Supplement To: CHAPTER 33

ROADWAY DRAINAGE

33.14 Green Infrastructure / Low Impact Development Stormwater Management

33.14.1 General

The purpose of this section is to provide design requirements for low impact development within a public right of way (ROW). The intent is to provide stormwater retention to meet the regulatory requirements while also providing the horticulturally appropriate soil volumes for healthy street trees and other plantings. Standard low impact development techniques to be used in the public ROW shall be permeable pavement and bioretention. In additional, refer to Chapter 47 for street tree and associated soil volume requirements. Other BMP types may be used with approval by DDOT and DDOE.

33.14.2 Authority

Designs shall comply with the unified approach to sizing stormwater management practices in the City, as described in the "Stormwater Management Guidebook" (Guidebook) by the District Department of the Environment (DDOE). The design requirements herein are in addition to those described in the DDOE Guidebook, and are intended to refine and clarify what design practices are preferred within the public ROW.

33.14.3 Permeable Pavement

Permeable pavement shall be used when approved by DDOT for use on specific projects, in lieu of traditional impervious pavement types, in appropriate locations within the public ROW. Types subjected to vehicular traffic loads include porous asphalt, pervious concrete, and permeable unit pavers. Other types not subjected to traffic loads may be allowed on a project by project basis, such as flexible pavement and plastic grid pavers.

33.14.3.1 Types of Permeable Pavement Facilities

The types of permeable pavement facilities and appropriate uses are tabulated below. Designs which differ from the table below may be allowed with DDOT approval.

Type / Application	Alley	Roadway*	Sidewalk	Covered Soil Volume for Plants	Trail
Porous Asphalt	●	●			●
Pervious Concrete	●	●	●	●	●
Permeable Interlocking Unit Pavers	●	●	●	●	
Other Unit Pavers **				●	
Porous Rubber			●	●	●
Plastic Grid Pavers				●	

* Appropriate for low volume roadways & dedicated parking lanes ** Spaced to allow infiltration

33.14.3.2 Permeable Pavement Cross Section

All Permeable Pavement Systems:

- The wearing surface shall consist of the type of pavement selected with any required bedding layers under the surface, in accordance with all applicable standard details, specifications and manufacturer recommendations as applicable. The wearing surface shall meet the latest ADA requirements.

Vehicular Use Permeable Pavement Systems (Roadway, Alleys):

- The choker layer is an open graded stone between the wearing surface and the reservoir layer, for providing separation and preventing migration between the layers due to the differences in material and void sizes underneath.
- The reservoir layer is an open graded stone for meeting the 1.2 inch retention volume requirement (to the maximum extent practicable, where applicable). The depth of the stone shall be determined in part based on the required storage volume for the site.

Pedestrian Use Permeable Pavement Systems (Sidewalk, Trail, Covered Soil Volume):

- The aggregate base layer is an open graded stone for meeting the 1.2 inch retention volume requirement (to the maximum extent practicable, where applicable). The depth of the stone shall be determined based on the required storage volume for the site, with a minimum of 6" where above tree soil volume, and 4" otherwise.
    - Beneath the aggregate base layer in sidewalk and trail areas, the subgrade shall be uncompacted, and scarified where feasible.
    - Beneath the aggregate base layer in covered soil volume areas, there is layer of structural soils as described in Chapter 47.

Other Components of Cross Section as Required By Site Constraints:

- Subsurface drainage by use of 4 inch to 6 inch diameter perforated underdrain in a separate layer of open graded stone below the reservoir layer, or within the reservoir layer, shall be used beneath all vehicular use permeable pavement installations unless elimination of the underdrain is expressly approved by DDOT.
    - For sites where native soil design infiltration rate is measured to be greater than or equal to 0.25 in/hour, the subsurface pipes may be elevated to provide infiltration sumps of reservoir stone below them. Use of such elevated pipes, called overdrains, is encouraged and provides enhanced retention. An alternative approach to an overdrain is an underdrain with an up-turned elbow outlet.
    - For designs with an impermeable liner on the bottom, the minimum slope of the subsurface drainage pipes is 2% and shall match the bottom (invert) slope of the facility.
    - For designs without an impermeable liner, the minimum slope of subsurface drainage pipes above the frost line shall be 0.5%. Otherwise, no slope is required.

- Geotextile meeting requirements of the current DDOT specification for use in stormwater facilities shall be placed on the sides of open graded stone, to prevent migration of adjacent fine material into the permeable pavement stone.
- Impermeable PVC liners should be used in permeable pavement systems as follows:
  - Facilities within 10 feet of a structure (e.g. an existing building) shall be lined on the side adjacent to the structure.
  - At the interface between pervious pavement and traditional pavement.
  - In areas where infiltration is not permitted, such as hot spots.
  - Facilities designed for water re-use or harvesting.
  - Where the installation is located on expansive soils, as recommended by the geotechnical engineer.

33.14.3.3 Contributing Drainage Area

The maximum contributing drainage area to permeable pavement surface area ratio is 4:1. Stormwater runoff from pervious areas often contribute sediment and lead to clogging and increased maintenance requirements for permeable pavement, and should be avoided to the extent possible. At least 95% of all areas draining to permeable pavement shall be impervious, not including the permeable pavement area itself, unless approved by DDOT. Pretreatment or specific maintenance program are options that DDOT will consider for approval where contributing drainage area is less than 95%.

33.14.3.4 Stormwater Conveyance

Stormwater conveyance from all impervious areas including standard pavement shall, to the extent feasible, drain to permeable pavement as sheet or overland flow. Otherwise pre-treatment for energy dissipation and sediment control shall be required where any concentrated flow is directed onto permeable pavement. Level spreaders may be designed to convert concentrated flow to sheet flow into the permeable pavement facility.

33.14.3.5 Pavement Design

For alley restorations, the DDOT approved standard drawings shall be used for permeable pavement installations.

For other pavements subjected to vehicle traffic loading, pavement design calculations shall be required, to include modifying the pavement cross section within the DDOT approved standard drawings to meet or exceed the pavement strength requirements. AASHTO methods for flexible pavement design shall be used for porous asphalt and permeable unit pavers. AASHTO methods for rigid pavement design shall be used for pervious concrete.

Testing of the bearing capacity for underlying soils shall be required for all permeable pavement design, shall be site specific and shall be in accordance with AASHTO methods.

Other considerations for the pavement design strength include:

- Edge restraints shall be used for all permeable unit pavers. Edge restraints may also be used for porous asphalt and pervious concrete as necessary.
- A geotechnical engineer shall determine the bearing capacity of underlying soils in the pavement design. In soft soils with low bearing capacity where infiltration is planned, geo-grid shall be use in lieu of removal of the material and placement/ compaction of selected backfill.

33.14.3.6 Reservoir and Underdrain/Overdrain Sizing for Retention Volume

The volume of storage for permeable pavements systems shall be designed to meet the regulatory requirements promulgated by DDOE, including applicable Maximum Extent Practicable (MEP) procedures. Storage design shall meet the following:

- Drawdown time for 1.2 inches of runoff volume over the contributing drainage area shall be 24 hours minimum and 48 hours maximum. Drawdown time shall be calculated using the DDOE Guidebook equations, based on infiltration rate of native soils at the invert of the facility, and the flow through the underdrains or overdrains.
- Volume shall be sized so that the peak discharge associated with the 2 year frequency storm does not surcharge the wearing surface at the low end of the facility. The total hydraulic sizing of the permeable pavement system, consisting of the permeable pavement structure and the adjacent storm drain system, shall meet 33.2 and 33.4.
- To achieve the design volume, the profile of the pavement shall be designed in one of the following scenarios, which shall be selected in consideration of the topography of the site and project budget:
    - Use of a terraced invert, with the slope between steps less than or equal to 2%. Vertical drop of terraced invert shall be 6” to 12”.
    - Use of a continuous bottom slope less than or equal to 2%.
    - Use of check dams with variable bottom slope, sized to not surcharge the low end of the wearing course.

33.14.3.7 Adjunct Components

- A minimum of two clean-outs/observation wells are required per facility and shall be shown on design plans.
- Signage for public awareness shall be provided when directed by DDOT

33.14.3.8 Limitations

- Bottom of permeable pavement system must be located at least two feet above the seasonally high water table
- Permeable pavements with infiltration are not allowed in Hot Spots as defined in the DDOE Guidebook.
- Permeable pavements should not be installed where sand use is expected, such as in residential areas where adjacent homeowners may treat walkways with sand.

33.14.4 Bioretention

Bioretention shall be placed within vegetated areas of the public ROW and landscaped with a selection of plants from the most recent DDOT-approved planting lists. Bioretention design shall be consistent with the DDOE Guidebook with the following additional requirements.

33.14.4.1 Types of Bioretention Facilities

- Bioretention Basins in Open Area: This type is a subset of DDOE's Traditional Bioretention, and is typically a moderate to large-scale bioretention cell with a 6" to 12" ponding depth. Typically these facilities will include shrub and groundcover, and sometimes tree plantings. Basins in open areas will typically have sloped sides.
- Curb Extension Bioretention: This type is a subset of DDOE's Streetscape Bioretention, and is generally placed in locations where a new curb is constructed into the parking lane to create an opportunity for bioretention, which may or may not incorporate a portion of the sidewalk. Off-line facilities without outlet curb cuts are preferred, although in a retrofit scenario, the existing crown and longitudinal grade of the curb may necessitate the use of an outlet curb cut.
- Streetscape Bioretention Planter: This type is a subset of DDOE's Streetscape Bioretention, and is typically a small-scale bioretention cell, often located between the curb and sidewalk, up to a foot lower than the surface of the sidewalk. These facilities may include tree, shrub and groundcover plantings. Streetscape Bioretention Planters will nearly always have vertical sides.
- Bioswale: This type is a consistent with DDOE's Dry Swale/ Bio-swale, and is a drainage channels or linear infiltration basins adjacent to either the roadway or the sidewalk, typically vegetated with trees, shrubs, groundcovers or turf. Bioswales may be designed to convey or retain stormwater. Swales adjacent to roadways and that receive stormwater runoff from roadway surfaces shall be designed according to the requirements of the DDOE Stormwater Guidebook as open channels.

33.14.4.2 Bioretention Cross Sectional Components

Soil types used in the various bioretention facilities shall be in accordance with the DDOT approved specification.

Soil Profiles

In addition to requirements of DDOE, bioretention facilities shall be designed as follows:

- The soil profile within Basins, Curb Extensions, Planters and Bioswales shall consist of 18 to 36 inches of Bioretention Soil, sized to meet the retention volume requirements, to the maximum extent practicable where applicable.
- Where subsurface drainage is required:
  - A choker layer consisting of a minimum of 3 inches of sand and gravel shall be placed beneath the planting soil to prevent the planting soil from migrating into underlying stone.

  - A layer of 9 to 12 inches of open graded stone shall be placed beneath the choker layer, with perforated pipes embedded in the #57 stone. Geotextile shall be placed on the sides of the #57 stone.
  - Additional stone beneath the first 9 to 12 inches may be provided to enhance the infiltration volume of the facility.
- Impermeable PVC liners are to be used in bioretention facilities as follows:
  - Facilities within 10 feet of a structure (e.g. an existing building) shall be lined on the side adjacent to the structure.
  - Facilities within 5 feet of the roadway face of curb shall be lined on the side adjacent to the roadway.
  - In areas where infiltration is not permitted, such as hot spots, shall be lined on all sides. In this case, subsurface drainage is required.

33.14.4.3 Contributing Drainage Areas

The impervious and compacted cover areas that drain into bioretention facilities should be limited in size to prevent excessive saturation of soils and the consequent development of anaerobic soil conditions. The maximum contributing drainage area to bioretention surface area ratio is as follows:

- for bioretention basins, curb extensions, and streetscape bioretention planters without subsurface drainage: 20:1
- for bioretention basins, curb extensions, and streetscape bioretention planters with subsurface drainage: 33:1
- for other bioswales and open drainage channels: based on engineering design

33.14.4.4 Allowable Ponding Depths

Allowable ponding depth in bioretention facilities shall be selected by designers based on the adjacent land use, expected pedestrian activity, and the associated need for railings around the facilities. The DDOT approved standard drawings indicate maximum allowable ponding depths for some facility types.

- Bioretention Basins: May be designed at depths that will require railing of fencing. For online facilities, provide a minimum of 3" freeboard from overflow structure to overtopping elevation.
- Curb Extensions and Bioswales: Shall be designed with depths and/or side slopes which do not require railings.
- Streetscape Bioretention Planter: May be designed at depths that will require railings.

33.14.4.5 Bioretention Sizing and Hydraulic Design for Stormwater Retention Volume

The volume of storage for bioretention facilities shall be designed to meet the regulatory requirements promulgated by DDOE, including applicable Maximum Extent Practicable (MEP) procedures. Storage design shall meet the following:

- In accordance with DDOE requirements, at least 50% of the retention volume should be provided as surface water storage in bioretention areas. Up to 50% of the retention volume can be provided through the void spaces in the bioretention soil, crushed stone layers, and stormwater pipe systems.
- Drawdown time for 1.2 inches of runoff volume over the contributing drainage area shall be 24 hours maximum. Drawdown time shall be calculated using the DDOE Guidebook equations, based on infiltration rate of native soils at the invert of the facility, and the flow through the underdrains or overdrains.
- Check dams in bioswales and bioretention curb bump-outs may be necessary to achieve the storage volume, to slow velocities, or both.
- Slopes of bioswales shall be designed to prevent erosion based on anticipated stormwater flow rates. Jute or coir erosion control mats shall be used to stabilize soils until plant materials have been established.
- Pre-treatment devices in accordance with DDOE requirements are required. Applicable choices include:
    - Bioretention in Open Area: Stone-filled forebay or spreader, stone diaphragm, or grass filter strip.
    - Curb Extensions: Concrete entry forebay as depicted in DDOT standard drawings.
    - Streetscape Bioretention Planters: Stone forebay/splash block adjacent to curb cut, trash rack or leaf screen across curb cut.

33.14.4.6 Adjunct Components

- A minimum of two clean-outs/observation wells are required for basins and curb extensions, and shall be shown on design plans. For continuous bioretentuion facilities, clean-out/observation well frequency shall be recommended by designer and approved by DDOT.
- Edges around bioretention facilities may be sloped or vertical (short walls or thickened curb).
    - Railing around bioretention with vertical edges is required when drop from sidewalk to bioretention surface is $\geq$ 12 inches. Top of railing shall be 18" above sidewalk, with vertical and/or horizontal member spacing which meets ADA detection requirements for visually impaired pedestrians.
    - When sides are sloped, the finished grade must be stabilized according to DDOT requirements.
- Pedestrian crossings of continuous bioretention facilities adjacent to curb are required as below. The crossing shall meet ADA requirements.
    - 35 foot maximum spacing in high pedestrian volume areas
    - 70 foot maximum spacing in other areas

- Parking egress strip of a width between 18" and 24" (measured from face of curb) shall be provided adjacent to parking lanes where total public space width is at least 12 feet between face of curb and back of sidewalk, using the remaining space available after deducting the required walkway width and bioretention width requirements.
- Signage for public awareness shall be provided when directed by DDOT.

33.14.4.8 Limitations

- Bottom of bioretention must be located at least two feet above the seasonally high water table.
- Bioretention with infiltration is not allowed in Hot Spots as defined by DDOE.

33.14.5 Utility Conflicts

Being prepared in conjunction with utility agency coordination.

33.14.6 Designing to the Maximum Extent Practicable

Being prepared in conjunction with the MEP Procedure in the DDOE Stormwater Guidebook.

33.14.7 Submittal Requirements

Being completed in conjunction with the MEP Procedure in the DDOE Stormwater Guidebook.

Information to be included with the 65% design submittal and subsequent design submittals will include:

- Plans with the type, locations and dimensions of all stormwater management facilities and associated planting plans, with key elevations depicted as follows:
    - Inflow elevation
    - Outflow elevation (for online facilities)
    - Invert elevation of bioretention surface
    - Top of ponding elevation
    - Bottom of reservoir/stone layer (bottom of storage)
    - If applicable, underdrain connection point with tie-in invert elevation.
- Calculations showing contributing drainage area ratios for each facility.
- Calculations of stormwater retention volumes, required versus provided.
- Statement from a geotechnical engineer or soil scientist relative to anticipated infiltration rates in the subsoil.

Supplement To: CHAPTER 47

LANDSCAPE DESIGN CRITERIA

47.7 Enhanced Tree Space Design

Street trees shall be selected from approved lists, and placed in appropriate locations within the public ROW. Surrounding soils, including nearby soils under sidewalks shall comply with the design requirements noted below.

47.7.1 Minimum Soil Volumes

Based on trees selected from the DDOT approved lists, the following are the minimum allowable soil volumes for tree rooting:

- Large Trees: 1,500 cubic feet of soil within a 27 foot radius.
- Medium Trees: 1,000 cubic feet of soil within a 22 foot radius.
- Small Trees: 600 cubic feet of soil within a 16 foot radius.
- Where soil volumes within the maximum allowable radii for adjacent trees overlap, up to 25% of the required soil volume per tree may be shared.
- For trees that are designed to have a covered soil volume which connects to an open area (for example behind the sidewalk), the open area can be considered as part of the required soil volume.
- For existing trees to remain, the root structure of existing tree shall be protected to the extent feasible and provided with additional soil volumes to meet the above requirements.

47.7.2 Tree Planting Design in New or Reconstructed Streetscapes

- Tree Planting space within sidewalk areas with soil volume beneath pavements shall be a minimum of four feet wide by a minimum of six feet long. Larger tree boxes may be required to accommodate large root balls or additional plant materials.
- Tree Planting space with continuous open areas adjacent to sidewalk may be one of the following:
    - Turf area between trees, defined as “turf strip infiltration”.
    - Mulched area between trees, defined as “plant bed”.
- The size of the open tree planting area is influenced by the site as follows:
    - For narrow public space areas equaling 10’ or less, the open tree space will typically be set at the minimum opening, with a goal of providing additional paved surface for pedestrian usage.
    - For wider public space areas, the open tree space can be continuous, with pedestrian crossings as required in 47.7.8.

- In areas where pedestrian activity is not expected to be significant, it is not necessary to follow the above guidance.

47.7.3 Tree Planting Design Retrofits

- Tree Planting space within existing sidewalk areas that do not have soil volume beneath pavement shall be a minimum of six feet wide by a minimum of nine feet long. Tree Planting space dimensions shall be reduced as necessary based on physical constraints as approved by DDOT.
- To the extent feasible, soil rooting volumes shall be expanded by creating turf infiltration strips, or by placing soils beneath pavements extending along the sidewalk or across the sidewalk. Refer to Section 33.14.4.

47.7.4 Covered Soil for Meeting Tree Soil Volume Requirements

In order to provide adequate soils for street trees, horticulturally appropriate soils must often be placed beneath the adjacent paved surfaces. Acceptable soil systems include Suspended Pavements, CU Soil and Sand-Based Structural Soil (SBSS).

- Suspended pavements include structural slabs that span between structural supports and commercially-available structural systems. Manufacturer details and certification must be provided for commercial systems. Structural calculations and details must be provided for other Suspended Pavement installations. Soil placed beneath Suspended Pavements shall be a minimum of 30 inches of Bioretention Soil.
- The Sand-Based Structural Soil System is a non-propriety soil system that typically includes a minimum of six inches of open graded crushed stone over a minimum of 30 inches of Sand-Based Structural Soil. Aeration of the overlying stone and a source of water are essential components.
- CU Soil is a proprietary product and shall be obtained only from licensed facilities. CU Soil shall not be used in conjunction with stormwater infiltration.

47.7.5 Tree Space Soil Volume Cross Section

Soil Types

Soil types used in the tree space, in accordance with the DDOT approved specification, are generally described as follows:

- Plant Bed Soil: used for the top 12 inches of open planting beds.
- Lawn Soil: used for the top 12 inches in turf or other areas that will experience moderate or heavy foot traffic.
- Bioretention Soil: used in bioretention basins, bioswales, curb extensions, and beneath suspended pavements.
- Sand-Based Structural Soil (SBSS): used to support pavements and as horticultural subsoil beneath Plant Bed and Lawn Soils.

- CU Soil: used to support pavements and obtained only from licensed CU Soil providers.

Soil Profile

- The soil profile of tree space soil volume is as follows:
  - For Plant Beds 12 inches of Plant Bed Soil over a minimum of 18 inches of Sand-Based Structural Soil.
  - For Turf Infiltration Strip, 12 inches of Lawn Soil over a minimum of 18 inches of Sand-Based Structural Soil.
  - For Covered Soil Volume, a minimum of 12" of Plant bed Soil over 18 inches of Sand-Based Structural Soil at open tree areas. In covered areas, 30 inches of Sand-Based Structural Soil, with 6" of washed open graded aggregate between SBSS and covered surface.
- Where subsurface drainage is required per Section 47.7.9 (not including Bioretention Basins):
  - A layer 12 inches of sand shall be placed over scarified subsoil, and:
  - If infiltration rate is less than 0.14 inches per hour, subsurface drain pipes (with geotextile surround) shall be embedded in the sand and connected to the stormwater drainage system.
- Prior to placing bottom layer of the soil profile, the sub-soil shall be loosened by tilling, ripping, trenching or a similar means to maximize infiltration.

47.7.6 Stormwater Retention and Treatment Volume

Tree space with expanded soil volume will serve as a method of capturing and retaining the required 1.2 inches of stormwater in accordance with DDOE requirements. These facilities can be designed to meet the requirements of the DDOE's Bioretention type "Engineered Tree Box", whether designed as an enclosed plant bed with covered soil volume, or a continuous open area (either mulched or with turf) with soil volume under the adjacent sidewalk.

For tree spaces designed to retain water, the maximum contributing drainage area to bioretention surface area ratio is 4:1.

47.7.7 Stormwater Conveyance for Irrigation of Soil

- Soils beneath pavements should be irrigated by no less than 0.5 times, and no more than 4.0 times, the area of infiltration.
- For tree rooting soils beneath pavements the optimum strategy for providing an even distribution of stormwater for irrigation and infiltration purposes is the use of permeable pavements.
- Where feasible, permeable pavements shall used in Suspended Pavement or Sand-Based Structural Soil installations. Approved geogrids shall be placed beneath non-interlocking permeable pavements.

- Where permeable pavements are not used, linear drains with grates discharging directly to SBSS or small watersheds draining to catch basins with distribution perforated pipes to the soils shall be provided.
- Where the covered soil volume includes impervious cover of not more than 6 feet in width, the use of linear drains or catch basins is optional.
- Stormwater retention capacity shall be created over all Suspended Pavement Soils or Sand-Based Structural Soils by using 6" minimum depth of uniformly graded crushed stone materials, such as #8 or #57 stone.

47.7.8 Adjunct Components

- Pedestrian crossings of continuous open planting strips adjacent to curb are required as below. The crossing shall meet ADA requirements.
  - Alternating between trees in high pedestrian volume areas
  - Alternating every other tree in other areas
- Parking egress strip of a width between 18" and 24" (measured from face of curb) shall be provided adjacent to curb in metered/paid street parking zones where total public space width is at least 12 feet between face of curb and back of sidewalk, using the remaining space available after deducting the required walkway width and minimum open tree space dimension requirements.
- Ornamental fencing meeting DDOT requirements may be required around open tree planting space to protect planting soil from pedestrian foot traffic.
- Bike racks may be combined with ornamental fencing around open tree planting space. Type of rack to be selected in coordination with DDOT project manager.

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47.7.9 Soil Testing and Subsurface Drainage

Natural Resources Conservation Service (NRCS) Soil Mapping hydrologic units may be used where applicable to estimate subsoil infiltration rates or soils may be tested directly by measuring in-place infiltration rates. Where infiltration rates are measured directly tests shall be at a frequency of not less than one test per 1000 square feet. DDOT may require additional testing where variable soil conditions are anticipated.

Infiltration Rate	NRCS Soil Group	Subsurface Requirement
$\geq$ 0.5 in/hr	A or B	None
Between 0.14 and 0.5 in/hr	C	12" of sand beneath street tree soil volume
$\leq$ 0.14 in/hr	D	12" of sand with 4" perforated underdrain, (with geotextile surround) beneath street tree soil volume – connected to the storm drainage system

47.7.10 Structural Support

All structural elements, including pavements and curbs, must be founded over structurally stable soils. Stable soils should extend laterally from the point of support at a slope of 1 horizontal to 2 vertical in the downward direction. Plant Bed, Lawn and Bioretention Soils are not structurally stable. SBSS and CU Soil are structurally stable.

47.7.11 Submittal Requirements

Information to be included with the 65% design submittal and subsequent design submittals will include:

- Plans with the type, locations and dimensions of all tree spaces.
- Pavement and soil profiles with all conflicts, including supporting structural calculations for permeable pavement under traffic loadings.
- Calculations showing contributing drainage area ratios for each facility.
- Calculations of stormwater retention volumes, required versus provided.
- Calculations of soil rooting volumes, per street tree.
- Statement from a geotechnical engineer or soil scientist relative to anticipated infiltration rates in the subsoil.
- If soil volume calculations include soils other than SBSS and planting soils in tree boxes, planting beds, bio-swales or bioretention areas within the sidewalk area (e.g. adjacent open areas), a statement from an arborist or soil scientist determining the volume of horticulturally appropriate soils shall be submitted.