material paragraph, “local” means within 250 miles from the planting Site. However, a reasonable effort must be made to obtain sources of plant material as close to the planting Site as possible. All plants must be nursery grown unless otherwise stated. Collected material will not be accepted. Except as may otherwise be specified in this native plant material paragraph, all other sections of this Plant Material specification will also apply to the Native Plants. The Contractor must not make substitution of plant types without prior written approval by the Engineer per Subsection GI-4.17.3.

(B) TOPSOIL

Backfilled Soil must comply with the requirements of Section GI-4.15 or Section GI-2.13, and per design. All references in this Section to topsoil will include a topsoil or different planting medium, such as engineered soil or sand, where applicable.

(C) COMPOST

Compost must contain organic matter, or material of generally humus nature capable of sustaining the growth of vegetation, with no admixture of refuse or material toxic to plant growth. The Compost must be free of pathogens and stones, lumps, or similar objects larger than two (2”) inches in greatest diameter, as well as roots, brush, and weeds.

Composts that have been derived from organic waste such as food and agriculture residues, animal manures, and sewage sludge that meet the above requirements, and are approved by the New York State DEC, are acceptable compost sources. Compost must have an approximate N-P-K analysis of at least 1-1-0 as delivered, with a pH between 5.5 and 8.5

and a solids content of at least fifty (50%) percent. Compost must have a minimum of fifty (50%) percent organic material.

Compost must be “Nature’s Choice Compost” by Nature’s Choice Corp., Union, NJ, or an approved equivalent. Contractor may also substitute an organic biosolid humus such as “Landscapers’ Advantage ™” Class A compost (30 cubic yard minimum), manufactured by J.P. Mascaro & Son, Harleyville, PA; or “AllGro Compost”, as manufactured by AllGro, Inc., Hapton, NH; or an approved equivalent.

(D) FERTILIZER

Commercial fertilizer must be a complete fertilizer, part of the elements of which are derived from non-toxic organic sources with low persistence, and must contain the following percentages by weight: nitrogen 5%; phosphoric acid 10%; potash 5%. It must be uniform in composition, dry, free flowing and must be delivered to the site in unopened original containers, all bearing the manufacturer’s guaranteed analysis.

(E) LIME

Lime must be ground dolomitic limestone not less than 85% total carbonated, ground so that 50% passes 100 mesh sieve and 90% passes 20 mesh sieve. Amount of lime must be determined by the soil test and the plant requirements.

(F) BONE MEAL

Bone meal must be firmly ground and have a minimum analysis of 2% nitrogen and 20% phosphoric acid.

(G) HERBICIDE

Herbicide must be a non-toxic, biodegradable selective preemergence herbicide for the control of crabgrass and other annual weed grasses. Product must be used in planting beds. Product must never be used on new lawns or topsoil designated for seeded areas.

(H) MYCORRHIZAL FUNGI INOCULANT

Mycorrhizal fungi inoculant must be applied by means of a three ounce (3 oz.) premeasured dry formulation packet, as manufactured by Plant Health Care, Inc., Pittsburgh, PA; Rhizanova Tree Transplant, as manufactured by Becker Underwood, Inc., Ames, IA; DIEHARD®, as manufactured by Horticultural Alliance and distributed through Atlantic Irrigation, White Plains, NY; or, an approved equivalent. Packets must contain, as a minimum: one thousand (1000) live spores of Vesicular-Arbuscular Endomycorrhizal fungi, including: *Entrephosphora columbiana Rhizophagus irregularis*, *Glomus clarum*, *Glomus etunicatum*, and *Glomus sp.;* seventeen million five hundred thousand (17,500,000) live spores of Ectomycorrhizal fungi, including: *Pisolithus tinctorius*; biostimulants including *Yucca schidigera* extract; soluble sea kelp extract derived from *Ascophylum nodosum*; humic acids; and acrylamide copolymer gel as a water absorbent medium.

Mycorrhizal inoculant should be used for planting trees, woody shrubs and herbaceous groundcovers. Mycorrhizal fungi inoculant must be added to the top six (6) to eight (8”) inches of backfill soil in each planting pit and thoroughly mixed to distribute the inoculant.. Mycorrhizal inoculant is a dated material and must be used before it expires within 6

months..

The material must be applied per the following table:

Table 4.17-1 Mycorrhizal Inoculant Requirements for Woody and Herbaceous Plants

Size of rootball or container	Ounces per plant
1 gallon	1
2 gal.	2
3 gal.	3
5 gal.	3
20” B&B	6
24” B&B	9
30” B&B	9

(I) FERTILIZER

Commercial fertilizer shall be a complete fertilizer, part of the elements of which are derived from organic non-toxic sources with low persistence, and shall contain the following percentages by weight: nitrogen 5%; phosphoric acid 10%; potash 5%. It shall be uniform in composition, dry, free flowing and shall be delivered to the site in unopened original containers, all bearing the manufacturer’s guaranteed analysis.

Percentages of N and P shall be adjusted in consultation with approved soil submittals, where N or P levels are high.
For fall planting, combined Fertilizer-Mycorrhizae granular formula with lower N-P-K levels, such as Healthy Start MRT 3-4-3 M-Roots may be used in place of separate Fertilizer and Mychorrhize applications. Application rates shall be per manufacturer's instructions.

(J) WATER RETENTION ADDITIVE

Water Retention Additives must comply with the requirements of Subsection 4.16.4.(G).

(K) MULCH

Shredded bark mulch must be a natural forest product composed of shredded bark or wood not exceeding three inches (3") in length and one inch (1") in width, Mulch shall be derived from tree material, not from wood waste or by-products like sawdust, shredded palettes, or other debris. Mulch shall be natural in color and not dyed. It shall be of a uniform grade with no additives or any other treatment. Mulch with leaves, twigs, and/or debris shall not be acceptable. The pH factor should range from 5.8 to 6.2.When available, the Contractor must use locally sourced mulch from NYC DPR which fulfills the above requirements.

(L) EROSION CONTROL MATTING

Where erosion control matting is specified on the Contract Drawings or Standard Drawings, it will be used in place of mulch.

GI-4.17.5 METHODS.

(A) ORDERING PLANT MATERIAL

The Contractor must notify the Engineer of the unavailability of any tree, shrub, herbaceous plant, or bulb species designated in the Contract, as well as provide confirmation to the Engineer of all orders from all sources of supply. The Contractor must provide the Engineer with written confirmation of availability by the supplying nursery or the request for similarly confirmed substitutes two (2) months before intended planting season. Any request for species substitution due to unavailability must be submitted in writing to the Engineer, within two (2) months prior to planting season. The Contractor must include the names and addresses of at least ten (10) nurseries they have contacted in an effort to locate these species, and the list will be submitted to the Engineer. All nurseries supplying material are required to have a registration certificate from the Department of Agriculture and Markets, Division of Plant Industry, New York, or any other state where plant material is obtained, certifying that plant material is apparently free of injurious insects and diseases.

(B) TIME OF PLANTING

Unless otherwise directed by the Engineer in writing, the contractor must perform actual planting only when weather and soil conditions are suitable for optimal benefit to the plant. Contractor must also provide water to the plants as necessary if conditions are expected to be dry and hot. Planting must be performed in the following timeframes:

Table 4.17-1 – Planting Time Frames

Plant Type	Shrubs (Evergreen/Deciduous)	Herbaceous Plants (Grasses/Perennials)	Spring-Flowering Bulbs
Spring Planting	March 1 to May 15	April 1 to May 15	None
Fall Planting	Sept. 15 to Oct. 30th	Sept. 1 to Oct 15	Sept. 15- Nov 30

In the case that the planting season is missed for any reason, the Contractor must cover the soil with erosion control matting, mulch, or a cover crop until the appropriate planting season is available. Trees must be planted prior to understory planting, according to above Table 4.17-1 and Section 4.16.

(C) Plant material must not be planted by the Contractor until inspected by the Engineer at the site of the Work. Plant material will be rejected if delivered with broken or damaged containers, or if damaged on site by rough handling. All rejected material must be immediately be removed from the site and replaced with acceptable material at no additional cost. Final inspection will be made at Substantial Completion of the contract.

(D) SHIPMENTS AND CERTIFICATION

All plants must be packed, transported and handled with utmost care and in such manner as to ensure adequate protection against desiccation, climatic, seasonal and other injuries. When transported in closed vehicles, plants must receive adequate ventilation to prevent

sweating. When transported in open vehicles, plants must be protected by tarpaulins or other suitable cover material. Unloading must be carefully done to prevent injury to plants. Until planted, all materials must be properly maintained and kept adequately watered. Each shipment must be certified by the State and Federal Authorities to be free from disease and infestation. Any inspection certificates required by law to this effect must accompany each shipping invoice or order of stock and on arrival, the certificate must be filed with the Engineer.

(M) PREPARATION OF SOIL

(1) Specified Soil must be placed in accordance with Topsoil Specification and Engineered Soil Specification, gently graded according to contract plans in preparation for planting and protected as identified in respective specifications to protect against soil compaction and weed establishment. Contractor may choose to sand bag both the inlet and outlet of the Rain Garden to prevent storm water from eroding asset prior to planting.

(N) EXCAVATION AND PLANTING

(1) Planting must be done in the presence of the Engineer. All material must be inspected by the Engineer as it is removed from the truck, prior to placing in an approved storage area or the designated planting site. All rejected material must be removed from the site and replaced with acceptable material at no additional cost to the City.

(2) Plants must be carefully removed from the flats or cell-packs to avoid damaging roots or stems and planted in prepared planting beds. Plants with exposed roots must be placed in the proper position in the center of the pit after the soil in the bottom of the pit has been firmed. Roots must be arranged in their natural position and existing soil worked in among them, firmed at intervals, and mycorrhizal inoculant and water retention additive worked into the top eight (8”) inches of backfill soil in the correct proportions. Fertilizer must be incorporated with the soil before setting out plants, at the rate of one (1) pound of fertilizer to twenty (20) square feet of area. Entire area must be graded so that surface contour is not altered from the overall surface drainage pattern. Apply mulch or erosion control matting and herbicide as herein specified. The plants must then be thoroughly settled in with water. Care must be taken to avoid bruising or breaking the roots when tamping the soil. All large and fleshy roots that are bruised or broken must be pruned, making a clean cut before planting.

(3) All material must be set, after settlement, at the same level at which they have grown in the nursery, i.e., at the base of the crown. Care must be exercised in setting the plants plumb. All ropes, stones, etc. must be removed from the pit before backfilling. Soil for backfill must be loose and friable and not frozen or compacted. As acceptable, soil must be thoroughly firmed around each crown, and plants thoroughly firmed around each crown, and plants thoroughly watered in no longer than one hour after planting.

(4) For containerized material, girdling roots must be removed. Circling roots must be separated and spread out to not impede future growth. Intertwining roots must be pulled apart or scored. Overly pot-bound plants will be rejected.

(5) Place balled and burlapped material in the prepared planting pit by lifting, and carry it by the rootball. Set shrub straight and in the center of the pit, with the most desirable side facing toward the predominant view. Cut and remove rope or wire from the top two-thirds (2/3) of the rootball and cut off the burlap back to the edge of

the ball. Remove as much woven product and twine as possible. All plastic or synthetic fabric must be removed from the ball at the time of planting. Remaining lateral wire must be cut to prevent future root interference. Wire must not be galvanized or aluminum wire. Balled and burlapped plants must be handled so that the ball will not be loosened. After the soil has been thoroughly firmed under and around the ball, the burlap must be cut away from the upper half of the ball, and the remaining burlap must be entirely removed. Soil must be firmed at six (6) to eight (8") inch intervals and thoroughly settled with water.

Herbaceous, and Groundcover plants must be carefully removed from containers or flats immediately prior to planting and set to the same depths as they were grown in the nursery bed or container, to the correct spacing indicated on the plans. Roots must be arranged to their natural position and topsoil worked in among them ensuring that the entire root mass is below ground, and all of the vegetative growth is above ground. Taking care to avoid bruising or damaging the roots, and fertilizer tablets added to the top four (4") inches of backfill soil in the correct proportion for the respective pot size. No later than one (1) hour after planting, all plants must be thoroughly settled in with water.

(6) Bulbs must be planted in the locations indicated on the plans and to the depth and spacing indicated on the Plant Schedule. Spring Flowering Bulbs, Corms, Tubers, and Rhizomes must be planted in late September through November , no more than six (6) weeks before frost. Summer and Fall Flowering Bulbs, Corms, Tubers, Rhizomes and Plugs must be planted in spring, after the last frost, or as directed by the Engineer. Prior to planting, bulbs must be stored in a cool, dry, well-ventilated location for no longer than two (2) weeks before planting.

(7) Bare root material must be adequately protected from drying out. It must be removed from its plastic bag and planted immediately after inspection. The bundles of heeled-in plants must be set upright on the ground, covered with mulch, and kept adequately moist until the time of installation. Until the time of planting, all plant material must be stored in an approved location, securely fenced and maintained, to the satisfaction of the Engineer, at no additional cost to the City. All plants not planted immediately must be watered as necessary to maintain optimal health until planting.

(9) All of the above must be planted according to best horticulture practice.

(O) BACKFILLING

Backfill for woody and herbaceous planting beds must consist of topsoil or Engineered Soil as specified in Sections GI-4.15 and GI-2.13. Mychorrizal inoculant and Fertilizer must be added to shrubs and herbaceous plants respectively. Fertilizer to be applied according to manufacturer's recommendation for specified container size.

(P) FINISHING SURFACE AFTER BACKFILLING

The Contractor must cultivate and rake over finished planting areas and must leave the site in an orderly condition. On level ground or slight slopes, a shallow basin a little larger than the diameter of the plant pit must be left around each plant, as shown on the plans, or as directed by the Engineer. Upon completion of planting, all debris and waste material resulting from the planting operation must be removed from the project area, and the affected area raked and cleaned as necessary. Green Infrastructure Assets must be graded as shown on the plans.

All Work done in preparing shallow basins and regarding and reseeding of plant saucers must be included in the unit price bid per plant. All berms raised for shallow basins in level or gently sloping grass areas must be removed at the end of the establishment period, as well as tree stakes, if present.

(Q) MULCH OR EROSION CONTROL MATTING

Shredded bark mulch, where applicable, must be applied to the surface of the beds, as shown on the Contract Drawings or as directed by the Engineer. Mulch must be applied to a uniform depth of three (3) inches over groundcover beds, and must be so distributed as to create a smooth level cover over the exposed soil and to be kept away from the vegetative parts of the plant.

Erosion control matting must be installed and maintained, according to manufacturer's recommendations in rain gardens without mulch. Pants must not be covered, and matting must not touch stems of plants.

GI-4.17.6 SECURITY. Where indicated on the drawings, various types of shrubs must be secured against theft by the provision and installation of steel anchoring cables, clips, bolts, rubber or plastic cable sheaths, and various anchoring devices, as detailed on the Contract Drawings. No separate payment will be made for this Work when it is indicated on the Contract Drawings, the cost of which must be included in the unit price bid for the various shrub planting items.

GI-4.17.7 ESTABLISHMENT. Establishment must comply with the requirements of Section GI-4.10 PLANT ESTABLISHMENT (POST PLANTING CARE) herein.

GI-4.17.8 REPLACEMENT. Replacement must comply with the requirements of Section GI-4.10 PLANT ESTABLISHMENT (POST PLANTING CARE) herein.

GI-4.17.9 MEASUREMENT. The quantity to be measured for payment hereunder must be the number of plants of each species and size, furnished, planted and established in accordance with the Contract Drawings, specifications and directions of the Engineer.

GI-4.17.10 PRICES TO COVER. The contract price for planting must be a unit price per plant of each species and size and must cover the cost of all labor, material, plant, equipment, inspection, insurance, and necessary incidentals required to complete the Work of planting new plant materials, including their establishment, as shown on the Contract Drawings, as specified and as directed by the Engineer.

The cost of furnishing and incorporating topsoil, fertilizer and mulch are also included in the unit price bid for each planting item.

The Contractor will be paid the unit price for planting in the following percentage increments as described in Section GI-4.10 and Figure 4.10-1:

1) 40% - Successful Planting & Initial Inspection
2) 30% - Successful Second Inspection
3) 30% - Successful Third Inspection or Successful Guaranteed Period Inspection, whichever comes first

The Contractor will only be paid for the Work completed; if the Contractor does not successfully

complete the Establishment Period, no payment will be made for the percentage increments not completed. Completion of the Establishment Period includes completion of all Establishment Period tasks (post planting care items)

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.17 EG1G	SHRUBS PLANTED, EVERGREEN, 1 GALLON, ALL TYPES	EACH
GI-4.17 D1G	SHRUBS PLANTED, DECIDUOUS, 1 GALLON, ALL TYPES	EACH
GI-4.17 D3036	SHRUBS PLANTED, DECIDUOUS, 30” TO 36” HEIGHT, B&B. ALL TYPES	EACH
GI-4.17 D2G	SHRUBS PLANTED, DECIDUOUS, 2 GALLON, ALL TYPES	EACH
GI-4.17 D3G	SHRUBS PLANTED, DECIDUOUS, 3 GALLON, ALL TYPES	EACH
GI-4.17 D5G	SHRUBS PLANTED, DECIDUOUS, 5 GALLON. ALL TYPES	EACH
GI-4.17 EG3G	SHRUBS PLANTED, EVERGREEN, 3 GALLON. ALL TYPES	EACH
GI-4.17 EG5G	SHRUBS PLANTED, EVERGREEN, 5 GALLON. ALL TYPES	EACH
GI-4.17 EG2G	SHRUBS PLANTED, EVERGREEN 2 GALLON. ALL TYPES	EACH
GI-4.17 FB	FLOWERING BULB. PLANTED. ALL TYPES	EACH
GI-4.17 MAS	SHRUBS PLANTED. ALL TYPES	EACH
GI-4.17 OG1G	ORNAMENTAL GRASS PLANTED, 1 GALLON	EACH
GI-4.17 OG1QT	ORNAMENTAL GRASS PLANTED, 1 QT	EACH
GI-4.17 OG2G	ORNAMENTAL GRASS PLANTED, 2 GALLON	EACH
GI-4.17 OG3G	ORNAMENTAL GRASS PLANTED, 3 GALLON	EACH
GI-4.17 OGAS	ORNAMENTAL GRASS PLANTED. ALL TYPES	EACH
GI-4.17 P1QT	PERENNIALS 1 QT	EACH
GI-4.17 PB	GROUND COVER PLANTED. PERENNIALS. ALL TYPES	EACH
GI-4.17 PG1G	PERENNIALS OR GROUNDCOVERS. PLANTED. 1 GALLON. ALL TYPES	EACH
GI-4.17 PG2G	PERENNIALS OR GROUNDCOVERS. PLANTED. 2 GALLON. ALL TYPES	EACH
GI-4.17 PG3G	PERENNIALS OR GROUNDCOVERS. PLANTED. 3 GALLON. ALL TYPES	EACH
GI-4.17 PG1Q	PERENNIALS OR GROUNDCOVERS. PLANTED. 1 QUART. ALL TYPES	EACH
GI-4.17 FAT	FERN. ALL TYPES	EACH
GI-4.17 *xxxxxx*	SHRUBS PLANTED, (*Size and type as specified in Bid Pages*)	EACH
GI-4.17 *xxxxxx*	ORNAMENTAL GRASSES PLANTED, (*Size and type as specified in Bid Pages*)	EACH
GI-4.17 *xxxxxx*	GROUNDCOVER OR PERENNIALS PLANTED, (*Size and type as specified in Bid Pages*)	EACH

Note: *xxxxxx* denotes serialized pay item.

SECTION GI-4.19 – SODDING RELATED TO GI ASSETS

GI-4.19.1. INTENT.

This section describes the Work of sodding in or near a GI Asset.

GI-4.19.2. DESCRIPTION.

Sodding will consist of the preparation of the area to be sodded; the removal and disposal of existing soil and undesirable materials; the furnishing and incorporation of topsoil, ground limestone, and/or commercial fertilizer, when and as directed; furnishing, delivering, and incorporation of sod; and all required maintenance**.**

GI-4.19.3. MATERIALS.

A. Topsoil. Topsoil must comply with the requirements of Section GI-4.15.

B. Ground Limestone. The total carbonates in ground limestone (Calcium Carbonate) must not be less than 80% (or 44.8% Calcium Oxide equivalent). For calculation purposes, total carbonates will be considered as Calcium Carbonate.

C. Commercial Fertilizer: Low Phosphorus (Slow Release). Commercial fertilizer mixture must contain, by weight, Nitrogen (N) 7% min. to 10% max. of which 50% is slow-release; Phosphorus (P) 1% min. to 2% max.; and soluble Potash (K) 4% min. to 12% max.

Fertilizer must be pesticide free (no weed-and-feed) product such as Healthy Turf (8-1-9) as manufactured by Plant Health Care, Inc, Pittsburgh, PA; or Safer Ringer Lawn Restore (10-2-6) as manufactured by Woodstream Corp., Lifitz, PA; or Nutrients Plus (7-2-12) as manufactured by Nutrients Plus, Virginia Beach, VA; or an approved equivalent.

D. Sod. The approved Sod must be of superior quality, from seed of known origin and must be accompanied by a certificate indicating compliance with the regulations of the New York State Department of Agriculture and Markets. Sources of sod must be made known to the Engineer at least five days before cutting. Sod must be cut into squares or rectangular portions which must be twelve (12") inches or eighteen (18”) inches wide, or as approved, and may vary in length, but must be of a size which will permit them to be lifted without breaking. The sod, when delivered to the contract site, must be sufficiently moist so the soil will adhere firmly to the roots when it is handled. Before cutting, Sod must be mowed uniformly to a height of one and one-half (1-1/2”) inches. The sod must be cut to a minimum soil thickness of five-eighths (5/8”) of an inch, plus or minus one-quarter (+1/4”) of an inch. The sod must be reasonably free from weeds in conformance with accepted commercial practice and must consist of a mixture of permanent grasses such as blue grass, rye grass, and/or fine leafed fescues, in proportions as follows:

65%-85% TALL FESCUE - One or more of the following varieties: Aache II, Arid 3, Conchise III, Coronado Gold, Falcon IV, Jaguar III, Lancer (SH), Masterpiece, Rebel IV, Rebel Jr.(SH), Rebel Sentry, Rembrandt, Tomahawk E+, RTF or approved equal.

15%-25% BLUEGRASS - One or more of the following varieties: Able I (SH), Blacksburg, Glade (SH), Moonlight, Midnight, America (SH), Brilliant, Ram (SH), Touchdown (SH), Warren’s A-34(SH), Bristol (SH), Lofts 1757(SH) or approved equal.

0-10% PERENNIAL RYEGRASS - One or more of the following varieties: Brightstar II, Manhattan 4, Citation, Elfkin, or approved equal.

E. Certifications. The Contractor, prior to ordering any of the foregoing materials into the Work, must submit Certificates of Compliance to the Engineer. The said certificates must be obtained

as follows:

1. For Sod - from an approved supplier and must include a specification sheet from the supplier listing the percentage of each type of grass seed used in the mix; and
2. For Fertilizer, Limestone and Topsoil - from an approved analytical chemist.

The aforesaid certifications must not, in any way, affect the Engineer's right of on-site rejection of materials because of deterioration, adulteration or patent inferiority; nor his right to sample and test any of the supplied materials.

GI-4.19.4. METHODS.

When referred to or used herein, the words topsoil, limestone, fertilizer, and sod shall mean topsoil, ground limestone, commercial fertilizer, and sod, all of which are described and meet the requirements specified under Subsection GI-4.19.3., above.

When referred to or used herein, the word soil shall mean the fill placed in accordance with Section GI-4.11.

The removal and disposal of existing soil under must be made to a depth of six (6”) inches below the proposed grade. Removed soil must be replaced with five (5”) inches of topsoil, except where specified according to design.

Before any sod is placed, all areas to be sodded must be thoroughly loosened to a depth of nine (9”) inches below the proposed grade. All sticks, stones, roots or other objectionable materials which might interfere with the formation of a finely pulverized bed must be removed from the soil and a smooth uniform surface grade must be established. Hollows, depressions, and gullies must be filled by raking to level and topsoil added as necessary to provide a smooth surface prior to sodding. The area must be thoroughly compacted, to the satisfaction of the Engineer.

Ground limestone, if required according to schedule below, must be evenly distributed and worked lightly into the top three (3”) inches of soil at least five (5) days before applying fertilizer. Rate of application must be as follows, depending on the Hydrogen Ion concentration (pH) shown by topsoil laboratory test results:

pH	RATE (lbs. per 1000 sq.ft.)
6.0 to under 6.8	25
6.8 and over	0

Commercial fertilizer must be worked lightly into the top three (3”) inches of soil or topsoil prior to placement of sod. Commercial fertilizer must be applied at the rate recommended by manufacturer. The area must then be thoroughly watered prior to the placement of Sod; but only after it has dried out sufficiently will the area be considered ready to receive the Sod.

The Contractor must notify the Engineer in advance of the time he intends to begin sodding and must not proceed with such Work until permission has been granted. Frozen sod must not be placed, and sodding must not be done on frozen earth. Sodding must be laid on reasonable moist (not wet) soil which must be wetted, if so directed.

The Contractor must exercise extreme care to retain the native soil on the roots of the sod during transplanting operations. Dumping of sod from vehicles will not be permitted. Sod must be placed within thirty-six (36) hours from the time of harvesting. Sod that is dry or fails to meet the specification requirements will be rejected.

When laid in strips adjacent to sidewalks and curbs, sod must be flush with the surface of the adjacent structures.

The sod must be laid smoothly, edge to edge and all openings must be plugged with sod. Sod must be laid with the longest dimension parallel to the contours. Sodding must start at the base of slopes and progress upward in continuous parallel rows. Vertical joints between sods must be staggered.

Immediately after laying, sod must be pressed firmly into contact with the soil, using a two-hundred-pound (200 lb.) roller so as to eliminate air pockets, provide true and even surface, ensure knitting and protect all exposed sod edges, but without displacement of the sod or deformation of the sod surface. At the time of planting the sodded areas must be watered evenly and at a rate of five (5) gallons per square yard, unless otherwise directed.

The sodded area must be maintained by the Contractor until the issuance of the Final Acceptance as per NYC DDC Highway Specifications 4.19.5.

When, in the judgment of the Engineer, at any time prior to Substantial Completion of the Contract, any area which has been sodded fails for any reason to produce a satisfactory turf after a suitable period of time has elapsed, the Contractor must re-sod and re-fertilize such areas as specified for the original sodding. Re-sodding, and re-fertilizing must be at the Contractor's expense.

The Contractor must be responsible for setting up a regular schedule for weekly watering between April 1st and November 15th and for notifying the Engineer of any deviation from that schedule at least 2 (two) working days in advance of the regularly scheduled watering date.

All sod must be kept adequately moist. In the absence of one (1”) inch of rainfall within five (5) consecutive calendar days, watering must be performed as often as necessary and in sufficient quantities to maintain moist soil to a depth of five (5”) inches. Watering must be done in a manner which will not cause erosion nor other damage to the finished surfaces. Any surfaces which become gullied or otherwise damaged must be repaired to re-establish the graded and conditions of the soil prior to sodding and must then be re-fertilized and re-sodded as specified under this Work. Contractor shall perform pull test to confirm sod roots are established and watering is sufficient.

GI-4.19.6. MEASUREMENT.

The Work for this item will be measured in square yards of surface area which have been acceptably sodded.

GI-4.19.7. PRICE TO COVER.

The contract price will be a unit price per square yard of area initially sodded and will cover the cost of furnishing all labor, materials, plant, equipment, insurance, and necessary incidentals required and completing the Work in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Price will Include but not be limited to: furnishing and installing sod on topsoil and ensuring establishment of roots, down to a dept of at least four (4”) inches within a six (6) month period, excluding the dormant season between November and March.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.19	SODDING RELATED TO GI ASSETS	S.Y.

SECTION GI-4.20 – GRASS AND INTERIM COVER CROP SEEDING

GI-4.20.1. INTENT.

This section describes the Work of planting grass seed and temporary seeding for interim cover crops.

GI-4.20.2. DESCRIPTION.

The planting of seed will consist of the preparation of the area to be seeded; the removal and disposal of existing soil and undesirable materials; the furnishing and incorporation of specified soil, ground limestone, and/or commercial fertilizer, when and as directed; necessary reseeding; and all required maintenance.

The planting of grass seed includes restoration of adjacent areas. In planting strip areas, the Contractor must be required to restore areas damaged as a result of its operations, to the satisfaction of the Engineer, with grass seed or sod. (Sodding, Section 4.19 may be used in place of or in conjunction with Grass Seeding).

The planting of interim cover crops applies to constructed assets with topsoil or engineered soil, which cannot be immediately planted according to the design plan.

GI-4.20.3. MATERIALS.

(A) TOPSOIL

Topsoil must comply with the requirements of Section GI-4.15. Engineered soil is not an acceptable substitute for topsoil, except as per design for Standard ROWB Raingardens.

(B) GROUND LIMESTONE

Ground limestone, when required, must be spread by machine and evenly distributed and worked lightly into the top three (3") inches at least five (5) days before applying fertilizer. Rate of application must be as follows, depending on the Hydrogen Ion concentration (pH) shown by a pH test (pH test to be provided by the Contractor at no additional cost to the City):

pH	RATE (lbs. per 1000 sq.ft)
6.0 to under 6.8	25
6.8 and over	0

(C) COMMERCIAL FERTILIZER

Commercial fertilizer mixture must contain, by weight, Nitrogen (N) 7% min. to 10% max. of which 50% is slow-release; Phosphorus (P) 1% min. to 2% max.; and soluble Potash (K) must be 4% min. to 12% max. Fertilizer must be pesticide free (no weed-and-feed) product such as Healthy Turf (8-1-9) as manufactured by Plant Health Care, Inc, Pittsburgh, PA; or Safer Ringer Lawn Restore (10-2-6) as manufactured by Woodstream Corp., Lifitz, PA; or Nutrients Plus (7-2-12) as manufactured by Nutrients Plus, Virginia Beach, VA, or approved equivalent.

Fertilizer must be worked lightly into the top three (3") inches of soil or topsoil. Commercial fertilizer must be applied at the rate of 0.2 pounds per square yard. All areas to receive grass seeds must then be compacted using a two hundred pound (200 lb.) roller. The area must then be thoroughly watered prior to seed placement; but only after it has dried out sufficiently will the area be considered ready to receive the Seed.

Commercial fertilizer is not required for an interim cover crop.

(D) GRASS SEED

Grass seed must be sown only in topsoil as specified in GI-4.15. Grass seed must be fresh, recleaned seed of the latest crop and mixed in the following proportions by weight and meeting the following standards of pure live seed content (Purity & Germination) and maximum allowable weed seed content. All seed must be free of noxious weeds and undesirable grasses.

TABLE 4.20-A GRASS SEED MIXTURE
Percent by Weight

Grass Seed		Seed Purity	Max. Germination	Max. Weed
60%	TALL FESCUE- One or more of the following varieties: Aache II, Arid 3, Cochise III, Coronado Gold, Falcon IV, Justice, Jaguar III, Lancer (SH), Masterpiece, Rebel IV, Rebel Jr.(SH), Rebel Sentry, Rembrandt, Tomahawk E+, RTF, or approved equivalent.	98%	85%	0.25%
20%	BLUEGRASS - One or more of the following varieties: Able I (SH), Blacksburg, Glade (SH), Moonlight, Midnight, America (SH), Brilliant, Ram (SH), Touchdown (SH), Warren's A-34(SH), Bristol (SH), Lofts 1757(SH), or approved equivalent.	98%	80%	0.10%
20%	PERENNIAL RYEGRASS - One or more of the following varieties: Brightstar II, Manhattan 4, Citation, Elfkin, or approved equivalent.	98%	85%	0.25%

(E)INTERIM COVER CROP

Interim cover crop can be sown on either topsoil or engineered soil. The cover crop mixture must be designed to tolerate a wide range of conditions and is to be used in conjunction with erosion control matting. Seed mixes are as follows:

- For spring to early summer plantings, the mix must contain by weight 15 lbs per acre of Italian Rye-Grass (species: Lolium multiflorum), 30 lbs per acre of Annual Oats (Avena sativa), 5 lbs per acre Partridge Pea (Chamaecrista fasiculata), 2 lbs per acre Plains coreopsis (Coreopsis tinctorial).
- For summer plantings, May 20 to August 15, the mix must contain 45 lbs per acre of Buckwheat (Fagopyrum esculentum), 20 lbs per acre Italian Rye-Grass (Lolium multiflorum), 2 lbs per acre Firewheel (Gaillardia pulchella) and 3 lbs Spotted Beebalm (Mondarda punctata).
- For fall planting the mix must contain 50 lbs per acre Italian Rye-Grass (Lolium multiflorum), and 3 lbs per acre Bidens cernua.

Seed mixes must contain Pure Live Seed (PLS) as manufactured by Greenbelt Native Plant Center, Staten Island, NY, Ernst Conservation Seeds, Meadville, PA or approved equivalent. Seed mix and time of seeding must be approved by the Engineer prior to installation.

(F) CERTIFICATIONS

The Contractor, prior to incorporating any of the foregoing materials into the Work, must submit

Certificates of Compliance to the Engineer. The said certificates must be obtained as follows:

1. For Seed - from an approved seed testing laboratory which is not engaged in selling seed; and

2. For Fertilizer, Limestone and Topsoil - from an approved analytical chemist.

The aforesaid certifications must not, in any way, affect the Engineer's right of on-site rejection of materials because of deterioration, adulteration or patent inferiority; nor his right to sample and test any of the supplied materials.

GI-4.20.4. METHODS.

When referred to or used herein, the words topsoil, limestone, fertilizer, and seed will mean topsoil, ground limestone, commercial fertilizer, and grass seed or interim cover crop seed, all of which are described and meet the requirements specified under Subsection 4.20.3., above.

Aside from the aforementioned condition above, existing soil may only be reused in areas adjacent to asset when backfilled and compacted up to five (5") inches below the surface. Remaining removed soil must be replaced with topsoil.

All areas to be seeded must be thoroughly loosened and graded to true lines, free from all unsightly variations, bumps, ridges, or depressions. All sticks, stones, roots or other objectionable materials which might interfere with the formation of a finely pulverized seed bed must be removed.

Seeding must be done in moderately dry to moist (not wet) soil and at times when the wind does not exceed five (5) m.p.h. The rate of seeding must be ten (10) pounds per thousand (1,000) square feet. The seed must be sown and covered to the proper depth and firmed in such manner that a uniform stand will result.

Newly seeded areas must be watered to the point of saturation; initial watering must be done carefully so that no washing out of planted seed occurs. The Contractor must be responsible for setting up a regular schedule for weekly watering as specified in Subsection GI-4.10.3 (D) In the absence of one (1") inch of rainfall within five (5) consecutive calendar days, watering must be performed as often as necessary to achieve robust lawn coverage. Watering must be done in a manner which will not cause erosion nor other damage to the finished surfaces. Any surfaces which become gullied or otherwise damaged must be repaired to re-establish the graded and conditions of the soil prior to seeding and must then be re-fertilized and re-seeded as specified under this Work.

In areas where the stand of grass or cover crop is deemed unsatisfactory by the Engineer, the Contractor must resow grass seed or cover crop to produce a stand which must be acceptable. In these areas, the Contractor must loosen, break up, pulverize, rake and roll the soil or topsoil and incorporate necessary corrective additives, all, as required for the initial seeding operation.

(A) GRASS SEEDING

Ground limestone, when required, must be spread at the recommended rate and must be evenly distributed and worked lightly into the top three (3") inches at least five (5) days before applying fertilizer. Apply fertilizer, as specified in 4.20.3 according to manufacturers recommendations.

Grass Seed must be sown in the Fall, between August 15th and October 1st, or in the Spring during March, April, and May, or at such other times as directed by the Engineer. . Rake the seeded surface lightly to mix the grass seed in the top 1/8-inch of soil.

Topsoil must be then be thoroughly compacted with an approved lawn roller, to improve the germination rate, to the satisfaction of the Engineer. Sown seed may require straw cover to protect from birds.

Mowing of sown grass must be maintained by the Contractor until the issuance of the Final Acceptance as per NYC DDC Highway Specifications 4.20.5. Prior to mowing operation, the Contractor must remove and dispose of all weed growths.

(B) INTERIM COVER CROP SEEDING

Interim cover crops must be sown in their respective seasons as specified in section 4.20.3 (E). Contractor must consult with the Engineer regarding the suitability of the season before placing the temporary seeding. Temporary seeding must be made within 24 hours of placement of engineered soil & sand, or topsoil if applicable, is complete. If not, the soil must be scarified prior to seeding. Sown seed may require straw cover to protect from birds.

Any area that fails to establish vegetative cover adequate to prevent rill erosion must be reseeded as soon as such areas are identified. Cover crop should be removed as needed prior to installing permanent plantings.

Engineering soil must not be compacted.

GI-4.20.5. MEASUREMENT.

The quantity to be measured for payment hereunder will be the number of square yards of area initially seeded to the satisfaction of the Engineer. Measurement will be made on a one-time basis and no additional measurement will be made for any area resown as directed.

GI-4.20.6. PRICE TO COVER.

The contract price will be a unit price per square yard of area initially seeded and will cover the cost of furnishing all labor, materials, plant, equipment, insurance, and incidentals necessary to complete the Work, including, but not limited to, watering, mowing, weeding and reseeding, as required to result in establishment of at least 80% coverage of specified grass mix or interim cover crop, rooted to a depth of four (4”) inches or more, and all Work necessary to complete the Work in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

NOTE: THE COST OF FURNISHING AND INSTALLING GRASS SEED IN AREAS WITHIN THE PROJECT LIMITS OTHER THAN WITHIN THE FOOTPRINT OF THE GI ASSET, MUST BE INCLUDED IN THE UNIT PRICES BID FOR ALL SCHEDULED ITEMS.

Payment will be made under:

Item No.	Item	Pay Unit
GI-4.20.1	GRASS SEEDING	S.Y.
GI-4.20.2	INTERIM COVER CROP	S.Y.

SECTION GI-5.10 – STONE COLUMN

GI-5.10.1 DESCRIPTION

Furnish and install stone columns as specified herein in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer.

GI-5.10.2 MATERIALS

(A) Open-graded stone must comply with GI-2.07 – Clean Open Graded Stone.

(B) Pipe and fittings must comply with GI-2.16A – PVC Pipe (see Part (A) Special Specifications (For the Works Not to be Paid) of the GI-Pages).

(C) Non-woven geotextile fabric must comply with GI-2.09 DR – Geotextile Fabric For Drainage.

(D) Select granular fill material must comply with Section 6.67 of the NYC Department of Transportation Standard Highway Specifications

GI-5.10.3 SUBMITTALS

(A) Stone Column

1. Provide material submittals for each stone column component as required per referenced material specifications.
2. Shop drawings: the Contractor must submit design shop drawings for stone columns indicating size, location, depth, components, and method of installation.

(B) Pneumatic Excavation Methods

1. Follow the procedures in the NYC Department of Transportation's Standard Highway Specifications, General Conditions, Section 1.06.31.
2. Qualifications: Submit letter documenting prior experience of Contractor performing pneumatic excavation. The Contractor or Subcontractor performing this excavation Work must having at least one year of documented experience operating the pneumatic excavation tool in conjunction with related equipment as described herein.
3. Shop drawings: Where required, the Contractor must submit design shop drawings for any temporary excavation support system to be used during the pneumatic excavation Work. The shop drawings must be prepared, signed, and sealed by a Professional Engineer currently licensed in the State of New York. The shop drawings must be submitted to the Engineer at least two (2) weeks before commencement of excavation. Excavation Work may not commence until the shop drawings are approved by the Engineer.

GI-5.10.4 CONSTRUCTION METHODS

(A) Responsibilities of the Contractor:

1. Prior to bidding, the Contractor must examine the site and available information, and formulate methods of construction that will not result in any damage to existing trees or underground infrastructure during excavation. The Contractor will be held liable for irreparable and/or irreversible damage to any trees or underground infrastructure harmed due to the Contractor's methods and must replace those

trees or underground infrastructure as directed by the applicable City department., at no additional cost to the City.

2. Work site safety: In addition to the DDC's Safety Requirements policy and responsibilities, the pneumatic excavation must be performed in accordance with the manufacturer's operating instructions. The Contractor must be responsible to provide adequate equipment and perform pneumatic excavation techniques properly to preclude movement of any air-borne soils onto adjacent roadways or other areas beyond the designated work zone limits. Failure to contain and/or collect the excavated soil will result in the immediate termination of pneumatic excavation until soil containment and/or collection procedures are determined adequate by the Engineer. The Contractor must keep the public at a safe distance from the work zone at all times by means approved by the Engineer.
3. Dust Control: The work area must be watered thoroughly at least twenty-four (24) hours in advance of, but no more than forty-eight (48) hours, prior to the start of any pneumatic excavation in order to reduce the incidence of airborne dust resulting from the pneumatic excavation operation.

(B) Excavation

1. All excavation using the pneumatic excavation tool must be performed in accordance with the manufacturer's recommendations in order to remove soil without causing damage to the roots of trees, buried structures, and/or utilities either in or adjacent to the excavation. The Contractor must excavate within limits designated for pneumatic excavation shown on the Contract Drawings or as directed by the Engineer,
2. Excavation must be performed through the use of a pneumatic excavation tool with the following requirements:
    i. The high air velocity excavation tool must be specifically designed to fracture, pulverize, and displace porous and semi-porous soils without harming or causing damage to tree roots, existing subsurface utilities or other non-porous objects.
    ii. AIR COMPRESSOR. The air compressor may be either a portable or truck-mounted unit and must be adequately sized as required to power the pneumatic excavation tool in accordance with the manufacturer's recommendations for the pneumatic excavating tool.
    iii. VACUUM TRUCK. A vacuum truck should be used to collect excavated soil directly from the trench or pit.
    iv. CONTAINMENT STRUCTURE. To prevent the spread of excavated soil onto adjacent roadways and areas beyond the designated work zone limits, the Contractor must provide a mobile structure or barrier to contain the material dislodged by the pneumatic excavation tool from the trench or pit. Timber or corrugated metal shields, tents supported on tubular frames or other structures as approved by the Engineer may be used.
3. The excavation shall be eighteen (18") inch diameter to the full pipe length of the stone column as described below.

(C) The stone column must consist of:

1. Twelve (12) inch inside diameter perforated PVC pipe

i. PVC pipe shall be Schedule 80 or SDR-17 as minimum pipe wall thickness and shall be minimum Class 200 rated.

ii. The pipe length must be made according to the contract plans or as approved by the Engineer. The final depth of the stone column must be implanted according to the contract plans or as approved by the Engineer but must be no deeper than twenty (20') feet.

iii. The perforations must consist of 7/8" diameter holes, spaced 45 degrees apart radially, and six (6) inches O.C. longitudinally.

iv. Perforation opening area size per linear foot of the pipe must be 9.5 sq. inches minimum.

2. If needed, coupling to connect two segments of the perforated PVC pipe.

3. Twelve (12) inch round Column Cap must be manufactured with perforations or slotted grate. Minimum 50 percent opening size.

i. The top of the Stone Column Cap must be below the interface of the Engineered Soil and the Stone Base.

ii. ASTM D5208-14 "Standard Practice for Fluorescent Ultraviolet (UV) Exposure of Photodegradable Plastics"

iii. ASTM D4329 "Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics"

(D) The non-woven geotextile wrapped perforated PVC pipe shall be lowered into the prepared casing.

i. Stone columns shall be installed vertically plumb (as verified by use of a hand level). The Contractor shall make every effort necessary to maintain this plumb condition until backfilling is complete. Wells found to be out of plumb shall be unacceptable and replaced at no additional cost.

(E) Use select granular fill to fill the annular space between the stone column pipe and the hole.

(F) Fully saturate stone column and surrounding fill. Once the fill is saturated, additional granular fill should be used to bring to grade. Saturate again and repeat as necessary.

(G) Fill the perforated PVC pipe with open-graded stone matching the GI asset-type base material (GI-2.07.2) and seal with a perforated cap.

(H) Space the stone columns in accordance with the Contract Drawings and as directed by the Engineer.

(I) Only install a third, middle stone column within the Green Infrastructure Asset where the planting bed will contain no tree and in accordance with the Contract Drawings.

(J) During construction, keep the column free from foreign matter. The piping must be left thoroughly clean to the satisfaction of the Engineer.

GI-5.10.5 MEASUREMENTS AND PAYMENT

The quantities to be measured for payment under these Items must be the number of Vertical Feet of stone column installed to the satisfaction of the Engineer.

The price bid must be a unit price per Vertical Feet of stone column installed as shown on the Contract Drawings and must cover the cost of all labor, materials, equipment, insurance, and

incidentals necessary to complete the Work, including, but not limited to, pneumatic excavation, furnishing and installing twelve (12”) inch PVC diameter perforated pipe, PVC coupling(s), perforated cap, geotextile fabric for drainage and fastening collar, select granular fill, and clean open graded stone; all in accordance with the Contract Drawings, the specifications and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-5.10	STONE COLUMN	V.F.

SECTION GI-5.10 OW – OBSERVATION WELL

GI-5.10 OW.1 INTENT

This section describes the installation of Observation Wells, including the PVC pipes and fittings, ductile iron covers and frames, and accessories for providing observation wells for Infiltration basins, Type D bioswales, and where directed.

GI-5.10 OW.2 DESCRIPTION

Under this section, the Contractor must install Observation Wells and associated fittings in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices - current edition, and by the directions of the Engineer.

GI-5.10 OW.3 MATERIALS

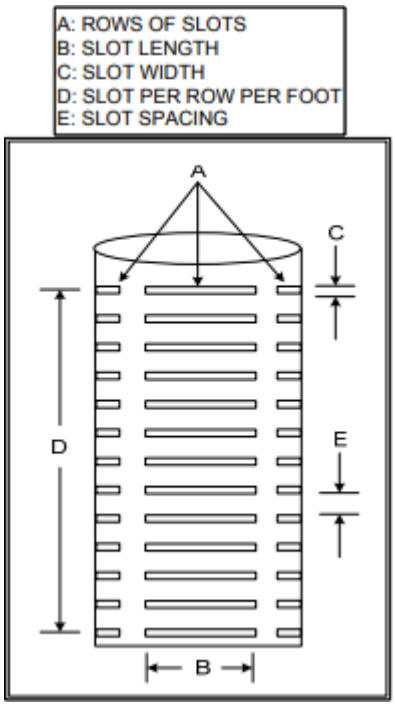
Observation Wells must comply with the following requirements:

(A) Pipe and fittings must comply with GI-2.16A – PVC Pipe (see Part (A) Special Specifications (For the Works Not to be Paid) of the GI-Pages). The pipe length must be determined by the Engineer. Pipe must be Schedule 40 four (4) inch inside diameter slotted well screen PVC pipe with the following slot sizing and layout:

Table GI-5.10 OW.3 Observation Well Slot Sizing

Slot Details		**Units**
Size (C)	0.01	in
Width (B)	2.5	in
# of Rows of Slots around pipe circumference (A)	4	rows
Vertical Spacing between Slots (E)	0.125	in

Figure 5.10 OW.3 Observation Well Slot Layout



(B) Four (4") inch round PVC caps are to be placed on the top and bottom of the observation well. Top cap must be easily removable, expandable rubber plug is preferred.

(C) The Observation Well cleanout covers must be gray cast iron covers with gray cast iron frames in compliance with GI-7.01 CC – Cleanout Cover.

(D) Lubrication must be used to ensure the ease access to the observation well. The lubricant to be use for the PVC top cap threads must be PTFE silicone-based grease, NSF rated H1 food grade, and NLGI grade 2, or engineer approved equivalent.

GI-5.10 OW.4 CONSTRUCTION METHODS

(A) General

All Work must be done to the satisfaction of the Engineer.

The Contractor must take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the Work.

(1) Place the observation well in accordance with the Contract Drawings, NYC DEP Standard Design and Guidelines for Green Infrastructure Practices - current edition, and as directed by the Engineer.

(2) During construction, keep the observation well free from foreign matter. The piping must be left thoroughly clean to the satisfaction of the Engineer.

(3) The observation well must be installed plumb and vertical with no slanting

(4) The cast iron cover must be installed flush with the concrete top at grade level.

(B) Furnishing and Installing Observation Well

(1) Prior to installation, the Contractor must inspect covers, frames, pipes, and fittings for correct alignment, conditions for proper attachment, free of cracks and/or damage, proper locking mechanism, and support. Any inconsistencies between contract drawings, standard design, and the observation well deemed detrimental to observation well placement must be reported in writing to the Engineer or owner's agent prior to placement.

(2) The Contractor must install observation well in accordance with shop drawings and standard installation practices as recommended by the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, current edition.

(3) After all concrete Work for the infiltration basin has cured, the approved lubricant must be applied to the threads of the PVC cap of the observation well. The threads must be cleaned just before application of the lubricant, and the lubricant must be applied evenly with a clean brush. Immediately after, the cast iron cover must be placed back to protect the observation well.

GI-5.10 OW.5 SUBMITTALS

The Contractor must submit working drawings which includes where applicable, manufacturer's descriptive literature, cut-sheets, end caps, lubricant, and installation instructions.

GI-5.10 OW.6 MEASUREMENT

The quantities to be measured for payment under each item must be the number of observation wells satisfactorily installed. For depths beyond five (5') feet and ordered by the engineer, payment to be made as a proportion of extra depth versus five (5') feet.

GI-5.10 OW.7 PRICE TO COVER

The contract price bid must be a unit price per EACH Observation Well and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to complete the Work of furnishing and installing the Observation Wells, and will include, but not be limited to, furnishing and installing slotted PVC piping and associated fittings all in accordance with the Contract Drawings, the specifications required under this Section, and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-5.10 OW	OBSERVATION WELL	EACH

SECTION GI-5.13 – STORMWATER INLET FOR GI ASSETS

GI-5.13.1. DESCRIPTION

Stormwater Inlets must be constructed of the sizes and shapes shown complete with frames, gratings, covers, hoods, hooks, and all other hardware as shown or required. The Contractor must furnish and install either type of Stormwater Inlet [standard or shallow] in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings, specifications, and directions of the Engineer.

GI-5.13.2. MATERIALS AND CONSTRUCTION METHODS

The Contractor is notified that the materials and construction methods necessary and required to construct complete stormwater inlets must be in accordance with the requirements for Catch Basins under Subsections 51.41.2 and 51.41.3 of the NYC DEP Standard Sewer and Water Main Specifications, and in accordance with NYC DEP Standard Design and Guidelines for Green Infrastructure Practices Standard Details that are made part of this Contract, unless otherwise amended herein.

GI-5.13.3. PRECAST REINFORCED CONCRETE STORMWATER INLET

The Contractor is advised that in lieu of poured-in-place stormwater inlets the substitution of Precast Reinforced Concrete Stormwater Inlets that comply with the Standards for Green Infrastructure drawings will be permitted as Stormwater Inlets. The Precast Reinforced Concrete Stormwater Inlets for GI Practices must be constructed in accordance with the applicable requirements for Catch Basins under Subsection 51.41.4 of the NYCDEP Standard Sewer and Water Main Specifications, and in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings that are made part of the Contract, unless otherwise amended herein.

GI-5.13.4. MEASUREMENT

The quantities of stormwater inlets to be measured for payment must be the number of stormwater inlets, incorporated in the Work, complete, to the satisfaction of the Engineer, as shown, specified or required.

GI-5.13.5. PRICE TO COVER

The contract price for STORMWATER INLET must be the unit price bid per each stormwater inlet and must cover the cost of all labor, materials, plant, equipment, samples, tests, insurance, and incidentals including brick leveling course adjacent to the STORMWATER INLET required and necessary to construct the stormwater inlets of the sizes and dimensions, and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See Section 40.03 - Earth Excavation of the NYC DEP Standard Sewer Specifications); reinforcement; all sheeting and bracing; pumping; fluming; bridging; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this Work and do all Work incidental thereto, all in accordance with the Contract Drawings, specifications and standards, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install frames, gratings, covers, hoods, hooks and all other hardware; in accordance with the Contract Drawings, specifications and standards, and as directed by the Engineer.

Where precast reinforced concrete stormwater inlets are used in lieu of poured-in-place stormwater inlets, the cost for furnishing, delivery and installation of the precast reinforced concrete stormwater inlets, complete with reinforcement; frames; gratings; covers; hoods; hooks and other hardware; additional excavation and sheeting, as required; select granular

fill; hand excavation; and all Work incidental thereto all in accordance with the Contract Drawings, specifications and standards, must be included in the contract price bid for either STORMWATER INLET. No additional or separate payments will be made for any Work associated with the installation of precast reinforced concrete stormwater inlets.

Payment will be made under:

Item No.	Item	Pay Unit
GI-5.13A	STORMWATER INLET	EACH
GI-5.13B	STORMWATER INLET (SHALLOW)	EACH
GI-5.13C	STORMWATER INLET (ROW GI TYPE D)	EACH

SECTION GI-5.35 – SLEEVE FOR UTILITY CROSSINGS

GI-5.35.1 DESCRIPTION

The Contractor must furnish and install PVC split sleeve pipes to protect utilities crossing Green Infrastructure Asset. Each split sleeve pipe must have a wire (not wire mesh) reinforced concrete collars on each side of the Green Infrastructure Asset, as shown on the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

If Lead water services or galvanized water services are found during excavation with no observable damages, they must be sleeved as per NYC DEP STANDARD DESIGN AND GUIDELINES FOR GREEN INFRASTRUCTURE PRACTICES drawings and the Engineer must be notified. If such lead and or galvanized water services were found with buried valves that would lead to conflict with the construction of the GI Asset, then an RFI shall be sent to the Engineer for review.

Sleeve lengths must range from five (5') feet to eight (8') feet depending on the width of the Green Infrastructure Asset or at any given location it must be two (2') feet greater than the width of the Green Infrastructure Asset. This section describes the full-depth saw cutting of both sidewalk and roadway pavements for the opening of pavements under other contract items.

GI-5.35.2 MATERIALS

(A) PVC SPLIT SLEEVE PIPE must be of the diameter and length required as shown on the Contract Drawings or as directed by the Engineer. PVC SPLIT SLEEVE PIPE must comply with the requirements of Section GI-2.16A.

(B) SOLID PVC PIPE for future water service must be installed as shown on the NYC Department of Environmental Protection STANDARD DESIGN AND GUIDELINES FOR GREEN INFRASTRUCTURE PRACTICES drawings. SOLID PVC PIPE must comply with the requirements of Section GI-2.16A.

(C) SEALING GASKET must be as recommended by the manufacturer of the sleeve.

(D) CONCRETE must be Type B-32 comply with the requirements of Sections 3.05 and 4.06 in the NYCDOT Standard Highway Specifications.

(E) WIRE REINFORCEMENT must comply with the requirements of Sections 4.14 in NYC Department of Transportation Standard Highway Specifications. Size and spacing must vary in accordance with the cross-sectional area of the utility and as directed by the Engineer.

(F) MORTAR, if required for end capping, must comply with the requirements of Section 3.07 in the NYC Department of Transportation Standard Highway Specifications, Type 1, Mortar, except that the proportions must be one (1) part of cement to one and one- half (1-1/2) parts of sand and that the ingredients may be mixed by hand.

(G) WATERTIGHT EXPANDING FOAM SEALANT encasing the utilities in the split sleeve pipe must be meet the requirements of ASTM C1620.

(H) PVC PIPES for the concrete piers supporting the concrete strip must be of the diameter and length required as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure Practices drawings or as directed by the Engineer. PVC PIPE must comply with the requirements of Section GI-2.16A.

(I) BLANK UTILITY SLEEVE MARKER (spare water duct survey marker) must be made

of aluminum and 3.5” diameter in size. Fonts and markings on the marker must be recessed and as shown in NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure Practices.

GI-5.35.3. SUBMITTALS

(A) For the BLANK UTILITY SLEEVE MARKER, the Contractor must submit, where applicable, manufacturer’s descriptive literature, cut-sheets, hardware specifications, and installation instructions.

GI-5.35.4 METHODS

(A) Duct spacers must be used to hold utilities in position to maintain a two (2”) separation between the concrete utility duct and the PVC Split Sleeves when encasing utilities within the split sleeve pipe.

(B) The space between the utility and the sleeve must be filled with watertight expanding foam sealant as directed by the Engineer.

(C) PVC pipe must be used to form the concrete piers per the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings.

(D) Immediately after the Engineer has inspected and approved the encasement, the PVC Split Sleeve pipe must be backfilled as per the appropriate items.

(E) Concreting must comply with the requirements of Sections 3.05 and 4.06 of NYC Department of Transportation Standard Highway Specifications.

(F) Spare water duct survey marker must be installed in the rear header of the asset, directly above where the additional sleeve is located. Direction of the arrows on the marker must match with the spare sleeve’s orientation.

GI-5.35.5 DAMAGE TO UTILITY CROSSINGS

Any damage caused to the utility crossings during the construction or any cause whatsoever, whether in or out of the trench, must be repaired at the sole expense of the Contractor. Partial repairs of lead, galvanized iron or steel pipes, are not permitted per DEP BWSO Regulation (RCNY Title 15 Chapter 20). If lead, galvanized iron or steel pipes are damaged, full replacements from meter to main are required.

GI-5.35.6 MEASUREMENTS

The quantities to be measured for payment under these Items must be the number of linear feet (laying length) of **SLEEVE FOR UTILITY CROSSINGS** actually laid in their final position, to the satisfaction of the Engineer, measured horizontally along the centerline of the PVC Split Sleeve pipe.

GI-5.35.7 PRICE TO COVER

The price bid for each type of **SLEEVE FOR UTILITY CROSSINGS** must be a unit price per linear foot and must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete the Work of furnishing and installing PVC Split Sleeve and Solid PVC Pipe of whatever diameter is required and must include, but not be limited to, furnishing and installing sealing gasket, fittings, end caps, sealant, mortar, formwork, supports, and connecting and joining pipe to other pipes or drainage structures; furnishing and placing concrete collars at each side of the Green Infrastructure Asset; all in accordance with the Contract Drawings, the specifications and directions of the Engineer.

No additional payment will be made for excavation and backfilling and must be included in the price of Item GI-5.35.

Payment will be made under:

Item No.	Item	Pay Unit
GI-5.35	SLEEVE FOR UTILITY CROSSINGS	L.F.

SECTION GI-6.09 – CONCRETE HEADER

GI-6.09I.1 INTENT

This section describes construction of Concrete Headers.

GI-6.09.2 DESCRIPTION

T (Trapezoid) - shaped Concrete Headers must be:

(1) Six (6”) inches wide at the top, fifteen (15”) or nineteen (19”) inches deep, and nine (9”) wide at the base
(2) Laid on a foundation three (3”) inches thick
(3) Constructed to the lines and grades as shown on the NYC Department of Environmental Protection Standard Design and Guidelines for Green Infrastructure

GI-6.09.3 MATERIALS AND METHODS

All materials and methods must comply with the requirements of Sections GI-6.09.3 and GI-6.09.4, as appropriate, in the NYC Department of Transportation Standard Highway Specifications.

The Concrete Headers must be installed in a way such that the underlying material stabilizes and properly supports the Concrete Headers to prevent any settling, cracking, or any other type of movement that can result in an uneven surface or unsafe conditions for pedestrians.

The final surface finish for Item GI-6.09-T1 must match, in texture and direction, per the specification for broomed poured-in-place concrete which follows Section 4.05.5(K)(2) of the NYC Department of Transportation’s Standard Highway Specifications.

GI-6.09.4 MEASUREMENT

The quantity to be measured for payment must be the number of linear feet of concrete header constructed, complete, in place, measured along the center line of the header.

GI-6.09.5 PRICE TO COVER

The contract price per linear foot of concrete header must cover the cost of furnishing all labor, materials, plant, equipment, insurance, and incidentals required to construct concrete header, complete, in place, and must include, but not be limited to, excavation, curing, furnishing samples for testing as may be required and maintaining the concrete header in good condition as required in Section 5.05 of the NYC Department of Transportation Standard Highway Specifications, all in full compliance with the Contract Drawings, the specifications and directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.09-T1	CONCRETE HEADER, TRAPEZOID-SHAPE (6” WIDE AT TOP X 15” DEEP X 9” WIDE AT BASE)	L.F.
GI-6.09-T2	CONCRETE HEADER, TRAPEZOID-SHAPE (6” WIDE AT TOP X 19” DEEP X 9” WIDE AT BASE)	L.F.

SECTION GI-6.46 – EPOXY BONDED STONE STRIP BED

GI-6.46.1. INTENT

This section describes the epoxy bonded stone strip bed. The Contractor must install a stone strip bed of the size and depth as shown on the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and apply an epoxy bonding agent to the stone strip beds located on top of gabions in Stormwater Greenstreets, and/or where indicated on the Contract Drawings, specifications, and as directed by the Engineer.

GI-6.46.2. MATERIALS

(A) The laid stone must conform to the requirements of GI-2.07C 1-1/2" CLEAN OPEN GRADED STONE,

(B) Epoxy Bonding agent must be a clear, non-toxic, UV-stable bonding. Minimum properties of approved epoxy systems include:

(1) Ultimate tensile strength - 4,000psi

(2) Compressive strength – 18,800psi

(3) Flexural Strength – 11,000psi

(4) Bond strength – 1,500psi

GI-6.46.3. METHODS

Stone Strip Beds must be placed as per Contract Drawings. Epoxy Bonding Agent must be then applied to the Stone Strip Beds located on top of gabions in Stormwater Greenstreets in place and/or where indicated on the Contract Drawings.

Epoxy bonding agent is to be sprayed on clean and dry stone surfaces to sufficiently bond top layer of the Clean Open Graded Stone but at a rate no less than recommended by the manufacturer. Do not install if rain is expected within 12 hours. Do not cover area with plastic. Install when outdoor temperature is 50 degrees or above and will not drop below 50 degrees F for at least 12 hours. Depending on temperature, allow 24-48 hours to cure.

GI-6.46.4. SUBMITTALS

Prior to the procurement of epoxy bonding agent, the following information and samples are required for review and approval for each source:

(1) Product Data: Submit product data provided by manufacturer.

(2) Submit a copy of the Safety Data Sheet (SDS) for the Epoxy Bonding Agent.

GI-6.46.5. EPOXY BONDING AGENT SUPPLIERS

1. Pond Armor
   P.O. Box 6558
   Santa Maria, CA 93456
   phone: 800-716-1545 · fax: 805-922-4580
   email: info@pondarmor.com www.pondarmor.com

2. Epoxy Bonding Agent #17
   A Division of Epoxy Systems, Inc. 20774 W. Pennsylvania Ave.
   Dunnellon, Florida 34431 email: info@epoxy.com www.epoxy.com

3. Adhesives Technology Corp. 450 East Copans Rd.
   Pompano Beach Fl, Florida 33064 https://atcepoxy.com/

4. Or approved equivalent.

GI-6.46.6. RELATED SECTIONS

Section GI-2.06 – L-Shaped Edging.

GI-6.46.7. MEAUREMENTS

The quantity of EPOXY BONDED STONE STRIP BED to be measured for payment must be the number of cubic yards of Clean Open Graded Stone incorporated in the finished Work, measured in place, to the satisfaction of the Engineer.

GI-6.46.8. PRICE TO COVER

The contract price bid per cubic yard of EPOXY BONDED STONE STRIP BED must cover the cost of all labor, materials, equipment, insurance, and incidentals necessary to furnish and place an approved strip stone bed at the site to complete the Work and must include, but not be limited to, furnishing and applying an epoxy bonding agent along the stone strip bed within the limits shown on the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.46	EPOXY BONDED STONE STRIP BED	C.Y.

SECTION GI-6.51 – PAVEMENT KEY ALONG CURB (3’ TO 6’ WIDE)

GI-6.51.1 INTENT

This section describes the Work of installing pavement keys to grind (mill) and remove a portion of the existing asphaltic wearing course and granular base to remove depressed or damaged roadway, to facilitate storm water runoff (without ponding), to facilitate installation of new pavement and must dispose of all asphaltic millings and other material, and prepare for resurfacing after completion of the concrete Work; all in accordance with the specifications, the Contract Drawings, and the directions of the Engineer.

The construction of pavement keys must consist of sawcutting, grinding (milling), and removing a portion of the existing wearing course and granular base to the required depth and width, generally next to curb or areas of poor pavement; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

GI-6.51.2 METHODS

All methods must comply with the requirements of Section 6.75 of the NYC Department of Transportation Standard Highway Specifications, current edition.

No debris will be allowed to accumulate at the site.

All grinding (milling) must be done prior to the construction of sidewalks and in conjunction with the installation of new or reset curb, precast porous concrete gutter, and aprons.

GI-6.51.3 USES

Pavement Key along the curb line (various widths) must be used in the following locations:

(A) At all locations requiring gutter adjustments (3' to 6' wide) both inside and outside the Green Infrastructure Asset’s curb limits as directed. To lower roadway or reshape roadway to eliminate ponding.

(B) To remove asphaltic bumps or depression or badly crazed areas in the roadway to provide positive surface flow into the Green Infrastructure Asset’s inlet area.

(C) Grinding (milling) must be to the required depth to facilitate an average of 2" resurfacing after the Work is completed.

(D) At locations to be excavated under other contract items.

(E) At locations as directed by the Engineer.

GI-6.51.4 MEASUREMENT

The quantity to be measured for payment, under Item GI-6.51, must be the number of cubic yards of grinding existing asphaltic concrete wearing course actually cut out to provide a pavement key along the curb as directed by the Engineer.

Measurement must be a vehicle measurement based on the number of cubic yards of millings removed from the site to the satisfaction of the Engineer, measured in trucks at the place of loading. Only water level loads that have been raked by the Contractor to a flat exposed surface will be accepted and no allowance will be made for any crown or peak of the load.

GI-6.51.6 PRICE TO COVER

The contract price per cubic yard of Item GI-6.51, must cover the cost of furnishing all labor, plant, equipment, insurance, and necessary incidentals required and completing the Work, including saw cutting at beginning and end of grinding limits, cutout of existing asphaltic material at street hardware and at saw cut joints, loading all grindings and excavated material into dump trucks, and removing and disposing of said material away from the site, all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

Resurfacing, under Item 4.02 AF-R, over the milled area must be approximately 2"± deep. Where ponding remains after resurfacing, no payment will be made for any Work at that location unless the ponding condition is corrected in a manner satisfactory to the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.51	PAVEMENT KEY ALONG CURB	C.Y.

SECTION GI-6.70– MAINTENANCE AND PROTECTION OF TRAFFIC

GI-6.70-1.1 DESCRIPTION

(A) Under this section, the Contractor will be required to complete the Work of maintaining and protecting all pedestrian and vehicular traffic within the vicinity of each Green Infrastructure Asset, as defined herein, and as specified in the contract documents and as noted in the Special Provisions (S – Pages) of the Project to be constructed under the Contract. This will include, but not be limited to, temporary line striping, furnishing, placing, relocating, and removing, when directed, all necessary temporary warning and regulatory signs and temporary traffic control devices to re-route and protect traffic – all Maintenance and Protection of Traffic measures must be in accordance with an approved Maintenance and Protection of Traffic (MPT) Plan, the Contract Drawings, the specifications and directions of the Engineer.

(B) Prior to mobilization, the Contractor must submit for review and approval an MPT Plan for the Work required under the contract. The MPT Plan must be prepared and sealed by an engineer with an active New York State Licensed Professional Engineer license, who is qualified and experienced in Traffic Engineering and Work Site Safety. The MPT Plan must include all necessary and required legal precautions for the protection of protection and vehicle traffic and for the safety of the public and must be subject to the review approval of the New York City Department of Transportation Office of Construction Mitigation and Coordination (OCMC) and the Engineer.

(C) The provisions of this section are supplementary to and do not abrogate the General Conditions (Section 1.06) of the NYC Department of Transportation Standard Highway Specifications, the General Notes on the Contract Drawings relating to maintenance and protection of traffic following this Section or the OCMC Traffic Stipulations. Furthermore, any conditions pertaining to the maintenance and protection of traffic during the life of the Contract which are addressed in the General Conditions and in the General Notes on the Contract Drawings, must be as having been addressed under this Section.

GI-6.70-1.2 MATERIALS AND METHODS

(A) All materials and methods must comply with Section 6.70 of the NYC Department of Transportation Standard Highway Specifications, current edition, and the Manual for Universal Traffic Control Devices (MUTCD).

GI-6.70-1.3 NONCONFORMANCE & LIQUIDATED DAMAGES

(A) If the Contractor fails to maintain and protect traffic adequately and safely for a period of three (3) hours at a Green Infrastructure Asset under construction, the Engineer may correct the adverse conditions by any means the Engineer deems appropriate and must deduct the cost of the corrective Work from any monies due to the Contractor.

(B) Where major nonconformance with the requirements of this specification is noted by the Engineer, and prompt Contractor compliance is deemed not to be obtainable, all contract Work may be stopped by direct order of the Engineer, regardless of whether corrections are made by the Engineer as stated in the paragraph above.

(C) In the event the Contractor fails to comply, within three (3) consecutive hours after written notice from the Engineer, with the requirements of the Contract and the specifications in the matter of providing facilities and services for the maintenance and protection of traffic, the Contractor must pay to the City of New York, until such notice has been complied with or rescinded, the sum specified in Schedule A per calendar day, for each instance of such failure, as liquidated damages and not as a penalty. Any money due the City of New York under this provision must be deducted from the amounts due or to become due to the Contractor for Work performed under the Contract.

GI-6.70-1.4 MEASUREMENT

(A) The quantity to be measured for payment must be the number of Green Infrastructure Assets constructed under this Contract for which the Contractor has provided adequate Maintenance and Protection of Traffic. Measurement must be made on a one-time basis for each Green Infrastructure Asset and no additional measurement or payment will be made for any removals, reinstallations or resetting of materials and equipment as may be required at the same Green Infrastructure Asset's location. Where there are two (2) or more Green Infrastructure Assets in the same block, each must be counted as a separate Green Infrastructure Asset.

(B) The quantity to be measured for payment must be based on the percent complete of the lump sum of MPT controls and requirements specified and as necessary to perform the Work in this contract, as determined by the Engineer.

GI-6.70-1.5 PRICE TO COVER

Payment Per Each Item Method

(A) The price bid for Maintenance and Protection of Traffic must be a unit price for EACH Green Infrastructure Asset which must cover the cost of all labor, materials, plant, equipment, insurance, and incidentals required to maintain and protect pedestrian and vehicular traffic, including, but not limited to, furnishing, installing, relocating and maintaining lighted barricades, plastic barrels with flashers, temporary timber curbs, construction signs, flashing arrow boards, variable message signs, safety orange construction fencing, chain link fence, temporary pedestrian steel barricades, warning devices, cones, flags, lights, temporary ribbon, temporary pavement markings, etc., unless otherwise provided for under other scheduled contract bid items; providing and maintaining roadway plates; constructing and maintaining temporary ramps; and all incidentals necessary for completing the Work at each Green Infrastructure Asset; all in accordance with the Contract Drawings, approved MPT Plans, the specifications, and the directions of the Engineer. However, no additional payment will be made no matter how many times an MPT set up is removed, reinstalled or changed after the initial MPT set up at each Green Infrastructure Asset.

(B) Payment for Maintenance and Protection of Traffic at each Green Infrastructure Asset will be made as follows:

Fifty (50%) percent of the unit price bid for each Green Infrastructure Asset will be paid when the initial MPT set up is satisfactorily installed at the Green Infrastructure Asset's location and the remaining fifty (50%) percent of the unit price bid will be paid for that location upon either completion of installed of the

Steel Tree Pit Guard or after the final temporary fencing is removed after planting, as applicable.

(C) Providing and placing of Asphaltic Concrete Mixture and/or Binder Mixture for temporary ramps and for temporary pavement and trench restorations will be paid for under the appropriate scheduled contract items.

Lump Sum Payment Method

(A) Thirty (30%) percent of the lump sum unit price for the MPT must be paid upon the review and approval of the MPT plan, mobilization and the satisfactory furnishing and implementation of the MPT measures, as determined by the Engineer.

(B) Sixty (60%) percent of the lump sum unit price for the MPT must be paid monthly during the contract duration for all necessary flagging, police details, the storage, replacement as required, maintenance, updates and adjustments to the MPT of the project as determined appropriate by the Engineer.

(C) Ten (10%) percent of the lump sum unit price for the MPT must be paid upon the satisfactory removal and demobilization of the MPT controls from the limits of the project as the determined by the Engineer.

(D) No additional payment will be made regardless of how many times the MPT controls are set up, removed, relocated, reinstalled or adjusted after the initial MPT set up at each project site.

(E) An adjustment to the lump sum cost for this item must be made in proportion to the percentage of actual contract completion. The final payment for this item will be in direct proportion (whether higher or lower) to the final contract value (minus all change orders of any kind and any overruns for Traffic Enforcement Agents, Crossing Guards, Uniformed Flag persons, Tree Consultants, BMP items, clean fill, contaminated/hazardous materials, and other bid item overruns that do not require MPT as determined by the Engineer) as compared to the original contract value.

(F) Payment must be inclusive of all labor, equipment, materials, flagger costs, police detail, and ancillary costs associated with the submission for review and approval, furnishing, installing and adjusting the MPT plan and associated controls necessary to perform the Work as specified here-in.

(G) Providing and placing of Asphaltic Concrete Mixture and/or Binder Mixture for temporary ramps and for temporary pavement and trench restorations is included in the lump sum.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.70	MAINTENANCE AND PROTECTION OF TRAFFIC	EACH
GI-6.70-A	MAINTENANCE AND PROTECTION OF TRAFFIC	LUMP SUM

SECTION GI-7.01SG – STEEL GRATE

GI-7.01SG.1 INTENT

This section describes the installation of steel gratings, frames, and accessories for use with Right-of-Way Green Infrastructure Assets, or as directed by Engineer.

Under this section, the Contractor must install steel frames and gratings all in accordance with the Contract Drawings, the specifications, and the directions of the Engineer.

GI-7.01SG.2 MATERIALS

Steel Grates and Frames must comply with the following requirements:

(A) Material to be Grade A36 Carbon Steel which is hot-dip galvanized per ASTM A123.

(B) Bearing bars must be 1” x 3/16” with edge of plate flush and true, spaced 11/16” on center as to provide 1/2” space between bars.

(C) Cross bars and bearing to be 1” x 3/16” plate cross section, spaced 4” on center.

(D) Bearing bars and cross bars must comply with ASTM A-123 Hot-Dip Galvanized Steel Products.

(E) Top surface of grate must be a slip resistant surface in accordance to US Dept. of Justice Americans with Disabilities Act – 2010 Design Standards Section 302.

(F) Steel angles must be L2” x 2” x 1/4” with galvanized steel grating fasteners as per ASTM A-153 Hot-Dip Galvanized Steel Hardware.

(G) Overall dimensions, details, and direction of bearing bars must be in accordance with the Contract Drawings.

(H) Fasteners used to secure the close mesh grating to the support angles must be 316 Stainless Steel.

(I) Metal plate with “NYC DEP” logo must be 1.5” x 5.5”, 1/8” thick, with 1” embossed fonts. The logo plate must be welded and flush with the top of the steel grate bars.

GI-7.01SG.3 MANUFACTURERS

(A) General Foundries Inc.
1 Progress Rd.
North Brunswick Township, NJ 08902
www.generalfoundries.com

(B) Ohio Gratings, Inc.
5299 Southway St. SW Canton, Ohio 4706
www.ohiogratings.com

(C) Amico
3245 Fayette Avenue
Birmingham, Alabama 35208
www.amicoglobal.com

(D) Grating Pacific, Inc. 3651 Sausalito Street
Los Alamitos, California 90720 http://www.gratingpacific.com

(E) Other manufacturers of equivalent products may be submitted to the Engineer for

approval.

GI-7.01SG.4 CONSTRUCTION METHODS

(A) GENERAL

All Work must be done in accordance with the directions of the Engineer.
The Contractor must take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the Work.

(B) FURNISHING AND INSTALLING STEEL GRATE

Prior to grating installation, the Contractor must inspect supports for correct alignment and conditions for proper attachment and support of the gratings. Any inconsistencies between Contract Drawings and supporting structure deemed detrimental to grating placement must be reported in writing to the Engineer prior to placement.

The Contractor must install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI/NAAMM MBG-531-09 Metal Bar Grating Manual. The Contractor must use approved attachment system and fasteners to secure grating to supporting members as shown on plans.

GI-7.01SG.5 SUBMITTALS

The Contractor must submit the manufacturer's catalog pages including load tables, anchor details and standard installation details. The Contractor must submit for approval shop drawings for fabrication and erection of all gratings, based on construction drawings of current issue. Include plans, elevations, and details of sections and connections as required. Show type and location of all fasteners. The Contractor must submit samples of Grating and Anchorage system for approval.

GI-7.01SG.6 MEASUREMENT

(A) The quantities to be measured for payment under the GI-7.01SG STEEL GRATE item must be the number of square feet of steel grating satisfactorily installed measured within the frame perimeter.

(B) The quantities to be measured for payment under the GI-7.01SGE STEEL GRATE (SPARE) item must be the number of square feet of steel grating satisfactorily delivered measured within the frame perimeter.

GI-7.01SG.7 PRICE TO COVER

(A) The unit price of STEEL GRATE must cover price per square foot and all labor, material, equipment, insurance, and incidentals necessary to install frames and grates, openings, metal plates, lifting hooks and G-Clip wrench, all in accordance with the Contract Drawings, the specifications, and the directions of the Engineer.

(B) The unit price of STEEL GRATE (SPARE) must cover price per square foot of all material, equipment, insurance, and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-7.01SG	STEEL GRATE	S.F.
GI-7.01SGE	STEEL GRATE (SPARE)	S.F.

SECTION GI-7.01 CC – CLEANOUT COVER

GI-7.01CC.1 INTENT

This section describes the installation of cast iron Cleanout Covers, frames, and accessories for providing cleanouts for infiltration basins with concrete tops and where directed.

GI-7.01CC.2 DESCRIPTION

Under this section, the Contractor must install cast iron removeable Cleanout Covers and set in place frames all in accordance with the Contract Drawings, the specifications, the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices - current edition, and by the directions of the Engineer.

GI-7.01CC.3 MATERIALS

Cleanout Covers must comply with the following requirements:

(A) Gray iron castings must comply with the requirements of ASTM A48 “Standard Specification for Gray Iron Castings”.

(B) Gray iron castings must be at least Class No. 35B, with a minimum tensile strength of thirty-five thousand (35,000) pounds per square inch as per ASTM A48.

(C) A camlock or locking system, must be an attached locking mechanism to the cover. Loose /separate bolts used to secure the cover to the frame are not acceptable locking mechanisms.

(D) Castings must conform to either the working drawings or patterns or both, as specified.

(E) Iron castings must have the initials of the manufacturer’s name, the date of manufacture and the initials of the plant of manufacture integrally cast on it at the time of manufacture.

(F) The metal must be such that it will make castings. The castings are to be of close and even grain and easily machined.

(G) Casting must be true to pattern, free from cracks, gas holes, flaws and excessive shrinkage. Surfaces of castings must be free from burnt on sand and be reasonably smooth after cleaning. Runners, risers, fins and other cast on pieces must be removed. Plugging and filling will not be allowed.

(H) When "machining" is specified or shown on the working drawings, it means the use of a machine or machines having cutting tool or tools to produce such surfaces and dimensions to a true and even surface.

(I) The underside of the seating rim of manhole covers will be machined. The upper side of the cover seating rims of manhole heads will also be machined.

GI-7.01CC.4 CONSTRUCTION METHODS

(A) GENERAL

All Work must be done in accordance with the directions of the Engineer.

The Contractor must take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the Work.

(B) FURNISHING AND INSTALLING CLEANOUT COVER

(1) Prior to installation, the Contractor must inspect covers and frame for correct alignment, conditions for proper attachment, cracks and/or damage, locking mechanism, and support of the cleanout. The locking mechanism must be in good working order. Any inconsistencies between contract drawings, supports, and the cleanouts deemed detrimental to cast iron Cleanout Cover placement must be reported in writing to the Engineer or owner's agent prior to placement.

(2) The Contractor must install cleanout in accordance with shop drawings and standard installation practices as recommended by the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices, current edition.

(3) The Contractor must ensure that the top of the Cleanout Covers and matching frames sit flush with the top of the surrounding surfaces.

(4) The Contractor must verify that these covers can be easily removed by hand with the use of simple tools in the presence of DEP staff.

(5) When requested, the Contractor must provide a set of tools used to open the clean out covers to DEP.

GI-7.01CC.5 SUBMITTALS

The Contractor must submit working drawings which will include, where applicable, manufacturer's brochure, cut-sheets and installation instructions for paint and primer to be used.

GI-7.01SCC.6 MEASUREMENT

The quantities to be measured for payment under each item must be the number of cast iron cleanouts satisfactorily installed.

Spare CAST IRON CLEANOUT COVERS may be requested. Measurement for payment must be EACH cast iron cleanout cover delivered to DEP.

GI-7.01CC.7 PRICE TO COVER

The contract price bid must be a unit price per EACH cast iron Cleanout Cover (cover and frame) and must cover the cost of all labor, material, equipment, insurance, and incidentals necessary to install Cleanout Covers, all in accordance with the Contract Drawings, the specifications required under this Section, and the directions of the Engineer.

The unit price bid of EACH CLEANOUT COVER (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-7.01 CC	CLEANOUT COVER	EACH
GI-7.01 CC-S	CLEANOUT COVER (SPARE)	EACH

SECTION GI-7.13E – MAINTENANCE OF GI SITE

GI-7.13E.1 DESCRIPTION

This section describes the maintenance, protection and cleanup of the construction site and each installed Green Infrastructure Asset, including but not limited to ROW Bioswales, Raingardens, Infiltration Basins, Greenstrips, Permeable or Porous Pavements or Stormwater Greenstreets. The Contractor is placed on notice that the Contractor must be required to provide a safe and clean site throughout all phases of the Work and during all of the Contractor's operations at each Green Infrastructure Asset. Furthermore, for the purposes of the contract, monitoring by the City of the Contractor's site maintenance, site protection and site cleanup is considered a project objective necessary to eliminate and/or mitigate public disruption and inconvenience, and to ensure public health and safety.

The Contractor must therefore, at all times, conduct this weekly operation in a manner which promotes a clean site and ensures the convenience, safety and health of general users consisting of, but not limited to, the motorist, the pedestrian and the abutting property owners/tenants, as well as those of the Contractor's own employees. During active construction, site must be cleaned and secured daily including all construction waste, litter, and materials. During the Establishment Period, weekly inspection for site cleanliness and litter must be removed.

The provisions of this section are supplementary to and do not abrogate the General Conditions (Section 1.06) of the NYC Department of Transportation Standard Highway Specifications or the General Notes on the Contract Drawings relating to the protection and cleanup of the site, and the delivery and storage of materials at the site of each Green Infrastructure Asset facility. Furthermore, any conditions pertaining to the maintenance, protection and cleanup of the construction site during the life of the Contract, including the Guarantee Period which are addressed in the General Conditions and in the General Notes on the Contract Drawings, whether or not addressed under this Section, must be deemed as having been addressed under this Section.

GI-7.13E.2 METHODS

(A) All methods must comply with the requirements of Subsection 7.13.2 of the NYC Department of Transportation Standard Highway Specifications, current edition.

(B) For assets with soil exposed (longer than 48 hours), such as Grass-top infiltration basins or standard ROWB assets receiving plants, erosion and weed prevention must be in place immediately upon placement of specified soil, and prior to plant or seed installation. Inlets/Outlets must be sandbagged, and assets must be protected with one of the following until the plant/seed installation: erosion control fabric as specified in Section GI-8.20, secured filter fabric, or shredded bark mulch. Temporary seeding, as specified in Section GI-4.20, may also be an acceptable alternative as directed by the Engineer.

(C) In addition, erosion repair, and soil and stone replacement must take place as needed following significant rainfall events. Visually inspect the Site for erosion and soil and stone settling, including areas around inlet and outlet structures, embankments, side slopes, and check dams. Symptoms of erosion can include erosive gullies or areas of bare soil. Remove any litter directly covering and immediately upstream or downstream of inlets and outlets so that the drainage path is clear.

(D) For permeable pavements, the contractor must be responsible for cleaning and maintenance of the permeable materials both during and after construction until

Substantial Completion and turn over to the City. The Contractor must keep construction soil from clogging permeable materials and perform regular maintenance to keep the permeable technologies free from clogging.

(E) To minimize maintenance requirements during construction, contractors to close inlet openings with temporary sytrofoam or timber barriers. The Contractor must also provide a temporary impermeable barrier, cut to size and placed directly under the metal grates immediately after construction. Contractor must ensure no debris, trash, or sediment can enter the infiltration basin during construction activities.

Prior to acceptance by the City for Substantial Completion the Contractor must remove all temporary barriers and flood test the asset utilizing DEP's Infiltration Basin Testing Procedure, ensuring functionality of the asset. The Contractor must also demonstrate all infiltration basin components are readily accessible in the presence of DEP staff.

Prior to the end of the Guarantee Period and turnover to DEP, the Contractor must deep clean all infiltration basins and their components. This Work must include cleaning of all debris from the grates and inlet openings, emptying the inlet baskets, cleaning of pipe screens jetting of each clean out opening and distribution pipe using a 360-degree nozzle head attachment, removing all sediment from pipe and perforations, and removal of all water and sediment from the infiltration basin chamber sump.

GI-7.13E.3 STORAGE OF MATERIALS AND EQUIPMENT

All storage of materials and equipment must comply with the requirements of Subsection 7.13.3 of the NYC Department of Transportation Standard Highway Specifications, current edition.

GI-7.13E.4 NONCONFORMANCE & LIQUIDATED DAMAGES

If the Contractor fails to maintain and protect the site of a Green Infrastructure Asset under construction adequately and safely for a period of three (3) or more consecutive hours, the Engineer may correct the adverse conditions by any means the Engineer deems appropriate, including, but not limited to, "outside services," and must deduct the cost of the corrective Work from any monies due to the Contractor.

However, where major nonconformance with the requirements of this specification is noted by the Engineer, and prompt Contractor compliance is deemed not to be obtainable, all contract Work may be stopped by direct order of the Engineer, regardless of whether corrections are made by the Engineer as stated in the paragraph above.

Furthermore, in addition to the remedies specified above, in the event the Contractor fails to comply, within three (3) consecutive hours after written notice from the Engineer, with the requirements of the contract and the specifications in the matter of providing facilities and services for the maintenance, protection and cleanup of the construction site, the Contractor must pay to the City of New York, until such notice has been complied with or rescinded, the sum shown per calendar day in **Schedule A**, for each instance of such failure, as liquidated damages and not as a penalty.

Any money due the City of New York under this provision must be deducted from the amounts due or to become due to the Contractor for Work performed under the contract.

GI-7.13E.5 MEASUREMENT

The quantity to be measured for payment must be the number of Green Infrastructure Assets constructed under this contract for which the Contractor has provided adequate Maintenance of Site. Measurement must be made on a one-time basis for each Green Infrastructure Asset and no additional measurement or payment will be made for maintaining the site at the same Green Infrastructure Asset's location. Where there are two (2) or more Green Infrastructure Assets in the same block each will be counted as a separate Green Infrastructure Asset.

GI-7.13E.6 PRICE TO COVER

The price bid for Maintenance of GI Site must be a unit price for EACH Green Infrastructure Asset which must cover the cost of furnishing all labor, materials, plants, equipment, insurance, and incidentals required to maintain, protect and clean up the site at each Green Infrastructure Asset, all in accordance with the Contract Drawings, these specifications, and the directions of the Engineer.

Payment under each location will be made in proportion to the percentage of the Green Infrastructure Asset actually completed.

The Contractor will be paid the unit price for the Maintenance of GI Asset in the following percentage increments:

1) 15% - Completed Construction of the GI Asset [including planting material]
2) 15% - Successful Initial Inspection, Re-Planting, or Testing.
3) 70% - Successful Guarantee Period Inspection

The Contractor will only be paid for the Work completed; if the Contractor does not successfully complete the maintenance of GI site, no payment will be made for the percentage increments not completed. Completion of the maintenance of GI site includes completion of all necessary tasks until the end of the Guarantee Period.

Payment will be made under:

Item No.	Item	Pay Unit
GI-7.13E	MAINTENANCE OF GI SITE	EACH

SECTION GI-8.20 – EROSION CONTROL MATTING

GI-8.20.1 INTENT

This section describes Erosion Control Matting, also called Rolled Erosion Control Product. The Contractor must furnish and place Erosion Control Matting as specified herein in accordance with the NYC DEP Standard Design and Guidelines for Green Infrastructure Practices drawings and as directed by the Engineer. Erosion Control Matting is intended to be used in place of Mulch, or as temporary erosion control for bare soil.

GI-8.20.2 SUBMITTALS

The Contractor must furnish two (2) labeled samples of the Erosion Control Matting intended for use in the Work for approval by the Engineer. The label must include the manufacturer's product name and the type of material. The Engineer reserves the right to reject on or after delivery any materials which do not, in the Engineer's opinion, meet these specifications.

GI-8.20.3 MATERIALS

(A) Erosion Control Matting, material must be constructed of either Curled wood fiber, Jute mesh, coconut fiber, a combination, or approved equal:

(1) Curled wood fiber: Blanket must consist of barbed, interlocking, curled fibers.

a. 80% of wood fiber must consist of six-inch fibers or greater fiber length.
b. blanket must be made with minimum dry (baseline) mass per unit area of eleven ounces per square yard (11 oz/sq. yard).
c. blanket must consist of minimum fiber count of approximately 7000 count per square yard.
d. Erosion control blankets of non-woven construction must be manufactured with netting to hold together the loose fibers through high flow conditions.
e. Netting must be 100% biodegradable.
f. Netting must have openings size of 1 inch by 2 inch or denser, or as accepted by the engineer.
g. Erosion control blanket must be secured with anchors as specified below and trenched or tucked into perimeter of asset.

(2) Coconut fiber: Coconut fiber must be made from 100% coir coconut fiber.

a. Machine produced blanket shall have and approximate longevity of 36 months, and permissible sheer stress of 2.25psf.
b. Coconut fiber blankets must be manufactured with biodegradble double-netting to hold together the loose fibers through high flow conditions, and have a minimum thickness of ½ inch.
c. Netting must be made of twisted jute or other biodegradable material.
d. Netting must be stitched on top and bottom and have openings size of one (1") inch by one (1") inch, or as accepted by the engineer.
e. Erosion control blanket must be secured with anchors as specified below and trenched or tucked into perimeter of asset.
f. Alternative coconut fiber product is open-weave net blanket with openings not more than 3/4"x34".

(3) Jute mesh: Jute mesh must be a uniform, open, plain weave cloth of undyed and unbleached single jute yarn. Jute mesh matting must be furnished in rolled

strips.

Jute mesh must be woven as follows:

a. Approximately 64 warp ends per yard of width;
b. Approximately 46 weft ends per linear yard.
c. Maximum opening of approximately 3/4" x 3/4".
d. Weight of Jute mesh must be a minimum of 11 ounces per square yard (plus or minus 5%). This yarn must be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and must not vary in thickness by more than one-half its normal diameter.
e. Jute mesh must be secured with anchors as specified below and trenched or tucked into perimeter of asset.

(B) Anchors: Erosion Control Matting must be held tightly secured to the engineered soil with stakes, staples, E-Staples, wood pegs, or other device with prior approval from the Engineer.

(1) Anchors must be biodegradable, water resistant, and do not soften from moisture during transport.
(2) Anchors must demonstrate ability to securely hook on to the matting/blanket, or the weaving of the mesh. It must prevent the Erosion Control Matting from floating during over flow conditions in the green infrastructure.

(C) The Erosion Control Matting must be of a consistent make up and protected during transport meeting the following conditions:

(1) Erosion Control Matting must be furnished in rolls and wrapped with suitable material to protect against moisture and extended ultraviolet exposure prior to placement.
(2) Erosion Control Matting must be of consistent thickness with fibers distributed evenly over the entire area of the matting.
(3) Erosion Control Matting must be free of defects and voids that would interfere with proper installation or impair performance.

(D) Smolder Resistance: The Erosion Control Matting must be naturally smolder resistant, passing the “Test Method” below. If not, it must be treated so as to be smolder resistant, meeting the following conditions:

(1) Erosion Control Matting must be made resistant to smoldering and/or after-glow by treatment with non-leaching and non-toxic chemicals. The chemicals must be non-toxic to vegetation and the germination of seed. The chemicals used for this purpose must resist leaching based on the equivalent of two inches of rain. The cloth itself must bear some identification mark to differentiate it from untreated jute cloth.
(2) “Test Method” – When a lighted cigarette is placed on the upper or treated surface of the cloth, neither flame nor after-glow will proceed in any direction more than twelve inches (12”) from the original position of the cigarette after it has burned out completely.

GI-8.20.4 METHODS

(A) The Erosion Control Matting must be rolled out flat, even and smooth without stretching the material in the same direction of the water flow, tucked in, then anchored to the engineering soil. Erosion control matting roll must be approximately 2' wider than the width of the rain garden, for proper installation. Erosion Control

Matting must be applied as a ground cover to the surface of all ROW Green Infrastructure Assets immediately after the planting is installed, interim cover crop is placed, or at the direction of the Engineer. Erosion Control Matting must be applied smoothly and must follow the grade of the ROW Green Infrastructure Asset. Erosion Control Matting must be cut and must not be placed within two (2”) inches of tree and shrub stems. Plants must not be covered.

(B) The Erosion Control Matting must be placed on topsoil and seeded areas without stretching so that it lays on the soil and is in contact with the soil at all points. The upper end of each roll of matting/blanket must be turned and buried to a depth of six (6”) inches, with the soil.

(C) Except at ends where the Erosion Control Matting might be buried for anchoring purposes, the whole of the Erosion Control Matting must remain visible after installation, it must not be covered with soil.

(D) The Erosion Control Matting must follow the slope and must have a minimum lap of six (6”) inches.

(E) The Erosion Control Matting must be anchored by trenching or tucking in two (2”) inches or more along asset perimeter; along headers, around erosion control device, and along concrete strip.

(F) The Erosion Control Matting must be held tightly to the soil throughout the asset by anchors detailed in the GI-8.20.3 Materials section. The anchors must be driven firmly into the ground. Anchors must be placed in a pattern according to the Erosion Control Matting manufacturer’s specifications, or as approved by the engineer. Additionally, anchors must be spaced not more than three (3’) feet apart, along the sides of the Erosion Control Matting and not more than one (1’) foot apart at roll ends or as determined by the Engineer.

(G) Installed Erosion Control Matting must be held tightly to the soil to the extent that it will remain in position through typical storm conditions, such as when the green infrastructure experiences overflow. Erosion control matting must not be shredded or torn into pieces, while plants are installed.

(H) MAINTENANCE: The Contractor must maintain the areas of Erosion Control Matting installation until final acceptance of the contract. Maintenance must consist of providing protection of Erosion Control Matting and the repair of areas damaged by equipment, erosion, fire, or other causes, to re-establish the grade and conditions of the area as specified.

GI-8.20.5 MEASUREMENT

The quantity of Erosion Control Matting to be paid for under this item must be the number of SQUARE YARDS actually installed at the site to the satisfaction of the Engineer.

GI-8.20.6 PRICE TO COVER

The price bid must be a unit price per SQUARE YARD of the Erosion Control Matting and must include the cost of all labor, materials, equipment, insurance, and incidentals necessary to complete and maintain the Work; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer.

The unit price bid of SQUARE YARD of the Erosion Control Matting (SPARE) must cover the cost of all material, equipment, insurance and incidentals required to fabricate and deliver the item to a location directed by the Engineer.

Payment will be made under:

Item No.	Item	Pay Unit
GI-8.20A	EROSION CONTROL MATTING	S.Y.
GI-8.20A-S	EROSION CONTROL MATTING (SPARE)	S.Y.

SECTION GI-6.02PA – PNEUMATIC EXCAVATION AROUND TREES

GI-6.02PA.1. INTENT.

This Section describes the excavation of trenches to be performed pneumatically around existing trees to remain.

GI-6.02PA.2. DESCRIPTION.

The Contractor must perform pneumatic excavation Work at locations where trees existing within the work area are required to remain. This Work requires the Contractor to protect tree roots during excavation and implement, as needed, a temporary excavation support system. Work covered under this section must be performed at the locations indicated on the Contract Drawings, in accordance with the specification, and as directed by the Engineer, in consultation with and under the supervision of a Tree Consultant in accordance with Section 4.21 of the NYCDOT Standard Highway Specifications, current edition.

GI-6.02PA.3. SUBMITTALS.

Follow the procedures in the NYC Department of Transportation's Standard Highway Specifications, General Conditions, **Section 1.06.31**.

(A) Qualifications: Submit letter documenting prior experience of Contractor performing pneumatic excavation.

(B) Shop drawings: Where required, the Contractor must submit design shop drawings for any temporary excavation support system to be used during the pneumatic excavation Work. The shop drawings must be prepared, signed, and sealed by a Professional Engineer currently licensed in the State of New York. The shop drawings must be submitted to the Engineer at least two (2) weeks before commencement of excavation. Excavation Work may not commence until the shop drawings are approved by the Engineer.

GI-6.02PA.4. QUALITY CONTROL

(A) OPERATOR QUALIFICATIONS: The Contractor or Subcontractor performing this excavation Work must have at least one year of documented experience operating the pneumatic excavation tool in conjunction with related equipment as described herein.

(B) TREE CONSULTANT: Unless otherwise directed by the Engineer, all pneumatic excavation Work must be performed under the direction of the Engineer, in consultation with the Tree Consultant (Item 4.21), also referred to as the Contractor's Certified Arborist.

(C) PRE-PNEUMATIC EXCAVATION MEETING: Prior to the start of such excavation, the Contractor and its approved Operator for pneumatic excavation must attend a meeting arranged by the Engineer, with the Tree Consultant (Item 4.21) and other parties as appropriate, to review the requirements of this item including the schedule of operations, the mandatory presence of the Tree Consultant, safety measures, reporting, etc. The Contractor is required to submit a schedule of his anticipated pneumatic excavations at this meeting.

GI-6.02PA.5. MATERIALS

Materials must meet the following requirements, as modified by any supplemental landscape specifications or special notes included in the contract documents. Where indicated, reference

must be to the latest revision/edition of Standard Specifications of the New York State Department of Transportation (NYSDOTSS):

(A) PNEUMATIC EXCAVATING TOOL. Excavation must be performed through the use of a pneumatic excavation tool with the following requirements:

(1) The high air velocity excavation tool must be specifically designed to fracture, pulverize, and displace porous and semi-porous soils without harming or causing damage to tree roots, existing subsurface utilities or other non-porous objects.

(2) The Contractor must submit catalog cuts from the manufacturer verifying that the Pneumatic excavation tool meets the following criteria:

Rated Operating Pressure: 6.2 – 7.0 bar

Air Stream Velocity at Cutting Head: 2,200 – 2,500 km/hr Air Displacement: 4,000 – 5,000 L/min

(B) AIR COMPRESSOR. The air compressor may be either a portable or truck-mounted unit and must be adequately sized as required to power the pneumatic excavation tool in accordance with the manufacturer's recommendations for the pneumatic excavating tool.

(C) VACUUM TRUCK. A vacuum truck should be used to collect excavated spoil directly from the trench or pit.

(D) CONTAINMENT STRUCTURE. To prevent the spread of excavated soil onto adjacent roadways and areas beyond the designated work zone limits, the Contractor must provide a mobile structure or barrier to contain the material dislodged by the pneumatic excavation tool from the trench or pit. Timber or corrugated metal shields, tents supported on tubular frames or other structures as approved by the Engineer may be used.

(E) ROOT PROTECTION. The following are required for root protection:

Table 6.02-1 Root Protection Requirements

Item	NYSDOTSS Articles
Quilted Covers	711-02
Burlap	711-06

GI-6.02PA.6. METHODS.

The Work must be performed where shown on the Contract Drawings and as directed by the Engineer.

(A) RESPONSIBILITIES OF THE CONTRACTOR: Prior to bidding, the Contractor must examine the site and available information, and formulate methods of construction that will not result in any damage to existing trees during excavation. The Contractor will be held liable for irreparable and/or irreversible damage to any trees harmed due to the Contractor's methods and must replace those trees as directed by the Department of Parks and Recreation, at no additional cost to the City.

(B) WORK SITE SAFETY: In addition to the DDC's Safety Requirements policy and responsibilities, the pneumatic excavation must be performed in accordance with the manufacturer's operating instructions. The Contractor must be responsible to provide adequate equipment and perform pneumatic excavation techniques properly to preclude movement of any air-borne soils onto adjacent roadways or other areas beyond the designated work zone limits. Failure to contain and/or collect the excavated soil will result in the immediate termination of pneumatic excavation until soil containment and/or collection procedures are determined adequate by the Engineer. The Contractor must keep the public at a safe distance from the work zone at all times by means approved by the Engineer.

(C) DUST CONTROL: The work area must be watered thoroughly at least twenty-four (24) hours in advance of, but no more than forty-eight (48) hours, prior to the start of any pneumatic excavation in order to reduce the incidence of airborne dust resulting from the pneumatic excavation operation.

(D) EXCAVATION – GENERAL: All excavation using the pneumatic excavation tool must be performed in accordance with the manufacturer's recommendations in order to remove soil without causing damage to the roots of trees, buried structures, and/or utilities either in or adjacent to the excavation. The Contractor must excavate within limits designated for pneumatic excavation shown on the Contract Drawings or as directed by the Engineer, in consultation with the Tree Consultant (Item 4.21), using the pneumatic excavating tool. When working near utilities, the Contractor must be responsible to locate underground facilities as required under 16 NYCRR Part 753 and Section 1.06.28 of the NYC Department of Transportation's Standard Highway Specifications.

(E) EXCAVATION – TEMPORARY EXCAVATION SUPPORT SYSTEM:

(1) Approved sheeting and bracing must be used where necessary to support the sides of the excavation, in order to: prevent damage to subsurface structures and adjacent buildings; safeguard persons and property; minimize inconvenience to traffic and the public; protect the structure to be installed; support the adjacent tree(s); and, provide suitable and safe working conditions. Except as otherwise provided, deviations from the above will be permitted only where, in the judgment of the Engineer, such exception will not result in any of the hazards described above.

(2) In cases where sheeting and bracing will not adequately protect adjacent structures from damage and settlement, the Contractor will be required to use such measures as are necessary to safely support and maintain adjacent and abutting property and structures, support the tree without causing damage to the tree, and to maintain the Work safe to life, limb, and property.

(3) All sheeting and bracing systems that the Contractor elects to use or that are ordered to use by the Engineer must comply with the requirements of Section 40.05, "SHEETING AND BRACING," of the NYC DEP, Standard Sewer and Water Main Specifications, and must receive the approvals stated therein.

(4) Unless otherwise specified in the Contract Drawings or these Specifications or specifically permitted in writing by the Engineer, the Contractor must be required to withdraw and remove all sheeting and bracing simultaneously with the backfilling of the excavation.

ROOT PROTECTION: The Contractor must place wet burlap or cotton mats upon both

the fibrous and structural roots immediately after they have been exposed by the pneumatic excavating tool. The burlap or cotton covering may be removed to perform inspection or construction operations, but the Contractor must be required to keep the burlap or cotton towels wet and the roots moist until backfilling is complete.

The Engineer must be immediately informed of any damaged tree roots. No tree roots may be pruned except as specifically authorized by the Tree Consultant (Item 4.21). In case the concentration of roots obstructs the placement of utilities, footings or other structures, limited pruning may be necessary as directed by the Tree Consultant (Item 4.21). Tree roots in excess of one (1) inch in diameter, measured at the edge of the excavation, must be cut cleanly at the edge of excavation using a sharp cutting tool. All root pruning must be performed under the direction of the Tree Consultant (Item 4.21).

(F) TREE CONDITION REPORT: The Contractor must supply the Tree Consultant (Item 4.21) with information as needed for the Tree Consultant to prepare periodic reports to the Engineer summarizing the number, type and condition of trees adjacent to each area of pneumatic excavation. These reports must also indicate the duration of open excavation and identify any root damage and mitigation actions taken.

(G) BACKFILLING: Refer to Section GI-6.02 PB “Backfilling Around Trees”, herein, for the requirements and procedures for backfilling excavated areas.

GI-6.02PA.7. MEASUREMENT.

The quantity to be measured for payment hereunder must be the number of cubic yards of soil and fill material removed by pneumatic excavation, completed, as described herein and to the satisfaction of the Engineer. The volume to be obtained by vehicle measurement.

In determining the vehicle measurement, only water level loads that have been raked by the Contractor to a flat exposed surface will be accepted by the Engineer and no allowance will be made for any crown or peak of the load.

GI-6.02PA.8. PRICE TO COVER.

The contract price bid for “PNEUMATIC EXCAVATION AROUND TREES” must be a unit price per cubic yard of material excavated as described herein, at the locations and to the limits indicated on the Contract Drawings or directed by the Engineer, in consultation with the Tree Consultant (Item 4.21). The unit price bid must include the cost of all labor, materials, plant, equipment, professional engineering design services, insurance, and all other Work incidental thereto needed to perform the excavation Work; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer. Disposal of excess and unsuitable (excluding contaminated) materials must also be included in the unit price bid for this Item 6.02 PA “PNEUMATIC EXCAVATION AROUND TREES.”

No separate payment will be made for replacement trees required by the Engineer in consultation with NYCDPR that the Contractor must acquire and plant as a result of damage to trees caused by the Contractor’s excavation methods.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.02 PA	PNEUMATIC EXCAVATION AROUND TREES	C.Y.

SECTION GI-6.02 PB – BACKFILLING AROUND TREES

GI-6.02PB.1. INTENT.

This Section describes the materials and methods for backfilling pneumatically excavated areas around existing trees to remain.

GI-6.02PB.2. DESCRIPTION.

The Contractor must be required to backfill pneumatically excavated areas around existing trees to remain. This Work requires the Contractor to protect existing tree roots and minimize grade changes around trees. Work covered under this section must be performed at the locations indicated on the Contract Drawings, in accordance with the contract documents, and as directed by the Engineer, in consultation with and under the supervision of a Tree Consultant (Item 4.21). in accordance with Section 4.21 of the NYCDOT standard highway specifications.

GI-6.02PB SUBMITTALS.

All submittals must be as per the NYC Department of Transportation's Standard Highway Specifications, General Conditions, Section 1.06.31.

(A) Proposed Samples and Test Results: The Contractor must submit two (2) one pound (1 lb.) bags of compost to the Engineer, with the testing report attached, for approval prior to delivering material to the site.

(B) The Contractor, at the direction and discretion of the Engineer, must furnish a certified report of an approved analytical chemist showing the mechanical and chemical analysis of representative samples of the compost they propose to use. All samples are to be taken by the Contractor and delivered to the Laboratory. The price bid must include laboratory and inspection charges.

(C) No compost must be delivered to the site until the Engineer has approved the samples, but such approval will not constitute final acceptance. The Engineer reserves the right to reject, on or after delivery, any material which does not, in the Engineer's opinion, meet these specifications. When compost is stored on the job, it must be done as directed by the Engineer.

(D) The Contractor must provide certification for the mycorrhizal fungi product.

GI-6.02PB QUALITY CONTROL

(A) TREE CONSULTANT: Unless otherwise directed by the Engineer, all backfilling must be performed under the direction of the Engineer, in consultation with the Tree Consultant (Item 4.21), also referred to as the Certified Arborist.

All work limits to be determined in the field by the Tree Consultant.

(D) PRE-BACKFIILLING MEETING: Prior to the start of backfilling, the Contractor and its approved Operator for backfilling must attend a meeting arranged by the Engineer, with the Tree Consultant (Item 4.21) and other parties as appropriate, to review the required composition of backfill material, the necessity of maintaining the existing grade, the mandatory presence of the Tree Consultant, safety measures, etc.

No staging or storage of equipment or materials must occur within the tree protection zone of the project.

GI-6.02PB.4. RESPONSIBILITIES OF THE CONTRACTOR.

Prior to bidding, the Contractor must examine the site and formulate methods and equipment that will not result in any damage to existing trees during backfilling operations. The Contractor will be held liable for irreparable and/or irreversible damage to any trees harmed due to the Contractor's methods and must replace those trees as directed by the NYC DPR, at no additional cost to the City.

GI-6.02PB.5. MATERIALS.

Backfill material must be composed of 5% compost, mycorrhizal fungi, and 95% excavated soil (from Item No. 6.02PA - Pneumatic Excavation Around Trees). Mix to be determined by volume, not weight. Materials must meet the following requirements, as modified by any supplemental landscape specifications or special notes included in the contract drawings. Materials must be thoroughly mixed before spreading, to the satisfaction of the Engineer.

(A) COMPOST. Compost must contain organic matter, or material of generally humus nature capable of sustaining the growth of vegetation, with no admixture of refuse or material toxic to plant growth. The Compost must be free of pathogens, stones, lumps, or similar objects larger than two inches in greatest diameter, as well as roots, brush and weeds.

Composts that have been derived from organic wastes such as food and agriculture residues, animal manures, composted leaves that meet the above requirements, and are approved by the New York State DEC, are acceptable compost sources. Compost must have an approximate N-P-K analysis of at least 1-1-0 as delivered, with a pH between 5.5 and 8.0 and a solids content of at least fifty percent (50%). Compost must have a minimum of twenty-five (25%) to a maximum of fifty percent (50%) organic material.

Compost must be furnished by the following manufacturers or approved equivalent:

- Long Island Compost, Islip, NY; or
- "Nature's Choice Compost" by Nature's Choice Corp., Union, NJ; or
- Agresoil compost by Agresource, Inc. Amesbury, MA; or an approved equivalent.
- Compost available from NYC Department of Sanitation may be acceptable for purposes of this specification. See www.nyc.gov/sanitation or www.nyccompost.org for pick-up sites.

Organic biosolids are not acceptable under this specification. Compost must not be delivered in a frozen or muddy condition.

(B) MYCORRHIZAL FUNGI INCOULANT. Fungi must be high quality mycorrhizal product from an approved source. Mycorrhizal fungi inoculants must be applied by means of a three ounce (3 oz.) premeasured dry formulation packet, such as Mycor Tree Saver Transplant®, as manufactured by Plant Health Care, Inc., Pittsburgh, PA; Rhizanova Tree Transplant, as manufactured by Becker Underwood, Inc., Ames, IA; DIEHARD®, as manufactured by Horticultural Alliance and distributed through Atlantic Irrigation, White Plains, NY; or, an approved equivalent. Packets must contain, as a minimum: one thousand (1000) live spores of Vesicular-Arbuscular fungi, including: *Entrephosphora Columbiana, Glomus clarum, Glomus etunicatum,* and *Glomus sp.;* seventeen million five hundred thousand (17,500,000) live spores of Ectomycorrhizal fungi, including: *Pisolithus tinctorius;* biostimulants including *Yucca schidigera* extract; soluble sea kelp derived from *Ascophylum nodosum;* humic acids;

and acrylamide copolymer gel as a water absorbent medium.

Mycorrhizal inoculant should be used for planting trees, woody shrubs, and woody groundcovers only; it not needed for herbaceous material. Mycorrhizal fungi inoculants must be added to the top six (6) to eight (8") inches of backfill soil in each planting pit and thoroughly mixed to distribute the inoculants. The opened packets must be given to the Engineer at the end of the day. Mycorrhizal inoculants is a dated material and must be used before it expires.

The material must be applied according to the following chart:

Table 6.02 PB-1 Mycorrhizal Inoculant Requirements for Backfilling Around Trees

Size of rootball	Ounces per tree
20"	6
30"	9
36"	12
42"	12

(C) EXCAVATED SOIL. Excavated soil should be stored on site in a mobile structure or protected by barriers and tents.

If recapture of excavated soil is less than 95% for the backfill of excavated volumes, the difference must be made up with additional topsoil. Topsoil must conform to Clay Loam constituent per Section GI-4.15. If recapture of excavated soil is more than 95% for the backfill of excavated volume, the excess soil must be removed from the site or reused as directed by the Engineer.

GI-6.02PB.6. BACKFILL PROCEDURES.

(A) WORK SITE SAFETY: The Contractor will be responsible in providing adequate equipment and perform backfilling operations properly to preclude movement of any air-borne soils onto adjacent roadways or other areas beyond the designated work zone limits. Failure to contain and/or collect the soil will result in the immediate termination of backfilling operations until soil containment and/or collection procedures are determined adequate by the Engineer. The Contractor must keep the public at a safe distance from the work zone at all times by means approved by the Engineer.

(B) DUST CONTROL: The work area must be watered thoroughly at least twenty-four (24) hours in advance of, but no more than forty-eight (48) hours, prior to the start of any backfilling in order to reduce the incidence of airborne dust.

(C) BACKFILLING – GENERAL: The Contractor must backfill within limits designated shown on the Contract Plans or as directed by the Engineer, in consultation with and under direct supervision of the Tree Consultant (Item 4.21).

No backfill material must be handled when, in the opinion of the Tree Consultant, is too wet. Place and spread approved backfill in dry weather on dry unfrozen grade. Ensure that all lumps are broken up and surface is smooth.

(D) ROOT PROTECTION: Roots should be protected by wet burlap or cotton mats upon exposure from excavation. The burlap or cotton covering may be removed to perform inspection or construction operations, but the Contractor must be required

to keep the burlap or cotton towels wet and the roots moist until backfilling is complete.

The Engineer must be immediately informed of any damaged tree roots. No tree roots may be pruned except as specifically authorized by the Tree Consultant (Item 4.21). In case the concentration of roots obstructs the placement of utilities, footings or other structures, limited pruning may be necessary as directed by the Tree Consultant (Item 4.21). Tree roots in excess of one (1) inch in diameter, measured at the edge of the excavation, must be cut cleanly at the edge of excavation using a sharp cutting tool. All root pruning must be performed under the direction of the Tree Consultant (Item 4.21).

(E) TREE CONDITION REPORT: The Contractor must supply the Tree Consultant (Item 4.21) with information as needed to prepare periodic reports to the Engineer summarizing the number, type, and condition of trees impacted by backfilling operation. These reports must also indicate the duration of open excavation and identify any root damage and mitigation actions taken.

GI-6.02PB.7. MEASUREMENT.

The quantity to be measured for payment hereunder must be the number of cubic yards of soil and fill material added by backfilling, completed, as described herein and to the satisfaction of the Engineer. The volume to be obtained by vehicle measurement.

In determining the vehicle measurement, only water level loads that have been raked by the Contractor to a flat exposed surface will be accepted by the Engineer and no allowance will be made for any crown or peak of the load.

GI-6.02PB.8. PRICE TO COVER.

The contract price for “BACKFILLING AROUND TREES” will be the unit price bid per cubic yard of material added as described herein, at the locations and to the limits indicated on the Contract Drawings or directed by the Engineer, in consultation with the Tree Consultant (Item 4.21). The unit price bid must include the cost of all labor, materials, equipment, professional engineering design services, insurance, and all other Work incidental thereto needed to perform the backfilling Work; all in accordance with the Contract Drawings, the specifications and the directions of the Engineer. Disposal of excess and unsuitable (excluding contaminated) materials must also be included in the unit price bid for Item 6.02 PB “BACKFILLING AROUND TREES.”

No separate payment will be made for replacement trees required by the Engineer in consultation with NYCDPR that the Contractor must acquire and plant as a result of damage to trees caused by the Contractor’s excavation methods.

Payment will be made under:

Item No	Item	Pay Unit
GI-6.02 PB	BACKFILLING AROUND TREES	C.Y.

SECTION GI-6.29 – TUBULAR MARKERS

GI-6.29.1 INTENT.

This section describes the Work of furnishing, installing, maintaining, and removing tubular markers.

GI-6.29.2 DESCRIPTION.

(A) PERMANENT TUBULAR MARKERS.

Under this section, the Contractor must furnish and install permanent tubular markers as indicated on the contract drawings and as directed by the Engineer.

(B) TEMPORARY TUBULAR MARKERS.

Under this section, the Contractor must furnish, install, maintain, relocate, and remove, when directed, temporary tubular markers as indicated on the contract drawings and as directed by the Engineer.

GI-6.29.3 MATERIALS.

Tubular markers must conform to the specifications set forth in the National Manual on Uniform Traffic Control Devices for Streets and Highways (National MUTCD) plus the New York State Supplemental (NYS Supplement) and must be NCHRP 350 approved as a Category 1 device. Tubular markers must have a minimum height of 36” (900- mm) and a minimum outside diameter of 2” (50-mm). Tubular Markers must be circular or elliptical in cross section and must have a maximum weight of 13-lb (6-kg), not including a mounting base.

Tubular marker colors must be as follows:

- Temporary tubular markers, tubular markers at bollards, and all other tubular markers: Orange
- Tubular markers at Green Infrastructure Assets: Black
- Or as directed by the Engineer

Tubular markers must have two horizontal circumferential stripes of white reflective sheeting a minimum of 3” (75-mm) wide. The top edge of the upper band must be a maximum of 2” (50-mm) from the top of the marker. The space stripes between must not exceed 6” (150-mm).

Reflective sheeting must conform to NYSDOT Standard Highway Specification Section 730- 05 Reflective Sheeting ASTM D4956 Type I or Type III. The sheeting must be bonded to the post with a precoated, pressure-sensitive adhesive or a tack-free, heat activated adhesive. Mechanical fasteners to bond reflective sheeting to the post will not be allowed.

For free-standing temporary tubular markers, the base and/or any nonflexible portion of the marker must not be more than 2” (50-mm) in height.

For tubular markers fastened to pavement, the bonding system used must be a fast-setting chemical compound, mastic-type material, or mechanical fastener capable of fixing the tubular marker to either concrete or asphalt pavement. The bonding system must not present a hazard to traffic if the tubular marker or base unit becomes unfixed from the pavement.

Acceptance of materials will be based on the manufacturer’s name and type of tubular marker appearing on the most current New York State Department of Transportation’s Approved List titled “Tubular Markers.”

GI-6.29.4 METHODS.

The Contractor must install tubular markers in accordance with the contract documents or as directed by the Engineer. The Contractor must attach the tubular markers to the pavement in a manner that prevents them from being moved or dislodged by traffic. Tubular markers must be installed on pavement that has been cleaned to remove pavement markings, oil, dirt, or other debris or substances that may interfere with a proper bond. Attachment to the pavement must be by mechanical fastener or by adhesive, in accordance with the manufacturer's recommendations. Bonding agents must be of sufficient amount or size to ensure proper bonding of the base to the pavement.

All temporary tubular markers must be maintained upright, at proper spacing, in proper alignment and orientation, kept clean, and replaced as required during the various stages of construction.

Temporary tubular markers removed or damaged by the Contractor's operations or by traffic must be replaced immediately, so that positive separation is maintained between opposing lanes of traffic at all times. Damaged reflective sheeting on interim tubular markers must be replaced before nightfall as necessary to maintain adequate visibility of the markers. In cases where only isolated individual markers are lost or damaged, and adequate visibility is maintained by the remaining markers, replacement will not be required until more than one (1) consecutive markers have been damaged or lost.

At the completion of the Work or when directed by the Engineer, the temporary tubular markers must be removed and disposed of away from the work site.

GI-6.29.5 MEASUREMENT.

(A) PERMANENT TUBULAR MARKERS.

The quantity to be measured for payment will be the actual number of Permanent Tubular Markers placed in the Work, to the satisfaction of the Engineer.

(B) TEMPORARY TUBULAR MARKERS.

The quantity to be measured for payment will be the actual number of Temporary Tubular Markers placed in the Work, to the satisfaction of the Engineer.

Payment will be made only for the initial installation of temporary tubular markers at any location. Whenever temporary tubular markers are moved to a new location, as required by the contract drawings or directed by the Engineer, payment will be made in the same manner as if it were an initial installation. However, only tubular markers that are in satisfactory conditions may be relocated to a new location. Minor movement of the temporary tubular markers from one side of the roadway to the other side, or rearrangement within a work area will not be considered as a movement to a new location and will not entitle the Contractor to additional payment.

No payment will be made for movements of Temporary Tubular Markers made for the Contractor's convenience; for movement of Temporary Tubular Markers at a given location at the end of a work period and subsequent replacement at the same location at the beginning of the next work period; for movement of Temporary Tubular Markers at a given location during a work period and subsequent replacement at the same location during the same work period; or for the interchanging of Temporary Tubular Markers between initial installations.

GI-6.29.6 PRICE TO COVER.

(A) PERMANENT TUBULAR MARKERS.

The contract price bid per each for Item No. 6.29 PTM – PERMANENT TUBULAR MARKERS, will cover the cost of furnishing all labor, materials, equipment, insurance, and necessary

incidentals required to complete the Work of furnishing and installing permanent tubular markers, all in accordance with the contract drawings, the specifications and the directions of the Engineer. No additional payment will be made for replacing damaged markers.

(B) TEMPORARY TUBULAR MARKERS.

The contract price bid per each for Item No. 6.29 TTM - TEMPORARY TUBULAR MARKERS, will cover the cost of furnishing all labor, materials, equipment, insurance, and necessary incidentals required to complete the Work of furnishing, installing, maintaining, relocating, and removing temporary tubular markers, all in accordance with the contract drawings, the specifications and the directions of the Engineer. No additional payment will be made for replacing damaged markers.

Payment will be made under:

Item No.	Item	Pay Unit
GI-6.29 PTM	PERMANENT TUBULAR MARKERS	EACH
GI-6.29 TTM	TEMPORARY TUBULAR MARKERS	EACH

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