

Green Stormwater Restoration and Repair Manual

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Seattle Public
Utilities
and
Department
of Planning
and
Development

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1. General Restoration Notes for Green Stormwater Infrastructure (GSI) Work.

The bioretention swales perform multiple functions. They provide both a vertical and linear treatment for stormwater flow and quality. Soil compaction in these systems will significantly impact the capacity of the soils for filtration and reduce plant growth.

General BMP's:

- Install Temporary Erosion and Sediment Control (TESC) per Washington State Department of Transportation Environmental Management standards to proactively plan, implement, and monitor measures to prevent stormwater from entering the swale(s) during restoration activities. Review TESC approach with SPU inspector. This may require blocking curb cuts to prevent flow from street and installing temporary flow control in upstream swale(s).
- Avoid placing stockpiles on or within 3-feet of any existing bioretention swale and landscape areas.
- Provide temporary pedestrian access.
- Protect irrigation and other utilities and features within the Rights-of-Way (ROW) and on adjacent properties. If any irrigation pipes or heads, utilities, features or paving are damaged, restore to original or better condition per 2011 City of Seattle Specifications.
- Schedule earthwork operations to minimize the potential for erosion, siltation and disturbance of other swales around any bioretention swale.
- Treat each GSI element damaged independently and restore it to equal or better than original conditions per Street Improvement Permitting (SIP) or other SPU approved design.
- Protect adjacent GSI swales from debris accumulation, sediment deposits and soil compaction during repair and restoration of damaged GSI.
- Remove all debris and or sediment from inside the GSI swale.
- Protect permeable pavement and/or sidewalks areas by covering the areas during restoration work.
- Do not use fertilizer in or around any GSI swale.
- Maintain TESC for a minimum of 45 days following restoration so that restored GSI swales shall not receive runoff from the adjacent roadways.
 - **Note:** swales receiving flow from daylighted pipes shall have cobble rock check dams placed at outlet.
- Maintain plantings during 1 year establishment period according to approved SIP plan or as otherwise noted.
- Avoid stockpiling any materials or debris on permeable cement/concrete street, sidewalk, or pervious parking areas. If permeable areas must be used for stockpile then protect surface with 6 mil or greater plastic sheeting or like kind.

2. Repair Requirements for Vegetated Swales.

Sediment, silt or debris removal 3 inches or less - depth deposited in bottom of swale less than 2 feet wide.

- Remove all sediment and mulch manually to a width of 2 feet with a hoe, shovel or other appropriate hand tool to avoid mixing sediment with bioretention soil mix and damaging plantings.
- Replace with 3 inches of medium grade arborist wood chips and fine grade to ensure finish grades of swale match original approved design. Mulch above ordinary high water mark to prevent clogging of any structures.
- Properly dispose of removed material off-site on the same day as removal or per approved TESC plan.
- Replace any damaged plantings and infill with new plantings in damaged area as required by SPU inspector.
- Landscape shall be the same as the original landscape design. Plantings may not be substituted unless approved by SPU inspector. (See also Vegetation Damage below).

Sediment, silt or debris removal 3 inches to 6 inches -depth deposited in bottom of swale less than 2 feet wide.

- Remove sediment, silt, debris or any foreign material from any area of the swales that has been damaged.
- In addition, remove 2 inches of existing mulch layer and 6 inches of existing bioretention soil mix. Replace with 6 inches of bioretention soil mix and a 2 inch mulch layer. Follow original approved SIP design and City specifications for soil preparation, mulch and mixing of bioretention soil mix.
- Properly dispose of removed material off-site within 2 days of its removal or per approved TESC plan.
- Match finish grades of swale to original design. Allow for a settlement of 2 to 5 inches to occur by adding additional bioretention soil mix to provide a 3:1 taper for 12-inches minimum from top of adjacent pavement or curb to surface of swale.
- Replace any damaged plantings and infill plantings in damaged area.
- Landscape shall be the same as the original landscape design. Plantings may not be substituted unless approved by SPU inspector. (See also Vegetation Damage below).

Sediment, silt or debris removal *6 inches and greater* - depth deposited in bottom of swale less than 2 feet wide.

- Full width (curb to sidewalk) restoration. Depth of repair (including up to full depth replacement of bioretention soil) to be determined by SPU inspector.
- Remove sediment, silt, debris or any foreign material, plus a minimum depth of eighteen (18) inches and replace per SIP, the length of the swale(s) that has been damaged. Replace with bioretention soil mix in maximum 12 inch lifts.
- Restore surface and fine grade according to details. If planted, then replant according to original SIP plan. Follow original approved SIP design and City specifications for soil preparation, mulch and mix design of bioretention soil mix.
- Properly dispose of removed material off-site within 2 days of its removal or per approved TESC plan.
- Assume settlement of 2 to 5 inches may occur depending on depth of replacement. Add additional bioretention soil mix to provide a 3:1 taper for 12-inches minimum from top of adjacent pavement or curb to surface of swale.
- Replace any damaged plantings and infill plantings in damaged area. Landscape shall be the same as the original landscape design. Plantings may not be substituted unless approved by SPU inspector. (See also Vegetation Damage below).
- Replace with 3 inches of medium grade arborist wood chips and fine grade to ensure finish grades of swale match original approved design. Mulch above ordinary high water mark to prevent clogging of any structures.

Vegetation damage.

- Block off drain curb cuts to prevent flow from entering swale during repair work and through re-establishment of plantings and seeding.
- Replace small plantings and or grass that has been damaged or affected by repair and restoration.
- Replace mulch around trees to depth of 3 inches.
- Follow Section 8-02 Landscape Construction, of the SPU Standard Specifications, for removing, storage & replacing of existing plants within each damaged swale.
- Replace any damaged plantings, vegetation and or grass.
- Landscape shall be the same as the original landscape design.
- Plantings may not be substituted unless approved by SPU inspector.
- Replace with 3 inches of medium grade arborist wood chips and fine grade to ensure finish grades of swale match original approved design. Mulch above ordinary high water mark to prevent clogging of any structures.
- Properly dispose of material off-site within 2 days of its removal or per approved TESC plan.
- Maintain plantings during re-establishment period.

3. Repair Requirements: Grass Lined Swales with or without Bioretention Soil.

Sediment, silt, or debris removal *3 inches or less.*

- In grass lined swales with bioretention soil mix, manually rake out (with steel rake) and remove sediment as directed by SPU inspector and reseed.
- In grass-lined conveyance swales without bioretention soil mix, manually rake out (with steel rake) and remove sediment as directed by SPU inspector and reseed.

Sediment, silt or debris removal *greater than 3 inches - with bioretention soil.*

- Full width (curb to sidewalk) restoration and depth to be determined by SPU inspector.
- Remove a minimum depth of 18 inches and a minimum width of 3 feet.
- Replace the length of the bioretention swale(s) that has been damaged with sediment, silt, debris or any other foreign material.
- Replace with bioretention soil in maximum 12 inch lifts.
- Restore surface and fine grade according to details. Seed or sod as directed SPU inspector.
- Follow original approved SIP design and City specifications for soil preparation, mulch and mixing of bioretention soil.
- Properly dispose of removed material off-site within 2 days of its removal or per approved TESC plan.
- Bioretention soil may be used in lieu of sand layer for a minimum upper replacement of 9 inches of bioretention soil mix in grass-lined swales that have been damaged with silt and sediment deposits.
- Assume settlement of 2 to 5 inches may occur. Add additional bioretention soil mix to provide a 3:1 taper for 12-inches minimum from top of adjacent pavement or curb to surface of swale.

Sediment, silt or debris removal in grass swales - with no Bioretention soil.

- In grass-lined conveyance swales without bioretention soil, remove deposits and upper 4 inches of soil in swale.
- Prepare soil to depth of 8 inches by tilling 4 inches of organic compost into top 8 inches of soil and grade to provide positive drainage in accordance with the attached sections and/or original design and specifications.
- Install sod or seed.

4. Vehicular/Construction/Utility Connection Related Damages.

- Restore swale as per original design or SIP.
 - This includes removing and restoring all damaged vegetation, excavate and replace all the bioretention soil mix down to the top of the Type 26 layer as specified for each particular swale, mulch with arborist wood chips, and replace landscaping to equal or better than the original design.
- Replace any bioretention soil and match finish grades of swale to original approved design.
- Properly dispose of material off-site within 2 days of its removal or per approved TESC plan.
- Replace all damaged vegetation and or grass.
 - Landscape shall be the same as the original landscape design or SIP.
 - Plantings may not be substituted unless approved by SPU inspector. (Also see Vegetation Damage above).
- Protect any existing permeable pavement during repair.
 - SPU inspector to inspect permeable pavement upon completion of swale repair for damage and or clogging.
 - If pavement requires repair, see Repair Requirements for Permeable Pavement repair section below.
- Provide videotape of pipe(s) when required by SPU inspector if heavy loading (equipment or vehicles) was driven or placed on or across swale.
 - SPU to review video and determine if pipe(s) will require replacement.
 - Repair pipe and restore swale to original design if required by SPU inspector.

5. Deposits or Damage from oil spills, fertilizers, or other harmful substances:

Vegetated or grasslined swale *with bioretention soil.*

- Full width (curb to sidewalk) restoration, length and depth to be determined by SPU inspector.
- Restore swale to equal or better than original conditions per SIP or other SPU approved design.
- At a minimum remove a depth of 18 inches and a width of 3 feet.
- Replace the length of the swale that has been contaminated.
- Replace with bioretention soil in maximum 12 inch lifts.
- Restore surface and fine grade according to original design or SIP. Seed or sod as directed SPU.
- Remove and replace damaged plants (see Vegetation damage above).
- Excavate contaminated soil and dispose of off-site in approved location.
- Replace all bioretention soil mix down to the top of the Type 26 layer, as specified, for each particular swale, mulch, and replace landscape to better than original conditions or per SIP.
- Properly dispose of any material off-site within 2 days of its removal or per approved TESC plan.
- In grass lined swales, bioretention soil may be used in lieu of sand layer for a minimum upper replacement of 9 inches of bioretention soil in grass-lined swales that have been damaged.
- Landscape shall be the same as the original design or SIP. Plantings may not be substituted unless approved by SPU inspector.
- Match finish grade of landscaping and conveyance system to original approved SIP design.
- Assume settlement of 2 to 5 inches may occur of bioretention soil mix. Add additional bioretention soil to provide a 3:1 taper for 12-inches minimum from top of adjacent pavement or curb to surface of swale.

Conveyance grass swales *with no bioretention soil.*

- In grass-lined conveyance swales without bioretention soil, remove contaminated soil to depth width and length specified by SPU inspector. At a minimum, remove upper 4-inches of soil in swale.
- Properly dispose of material off-site within 2 days of its removal or per approved TESC plan.
- Prepare soil to depth of 8 inches by tilling 4 inches of organic compost into top 8 inches of soil and grade to provide positive drainage in accordance with City of Seattle Standards and Specification and/or original design or SIP.
- Match finish grade of landscaping and conveyance system to original design or SIP.
- Install sod or seed.

6. Repair Requirements for Permeable Pavement.

General BMP's.

- Unfiltered stormwater runoff should be directed away from permeable pavement sidewalks or streets.
- Materials that do washout on to the pavement should be removed or vacuumed as soon as possible to prevent any additional clogging.
- Protect pavement from any construction staging areas.
- Do not place landscape materials directly on or near permeable pavement.
- Do not use sandbags near or on permeable pavement.
- Do not snow-plow permeable pavement streets, if necessary to plow street, raise snow plow blade.

Remove debris & sediment from permeable pavement.

- Inspect permeable pavement for damage.
- Remove oils and other similar materials in accordance with NRMCA recommendations.
- Vacuum silt and debris from permeable pavement so that field infiltration rate meets original design installation or as determined by SPU inspector.
- SPU Materials Lab to perform infiltration testing.
- Restore infiltration rates to original design or SIP.
- Remove all garbage and debris as required with wire brush, broom, or pressure washer.
- Dispose of debris and garbage off site.
- If vacuuming does not work, a pressure washer may be used. If pressure washer does not work to re-establish approved infiltration rates then remove and replace permeable concrete. Length of replacement to be determined by SPU inspector.

Full permeable pavement section replacement.

- Replace damaged pavements with permeable pavements in accordance with City of Seattle Standard Specification –Division 5, Section 06.
- Protect adjacent permeable pavement sections to remain, swale and other utilities and features from becoming clogged and damaged during replacement of pavement section.

7. General Specification Section References, Resources, and Other Useful References.

- Natural Drainage Systems - Specification Division 7, Section 21.
- Landscape Construction – Specification Division 8, Section 02.
- Planting Area Preparation – Specification Division 8, Section 02.
- Swale Plants – Specification Division 8, Section 02.
- Irrigation System – Specification Division 8, Section 03.
- Bioretention Soil Mix – Specification Division 9, Section 14.
- Permeable Pavements and Permeable Concrete – Specification Division 5, Section 06.
- Department of Development and Planning Director’s Rule Vol. II – Stormwater Manual, Construction Stormwater Control Technical Requirements Manual.
- Seattle Department of Transportation Right-of-Way Improvement Manual – Chapter 6
- Seattle Department of Transportation – Client Assistance Memo 2215, Permeable Pavement in the Right-of-Way.
- Green Stormwater Infrastructure (GSI) website (specification, CADD drawings, plant lists, links to other resources. <http://www.seattle.gov/util/greeninfrastructure>)

8. City of Seattle Contacts.

- Seattle Public Utilities, Drainage Operations, 24-hour emergency hotline: (206) 386-1800
- Seattle City Light, 24-hour emergency hotline: (206) 705-0051
- Seattle Public Utilities, Natural Drainage System, general information: (206) 684-3000
- Seattle City Light, Powerline Clearance Program: (206) 386-1733
- Seattle Department of Transportation, Arborist, street tree pruning needs: (206) 684-7649
- Seattle Department of Transportation, Landscape Architect, landscape questions: (206) 684-5041
- Seattle Department of Transportation, general information: (206) 684-ROAD
- Natural Lawn & Garden Hotline, for gardening questions & advice: (206) 633-0224

Seattle Public Utilities

Seattle Public Utilities
Seattle Municipal Tower
700 Fifth Avenue
Suite 4900
PO Box 34018
Seattle, WA 98124-4018

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