# SECTION 01 57 29

# TEMPORARY PROTECTION OF GREEN INFRASTRUCTURE FACILITIES

DESIGNER NOTE: The specifications below are based on the best available information. Designer should modify the specifications to satisfy project-specific constraints.

## GENERAL

### SUMMARY

#### This Section specifies the general requirements for providing temporary protection of green infrastructure (GI) facilities before, during, and after construction.

#### GI facilities are certain surface or subsurface facilities such as, but not limited to bioretention planters, subsurface systems, and permeable pavement that are designed to receive and then detain, retain, and/or infiltrate stormwater runoff.

#### Requirements in this section include temporary erosion & sediment (E&S) controls, diversion of flows and protection of infiltration areas.

### RELATED SECTIONS

#### Section 01 56 39 – Temporary Tree and Plant Protection

#### Section 01 57 13 – Temporary Erosion and Sediment Control

#### Section 01 57 30 – Protection of Adjacent Green Infrastructure

#### Section 01 71 33 – Protection of Adjacent Construction

#### Section 31 23 00 – Excavation and Fill

#### Section 32 01 90 – Operation and Maintenance of Planting

### DEFINITIONS

#### Bioretention Planter: Vegetated bed or basin that receives stormwater inflow (through curb cuts, pipe outfall, or similar) to provide flow control and water quality treatment.

#### Erosion and Sedimentation Best Management Practices (“E&S BMPs”): Facilities, measures or procedures used to minimize accelerated erosion and sedimentation and manage stormwater to protect, maintain, reclaim and restore the quality of stormwater runoff before, during, and after earth/soil disturbance activities.

#### Permeable Pavement: Paving system that reduces surface stormwater runoff via infiltration either through the paving material or through void spaces between individual paving blocks.

#### Subsurface System: A subsurface infiltration system is an underground stormwater storage structure that receives inflow through sub-surface piping. Also known as a dry well, stormwater drainage well, stormwater injection well, infiltration gallery or seepage pit. This facility stores stormwater in subsurface void spaces and slowly filters through the bottom of the trench into the native soil or is stored for later reuse.

#### Pretreatment System: A structure that separates coarse sediment and floatables (trash, debris, and, in some instances, oil) from stormwater before it enters a GI facility.

#### Soil Buffer Layer: Layer of native soil left in place within the footprint of a GI facility during construction of planter walls, curbs, gutters, flush concrete bands, and adjacent pavement in order to minimize subgrade compaction and the introduction of construction fines, sediment, and debris to the subgrade prior to placement of stone base, reservoir layers, and soil filter mix.

#### Soil Filter Mix: Engineered soil for backfill in bioretention basins designed specifically for infiltrating and cleansing stormwater.

### GENERAL REQUIREMENTS

#### Coordinate the work of this section with the work of Section 01 57 13 Temporary Erosion and Sediment Control.

#### The Contractor shall implement E&S BMPs at the location of all GI facility construction areas to eliminate the discharge of sediment and pollutants into the GI facilities’ infiltration area or onto the infiltration surfaces. The Contractor shall also implement E&S BMPs within larger GI facilities during construction to prevent erosion and the creation and transport of sediment within the facility footprint (for extended linear GI facilities such as permeable paver parking strips, etc.).

#### The Contractor shall implement surface flow diversion practices at the location of subsurface system, permeable pavement, and bioretention areas to eliminate the inundation, flooding, and conveyance of silt, sediment, and other types of contamination into/onto the infiltration areas and infiltration surfaces both during and immediately after construction. Design and install the surface flow diversions to divert runoff from adjacent surfaces to maintain an offline condition for newly constructed Green Infrastructure features. The surface flow diversion measures shall remain in place until all upstream construction is complete, adjacent surfaces are stabilized and cleaned, and all bioretention area plantings are established in a "rooted-in" condition.

#### The Contractor shall maintain a Soil Buffer Layer within the footprint of all infiltrating GI facilities following demolition of existing pavement, and throughout construction of outflow structures and piping, wall structures and permeable pavement ribbon curbs, and curbs/gutters. Soil buffer layer shall remain in place until all adjacent and upstream construction is complete, and adjacent surfaces are stabilized and cleaned. Upon completion of adjacent and upstream construction, remove soil buffer layer and excavate to full subgrade depth, and then immediately place stone base, reservoir layers, and soil filter mix.

#### Educate on-site personnel and maintain awareness of the importance of protecting GI facilities during construction. Site supervisors or the site safety representative shall discuss GI facility protection at the regular tailgate meetings conducted in accordance with the SWPPP or Erosion and Sediment Control Plan (“ESCP”) to discuss site erosion and sediment control.

### SUBMITTALS

#### In accordance with requirements of this Specification Section, the Contractor shall prepare and submit for approval the following documents within 30 days after the Notice to Proceed. These documents must be approved by the City Representative prior to initiation of any ground disturbing activities that may affect any existing GI facility.

##### GI Protection Plan: The City may require this document be prepared by a Qualified SWPPP Developer or Qualified SWPPP Practitioner. If this contract requires an ESCP or SWPPP, the GI Protection Plan will serve as a supplement to the those documents.

##### GI Protection Schedule: Describes which E&S BMPs will be deployed as well as where and when they will be installed, adjusted, and removed.

#### The Contractor shall be paid per the applicable bid item. If no such bid items exist, the preparation of the GI Protection Plan and GI Protection Schedule and for executing the erosion control measures shall be included within the Total Bid Price (refer to Section 00 41 10), and the City will make no separate measurement or payment for such work.

#### The GI Protection Plan shall be prepared in accordance with the following outline:

##### Clearly identify all Green Infrastructure facility areas to be protected during construction and the locations and types of E&S BMPs that will be installed to provide protection.

##### Following construction of each Green Infrastructure facility, clearly identify the locations and types of E&S BMPs that will be installed to provide protection through the plant establishment period and substantial completion of overall construction.

##### Identify all potential sediment sources and other pollutants (both permanent and temporary).

##### Identify the areas of likely concentrated flow.

##### Identify responsibilities of implementation and maintenance activities for each facility.

##### Provide a chain of responsibility, or allow for the City Representative to define the chain of responsibility between the City, general contractor, subcontractors, and vendors. Chain of responsibility shall identify which parties are responsible for which aspects of the maintenance and protection of each GI facility throughout the duration of construction.

##### Identify all temporary protection practices that may include:

###### Installation and maintenance of perimeter controls

###### Construction phasing

###### Vehicle tire mud tracking control

###### Temporary soil stockpile protection

###### Temporary aggregate stockpile protection

###### Soil Buffer Layer

###### GI facility inlet diversions

###### Flow diversion around GI facilities

##### Provide flow line elevations at flow diversion locations, indicating that positive drainage is being maintained.

#### The GI Protection Schedule shall be prepared in accordance with the following outline:

##### Provide beginning and end dates for construction and protection of each Green Infrastructure facility area.

##### Provide dates for each Green Infrastructure area indicating when construction E&S BMPs will be removed and replaced with post-construction E&S BMPs. Post-construction E&S BMPs will remain in place through the plant establishment period and substantial completion of overall construction.

## PRODUCTS

### GEOTEXTILE FABRIC (SILT FENCE AND FILTER FABRIC)

#### The physical properties of the geotextile for silt fence and filter fabric shall be as follows: weight 3 oz/yds, thickness 15 mils, grab tensile strength 100 lb, grab elongation 20%, mullen burst 235 min, trapezoidal tear 50 min, ultra-violet stability >90% strength retained, permeability-k 0.01 em/sec, and apparent opening size -50 test value.

### PLASTIC SHEETING

#### Plastic sheeting shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material. Plastic sheeting is intended to protect material stockpiles and completed GI work from inundation and sediment deposition.

### SANDBAGS / GRAVEL BAGS

#### Sandbags / gravel bags shall be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight 4 oz/yd2, mullen burst strength exceeding 300 psi in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not acceptable. All sandbag / gravel bag fill material shall be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material, conforming to the provisions in Standard Specifications Section 68-1.025 “Permeable Material.” Where applicable, place sand bags / gravel bags to provide flow diversion around the GI installation.

### ROCK SOCK

#### Rock socks are constructed of gravel that has been wrapped by wire mesh or a geotextile to form an elongated cylindrical filter. Where applicable, place rock socks typically either as a perimeter control or as part of inlet protection. When placed at angles in the curb line, rock socks are typically referred to as curb socks. Where applicable, use rock socks to trap sediment from stormwater runoff that flows onto roadways as a result of construction activities and to avoid sediment from being deposited in GI installations.

### COMPOST FILTER SOCK

#### Filter socks are three dimensional tubular devices used to trap the physical, chemical, and biological pollutants in stormwater. Where applicable, use during the GI construction phase to act as temporary filters to protect GI facilities, inlets and to provide perimeter controls. The physical properties of the filter sock netting shall be as follows: 5mm thick continuous HDPE filament, 12-in. diameter tubular knitted mesh with 3/8-in. openings.

### ERTEC EDGE GUARD (or equivalent)

#### A temporary sediment barrier made of high density polyethylene (HDPE) containing an integrated filter. Where applicable, before the start of construction, place the barrier along the perimeter and curb of GI facilities to eliminate sediment deposition. Edge Guard is used to intercept sediment and mulch laden water and prevent the sediment, mulch and associated pollutants from entering the GI installation, street and the storm drain system. The system reduces the velocity of water and allows it to flow-through, discouraging end-around flows, under and overflow.

### ERTEC S-FENCE (or equivalent)

#### A temporary sediment barrier made of high density polyethylene (HDPE) containing an integrated filter. Where applicable, before start of construction, place the device along the perimeter and curb of GI facilities to eliminate sediment deposition. S-Fence intercepts and filters sediment laden water and significantly reduces the sediment and associated pollutants that would otherwise be deposited on or in GI installations and reach the storm drain system. The system reduces the velocity of water and allows it to flow-through, discouraging end-around flows, underflow, and overflow.

### ERTEC PROWATTLE (or equivalent)

#### A water velocity interruption device for slope stabilization or a temporary perimeter sediment barrier with a hinged flap at the bottom made of high density polyethylene (HDPE) containing an integrated filter. Where applicable, place this device along the perimeter and curb of GI facilities to eliminate sediment deposition. ProWattle is used to intercept sediment laden water and the associated pollutants from entering the GI installation, street and the storm drain system. The system reduces the velocity of water yet allows it to flow-through, discouraging end-around flows, under and overflow. Use ProWattle along the inside and outside perimeters of a construction project or around temporary stockpiles.

### DIVERSION/BYPASS PIPING

#### Diversion/bypass piping is for bioretention planters that have outlet structures located within the planter. Where necessary, install temporary piping to convey surface flows to existing catch basin inlet or outlet structure, either within the GI facility or downstream of the GI facility.

## EXECUTION

### GENERAL

#### Inspect erosion and siltation control devices and provide corrective measures for deficiencies 24 hours prior to a forecasted rain and immediately after each rainfall, and at least daily during prolonged rainfall. Deficiencies shall be corrected immediately. If the Contractor fails to correct or take appropriate actions to remedy the specified deficiencies, the City Representative will require Contractor to discontinue work in other areas and concentrate efforts toward rectifying the specified deficiencies. The City reserves the right to remedy the specified deficiencies and deduct the entire cost of such work from monies due Contractor.

#### The GI Protection Plan may utilize plans, details, notes, and other information provided in the construction documents; however, such information shall not, in itself, be construed to meet the requirements of this Section 01 57 29. Observe firsthand the conditions of the site and then provide additional detail to ensure that the measures implemented accurately reflect the Contractor's means and methods for construction, to include: construction sequencing, site layout, construction access, temporary facilities, specific sedimentation, erosion and runoff discharge controls, and project organization.

### PERIMETER CONTROLS

#### Provide perimeter controls to protect off site areas, natural resource features, and GI facilities from disturbances that generate sediment-laden runoff and compaction from vehicle traffic. Drip lines of trees, soil and aggregate stockpiles, and infiltration areas are a few of the key features that Contractor must protect to prevent sedimentation and soil compaction during the GI construction process. Provide perimeter controls through the entire GI construction and acceptance process, even after pavement is in place. Until the site is stabilized and vehicle tracking and deposition of sediment from upstream sources is no longer an issue, protect GI facilities and keep off line.

#### Prevent water and sediment from entering the GI facility excavation or backfill materials. Should runoff enter the work area or backfill materials, remove and dispose of all accumulated sediment and silt and the contaminated backfill materials. Re-establish acceptable compaction and void ratio specified for last layer before proceeding with operations.

### E&S BMP INSTALLATION

#### During Construction – E&S BMPs are required for each green infrastructure area while construction is underway. Provide flow diversion throughout the duration of construction of each Green Infrastructure facility.

##### Use E&S BMPs to protect Green Infrastructure facility construction areas.

##### Direct flow around Green Infrastructure facility construction areas to avoid introduction of flows and sediment during construction.

##### Place flow diversion E&S BMPs to avoid creating ponding at local low points.

##### Install diversion/bypass piping to re-route flows around Green Infrastructure facilities where surface flow diversion is not possible.

#### Post Construction – Upon completion of construction of each green infrastructure facility, E&S BMPs continue to be necessary but the limits of the protected area may change. Provide flow diversion through substantial completion of construction and the plant establishment period, until all adjacent and upstream areas are paved and stabilized.

##### Reduce extent of E&S BMPs in the vicinity of completed Green Infrastructure facilities.

##### Locate E&S BMPs to block all GI facility inlets and to direct surface runoff to adjacent downstream catch basins.

##### Install diversion/bypass piping to re-route flows around Green Infrastructure facilities where surface flow diversion is not possible.

##### Leave underdrain valves open during post-construction period, where applicable.

##### Perform acceptance flow testing after initial plant establishment period (3 months).

### BIORETENTION FACILITIES

#### Protect subgrade with a soil buffer layer which shall remain in place until all adjacent and upstream construction is complete, and adjacent surfaces are stabilized and cleaned. Remove soil buffer layer and excavate to full subgrade depth upon completion of adjacent and upstream construction, and then immediately place stone base, reservoir layers, and soil filter mix.

#### Protect bioretention areas and plants against damage during the plant establishment phase.

#### Maintain all temporary fences, sand / gravel bags, barriers, silt screens, and signs as required for protection.

#### The Contractor shall rehabilitate any bioretention basin soil that is damaged through sediment loading and fails to meet the minimum infiltration rates listed in Section 32 19 13 or as directed by the City Representative at no additional cost to the City.

#### Do not allow stormwater to enter the bioretention basin during construction and staging, thereby reducing impacts on the subgrade, aggregate storage layers, and soil filter mix from high sediment loads associated with construction.

#### Block all inlets to bioretention facilities using sand / gravel bags or equivalent, silt screens and diversion/bypass piping to eliminate inflow of stormwater and sediment into the bioretention basin. Sand / gravel bags, screens and diversion/bypass piping shall remain in place until all construction and staging upstream is complete and plants are established.

#### If a bioretention facility receives runoff from the site and therefore is contaminated with sediments, remediate the facility. Remediate the facility by excavating all soil filter mix and aggregate and overexcavating sub-grade by at least six inches (or as existing utilities allow). Dispose of excavated material and replace with approved soil filter mix and aggregate. Machinery shall not be used within the basins in order to avoid compaction.

#### Block inlets to off-line bioretention basins.

#### Provide temporary diversion for on-line bioretention basins.

#### Rapidly stabilize cut side-slopes and surrounding areas.

### SUBSURFACE SYSTEMS

#### Protect subgrade with a soil buffer layer which shall remain in place until all adjacent and upstream construction is complete, and adjacent surfaces are stabilized and cleaned. Remove soil buffer layer and excavate to full subgrade depth upon completion of adjacent and upstream construction and then immediately place bedding and storage aggregates and storage structures (as applicable).

#### Protect subsurface system inlets and pretreatment systems from sediment deposition as a result of adjacent construction related activities.

#### Maintain temporary fences, sand bags, barriers, silt screens, and signs as required for protection of inlets and pretreatment systems.

#### Rehabilitate any subgrade and subsurface system storage aggregates that are damaged through sediment loading.

#### Do not allow stormwater to enter the subsurface system during construction and staging, thereby reducing impacts on the subgrade, aggregate storage layers, and storage structures from high sediment loads associated with construction.

#### Block all inlets to the subsurface system using sand bags or equivalent; silt screens; and diversion/bypass piping, to eliminate inflow of stormwater and sediment into the subsurface system. Sand bags, screens, and diversion/bypass piping shall remain in place until all construction and staging upstream is complete and, where applicable, the disturbed upstream areas are stabilized.

#### If a subsurface system receives runoff from the site and therefore is contaminated with sediments, remediate the system. Remediation consists of excavating all storage aggregate and over-excavating sub-grade by at least six inches (or as existing utilities allow) for aggregate filled systems. For vault type systems, remediation consists of removing accumulated sediment by hand; pressure washing the inside of all vault structures; and removing the waste water, sediment and, debris by vacuuming. Dispose of excavated material and replace with approved aggregate. Machinery shall not be used within the basins in order to avoid compaction.

#### If a subsurface pretreatment system (drain inserts, catch basins, sump inlets, sand traps, vortex separators, etc.) receives runoff from the site and therefore is contaminated with sediments, remediate the system. “Remediate” consists of removing accumulated sediment by hand; pressure washing the inside of all pretreatment structures; and removing the waste water, sediment, and debris by vacuuming.

#### Rapidly stabilize cut side-slopes and surrounding areas.

### PERMEABLE PAVEMENT

#### Protect subgrade with a soil buffer layer which shall remain in place until all adjacent and upstream construction is complete and adjacent surfaces are stabilized and cleaned. Upon completion of adjacent and upstream construction, remove soil buffer layer and excavate to full subgrade depth and immediately place stone base and reservoir layers.

#### Install perimeter controls to keep area where pavement is to be constructed free from sediment during entire job.

#### Pressure wash and vacuum sediment-contaminated and clogged permeable pavement surfaces.

##### Remove and replace clogged permeable pavement surfaces if pressure washing and vacuuming is not successful at restoring permeability.

#### Remove and replace sediment-contaminated bedding/leveling materials with clean materials, where applicable.

#### Remove and replace sediment-contaminated base materials with clean materials.

#### Remove and replace sediment-contaminated subbase materials with clean material, where applicable.

#### Remove and replace sediment-contaminated filter fabric materials with clean materials, where applicable.

#### If a permeable pavement area receives runoff from the site and therefore is contaminated with sediments, remediate the area. Remediate by excavating all aggregate and overexcavating sub-grade by at least six inches (or as existing utilities allow). Dispose of excavated material and replace with approved aggregate. Machinery shall not be used within the facility footprint in order to avoid compaction.

#### After work in this section is complete, the Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.

#### Keep all construction equipment off permeable pavement areas throughout construction - sediment tracking can clog permeable pavement.

### ERTEC EDGE GUARD or ERTEC S-FENCE (or equivalent)

#### ERTEC Edge Guard or ERTEC S-Fence shall be installed at the locations and to the limits shown on the approved GI Protection Plan and as otherwise directed by the City Representative.

#### The Contractor shall maintain the alignment and condition of the Edge Guard or S-Fence, as necessary, throughout its use on the project. Upon reaching final completion and/or at the direction of City Representative, the Contractor shall remove the Edge Guard or S-Fence from the project.

#### If required by construction activities as determined by City Representative, relocate Edge Guard or S-Fence as necessary.

### ERTEC PROWATTLE (or equivalent)

#### ERTEC ProWattle shall be installed at the locations and to the limits shown on the approved GI Protection Plan and as otherwise directed by the City Representative.

#### The Contractor shall maintain the alignment and condition of the ProWattle as necessary, throughout its use on the project. If flattened by equipment drive-overs, reshape to vertical immediately. Upon reaching final completion and/or at the direction of City Representative, the Contractor shall remove the ProWattle from the project.

#### If required by construction activities and as approved by the City Representative, the ProWattle shall be relocated as necessary.

#### Inspect ProWattle following rainfall events and at least daily during prolonged rainfall.

### SANDBAG / GRAVEL BAG DIVERSION

#### Install sandbag / gravel bag diversions at the locations and to the limits shown on the approved GI Protection Plan and as otherwise directed by the City Representative.

#### Install sandbag / gravel bag diversions to exclude stormwater runoff from entering the work areas and the permeable pavement and bioretention infiltration areas.

#### Where necessary, Contractor must begin sandbag / gravel bag diversion upstream of the GI facility such that positive drainage can be maintained from the flowline of the gutter, along the sandbag diversion, and around the GI facility.

#### Where positive drainage cannot be maintained around GI facility, install diversion/bypass piping to re-route flows around Green Infrastructure facilities.

#### Do use sandbag / gravel bag diversions in locations where they will encroach on travel lanes or block sidewalk access without approval by the City Representative.

### SITE HOUSEKEEPING

#### Contractor shall be responsible for cleaning the contributing area and areas immediately upstream of the GI facility installations of all silt, sediment, and debris during construction, and where applicable, during the post-construction establishment period.

END OF SECTION