Streamlining On-site Stormwater Management: Helping Municipalities Implement New Stormwater Requirements

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MuniCon - May 17, 2017
Overview

- Permit Requirements
- Types of Implementation Tools
- Examples
- References
- Questions
Permit Requirements

- Minimum Requirement #1 – Preparation of Stormwater Site Plans
- Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan (SWPPP)
  - New Element 13 – Protect Low Impact Development BMPs
- Minimum Requirement #5 – On-site Stormwater Management
  - List #1
  - List #2
  - Infeasibility criteria
Types of Implementation Tools

1. Guidance for small projects (MR #1-5)
2. Infeasibility Criteria Checklist
3. Infeasibility Mapping
4. Small Project Templates
   - Construction SWPPP (CAD and/or narrative)
   - Small Site BMP Plan
5. Simplified Sizing Tools/Calculators
6. Infiltration Testing Checklists
7. Plan Review Checklists
8. Construction Site Inspection Checklist
9. Post-construction Soil Quality and Depth Handout/Worksheet
10. Maintenance Checklists
Examples
Guidance for Small Projects (MR #1-5)

- Targeted towards single-family residential and small commercial development
- Graphics and photos
- Flowcharts or tables outlining MR#5 process and list approach to BMP selection
Examples
Guidance for Small Projects (MR #1-5)

Stormwater Worksheet and Guidance for Building Permits

Stormwater Worksheet

<table>
<thead>
<tr>
<th>General site information</th>
<th>Area (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOT SIZE</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New and replaced hard surfaces</th>
<th>Area (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roots (including covered decks and sheds)</td>
<td></td>
</tr>
<tr>
<td>Other hard surfaces (including driveways, walkways, and patios)</td>
<td></td>
</tr>
</tbody>
</table>

Total new and replaced hard surfaces *

*If the total new and replaced hard surfaces is 2,000-5,000 square feet then it is a “SMALL Project” (MR #1-5). If less than 2,000 square feet then it is a “VERY SMALL Project” (only MR #2—see page 3). If greater than 5,000 square feet then it is a “LARGE Project” (MR #1-9—consult with City staff).

Disturbed pervious surfaces

<table>
<thead>
<tr>
<th>Total land disturbed ** (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native ground converted to lawn and landscaped area (acres)</td>
</tr>
<tr>
<td>Native ground converted to pasture (acres)</td>
</tr>
</tbody>
</table>

**If total land disturbed is 7,000 square feet or more (with < 3/4 acre converted to lawn/landscaping, or < 2.5 acres converted to pasture) then this Guidance applies. If less than these thresholds, requirements for new and replaced hard surfaces only apply.

USDA Soil Type—see map provided by City

<table>
<thead>
<tr>
<th>Type A (Cantsberg gravelly sandy loam)</th>
<th>Area (square feet)</th>
<th>Percent (%) of Lot Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B2 (Sequim very gravelly sandy loam)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total combined area **

***If the total combined area of soil types A + B3 = 30% of the lot size or more, then infiltration testing is not required related to selection of permanent on-site stormwater best management practices (BMPs). It is assumed that infiltration is likely to be effective. However, while such testing is not required by the City, it may provide additional assurance to the owner and should be considered.)
Examples
Guidance for Small Projects (MR #1-5)

Small Project Stormwater Requirements

- Projects that discharge directly to, or indirectly through a storm drainage system to a creek are evaluated with List #1

1. List #1
   - For each category, select first feasible item on the list:
     - Category A: Lawn and landscaped areas
       - Post-construction soil quality and depth
     - Category B: Roofs
       1. Full dispersion or downspout full infiltration systems
       2. Rain gardens or bioretention
       3. Downspout dispersion systems
       4. Perforated stub-out connections
     - Category C: Other hard surfaces
       1. Full dispersion
       2. Permeable pavement, rain gardens, or bioretention
       3. Sheet flow dispersion or concentrated flow dispersion

2. List #2
   - (Projects with New/Replaced Hard Surfaces Greater Than 5000 sq-ft)

How to Implement Minimum Requirement #5 (On-Site Stormwater Management)

1. Step 1: Calculate areas by surface type (See Worksheet A)
   - Lawn & landscaped areas
   - Roofs
   - Other hard surfaces (e.g., driveways, patios, sidewalks)

2. Step 2: Determine receiving water (See Stormwater Discharge Map)

3. Step 3: Refer to List #1 (Creek Discharge), List #2, or List #3 (Direct Discharges). This fact sheet focuses on implementing List #1 and List #3 (Worksheet A)

4. Step 4: Evaluate the feasibility of BMPs (Worksheet C) in priority order based on:
   - Design criteria, limitations, and infeasibility criteria (Worksheet C)
   - Competing needs criteria (Volume 5, Chapter 5 of the Strategy Manual)

5. Step 5: Select the first BMP that is considered feasible for each surface type (See Worksheet C)

6. Step 6: Document the infeasibility (descriptive description and rationale) for each BMP that was not selected (Worksheet C)
Examples

Infeasibility Criteria Checklist

- Infeasibility criteria are scattered throughout Volume III and Volume V of the Stormwater Management Manual for Western Washington
- Several jurisdictions have found it helpful to compile this information into one consolidated location
- Others have converted to a checklist format for tracking the rationale for each BMP not selected
Examples

Infeasibility Criteria Checklist

**Appendix 7B – On-Site Stormwater Management BMP Infeasibility Criteria**

The following tables present infeasibility criteria that can be used to justify not using various on-site stormwater management BMPs for consideration in the List #1 or List #2 option of core Requirement #3. This information is also included under the detailed descriptions of each BMP, but is provided here in this appendix for additional clarity and efficiency. Where any inconsistency or lack of clarity exists, the requirements in the main text of each volume shall be applied. If a project is limited by one or more of the infeasibility criteria specified below, but still wishes to use the given BMP, they may propose a functionally equivalent design to the city for review and approval.

<table>
<thead>
<tr>
<th>BMP</th>
<th>Infeasibility Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawn and Landscaped Areas</td>
<td></td>
</tr>
<tr>
<td>Postconstruction Soil Quality and Depth</td>
<td></td>
</tr>
<tr>
<td>Site and design criteria provided in Section 7.4.1 cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>Roof</td>
<td></td>
</tr>
<tr>
<td>Full Dispersion</td>
<td></td>
</tr>
<tr>
<td>Site setbacks and design criteria provided in Section 7.4.2 (under Full Dispersion) cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>A minimum forested or native vegetation flowpath length of 1.00 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>Downspout Infiltration Systems</td>
<td></td>
</tr>
<tr>
<td>Site setbacks and design criteria provided in Section 7.4.10 (Downspout Infiltration Systems) cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>Lot(s) or site does not have outwash or loam soils</td>
<td></td>
</tr>
<tr>
<td>There is not at least 12 inches or more of permeable soil from the proposed bottom (final grade) of the infiltration system to the seasonal high groundwater table or other impermeable layer.</td>
<td></td>
</tr>
<tr>
<td>Downspout Dispersion Systems</td>
<td></td>
</tr>
<tr>
<td>Site setbacks and design criteria provided in Section 7.4.10 (Downspout Dispersion) cannot be achieved.</td>
<td></td>
</tr>
<tr>
<td>For splashblocks, a vegetated flowpath at least 30 feet in length from the downspout to the downstream property line, structure, stream, wetland, or other impervious surface is not feasible.</td>
<td></td>
</tr>
<tr>
<td>For trenches, a vegetated flowpath of at least 25 feet in between the outlet of the trench and any property line, structure, stream, wetland, or impervious surface is not feasible.</td>
<td></td>
</tr>
</tbody>
</table>

October 2016
Chapter 7 - Flow Control Design 7B-1
### Examples
### Infeasibility Criteria Checklist

#### Minimum Requirement #5 (On-Site Stormwater Management)

<table>
<thead>
<tr>
<th>Lawn and Landscaped Areas</th>
<th>Infeasibility Criteria</th>
<th>Infeasibility Description and Rationale for each BMP Not Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-construction Soil Quality and Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SWMMWWW Volume V, Section 5.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List #1, #2 and #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Dispersion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List #1 and #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site setbacks and design criteria provided in BMP T5.30 (SWMMWWW Volume V, Section 5.3) cannot be achieved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 95 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A minimum forested or native vegetation flowpath length of 100 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siting and design criteria cannot be achieved on site.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site setbacks and design criteria provided in BMP T5.10A (SWMMWWW Volume III, Section 3.1.1) cannot be achieved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The lot(s) or site does not have outwash or loam soils.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is not at least 3 feet or more of permeable soil from the proposed final grade to the seasonal high groundwater table or other impermeable layer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is not at least 1 foot or more of permeable soil from the proposed bottom of the infiltration system to the seasonal high groundwater table or other impermeable layer.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Examples

Infeasibility Mapping

- Incorporates information on slopes, erosion hazard areas, landslide hazard areas, and contaminated soils
- Does not typically include soils data (site specific analysis required)
- Range of scales
- Range of options for providing information to project proponents
Examples
Infeasibility Mapping
Examples
Infeasibility Mapping

Note: This map was developed using site suitability criteria in Volume 5 of Ecology’s Stormwater Management Manual for Western Washington (2012) Volume III and V. The map is intended for planning purposes only.

The GIS analysis included the following:
- Critical areas easements (partial dataset)
- Buffers around known landfills
- Slopes greater than 50%
- Class B hydrologic units
- Steep slope erosion areas and swales
- 10-foot buffer around underground storage tanks
- Landslide and liquefaction risk areas

Site-specific analysis is required prior to design and construction to evaluate the following (data available on the geospatial tool have an asterisk):
- Offset from roadways
- Bottom width
- Soil saturated hydraulic conductivity
- Springs used for drinking water
- Deep soil contamination
- Surface soil contamination
- Mission Tower Control Area and Superfund areas
- Small on-site sewage disposal systems
- Steep slope erosion areas and swales
- Septic system or drain field buffer
- Building foundation setbacks
- Groundwater protection area
- Water table depth
- Drinking water wells and/or open water features
- Class A & B & C (hydrologic units)
- 10-foot buffer around underground storage tanks

Legend
- Sites not feasible for bioretention cells & swales
- State Highway
- State Route
- Streets
- Rivers, Ponds
- Streams

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, December 2006.
Aerial flown in summer 2012.

Scale: 1 in = 2,333 feet
Date: 11/12/2014
File: Table1_11x17_14.mxd
Drawn by: kdth
Examples
Infeasibility Mapping

CITY OF ARLINGTON
PRELIMINARY SITE ASSESSMENT
SUMMARY REPORT

Parcel Number: [ ]
Address: [ ]
Property Ownership: [City or Private]

Site Characteristics

<table>
<thead>
<tr>
<th>Hydrologic Soil Groups</th>
<th>Class A Soils</th>
<th>Class B Soils</th>
<th>Class C Soils</th>
<th>Class D Soils</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>xx%</td>
<td>xx%</td>
<td>xx%</td>
<td>xx%</td>
</tr>
</tbody>
</table>

Drinking Water Well Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Steep Slopes Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Landslide Hazard Areas Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Erosion Hazard Areas Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Soil Contamination Areas Onsite?
Yes [ ] No [ ] Buffer Only [ ]

UST Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Septic system Onsite?
Yes [ ] No [ ] Buffer Only [ ]

MTCA/Superfund Onsite?
Yes [ ] No [ ] Buffer Only [ ]

Ground water recharge area?
Yes [ ] No [ ]

Ground water discharge area?
Yes [ ] No [ ]

BMPs Recommended for Evaluation

Infiltrating Bioretention Cell/Swale [ ]
Infiltrating Bioretention Planter Box [ ]
Non-Infiltrating Bioretention [ ]
Permeable Pavement [ ]
Ponds and Wetlands [ ]
Basic Filter Strips [ ]
Biofiltration Swales [ ]
Underground Detention and Treatment [ ]

Aboveground Sand Filtration [ ]
Infiltration BMPs [ ]
Dispersion BMPs [ ]

Site not suitable for BMPs [ ]
Site connects to regional system? [ ]
Examples

Construction SWPPP Templates

- Two components:
  - Checklist/narrative
  - CAD template with commonly used BMPs
Element 1: Preserve Vegetation / Mark Clearing Limits

The goal of this element is to preserve native vegetation and to clearly show the limits of disturbance.

This element does not apply to my project because:

- The site was cleared as part of clearing activity that is subject to an enforcement action and is re-vegetated. Restoration may be necessary to comply with Critical Area Regulations or NPDES requirements. Buffer Zones-BMP C102 may apply if Critical Areas exist on-site and buffer zones shall be protected.

If it does apply, describe the steps you will take and select the best management practices (BMPs) you will use:

- The perimeter of the area to be cleared shall be marked prior to clearing operation with visible flagging, orange plastic barrier fencing and/or orange silt fencing as shown on the SWPPP site plan. The total disturbed area shall be less than 7000 square feet. Vehicles will only be allowed in the areas to be graded, so no compaction of the undeveloped areas will occur.

Check the BMPs you will use:

- C101 Preserving Natural Vegetation
- C102 Buffer Zones
- C103 High Visibility Fence
Examples
Construction SWPPP Templates

BMP T513. POST-CONSTRUCTION SOIL QUALITY AND DEPTH

At the end of project, all areas disturbed and not covered with an impervious surface must be amended per the soil amendment detail below.

- Label all areas disturbed and not covered with an impervious surface incorporated into a drainage facility, or engineered as a structural fill or slope. See definitions below. Do not reference an alternate plan sheet.
- Provide an estimate of the volume of compost required. The actual volume of compost required will be determined in the field.

Definitions:

- Non-disturbed area (ND): Vegetated areas that will not be subject to land disturbing activity do not require soil amendment if they are fenced and continuously protected throughout construction. The fencing must be in place at the first ground disturbance inspection. No disturbance, including vehicle traffic or material storage, is allowed in these areas until final inspection. Label these areas as (ND) in the plan view.
- Soil Amendment Area (SA): Vegetated or compost areas (turf and landscape) must be amended per the soil amendment detail and the subsoil must be loosened. This includes areas impacted by clearing and grading, stockpiling, site access, pathways and materials or equipment storage. Label these areas as (SA) in the plan view.

BMP C233. SILT FENCE

- Joints in filter fabric shall be spliced at posts, use staples, wire rings or equivalent to attach fabric to posts.
- 2" x 2" wood posts, steel fence posts, or equivalent.
- 2" x 2" x 4" or equivalent.
- If standard strength fabric used.
- Bury bottom of filter material in minimum 4" x 4" trench.
- Posts 12" min. depth.
- Post spacing may be increased to 8" if wire backers is used.

Note: Angle silt fence back up the slope at the end of run.

Symbol:

City of

POLLUTION PREVENTION PLAN (SWPPP) TEMPLATE

Check Scale Used
1. One Square - Five Feet (5"
2. One Square - Twenty Feet (20"

North Arrow
Examples
Construction SWPPP Templates

COMPOST SOCK

FLOW

EXCESS SOCK MATERIAL, DRAWN IN AND TIED OFF AT STAKE (TYP.)

DISTURBED AREA

LENGTH VARIES

PLAN VIEW

SPACING VARIES (TYP.) SEE NOTE 3

DISTURBED AREA

SECTION A PROTECTED AREA

(SHOWN AS SLOPE PROTECTION)

SYMBOL:

1. COMPOST SOCK SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATION 9.14.4(9). COMPOST SOCK SHALL BE A MINIMUM OF 10" IN DIAMETER OR SIZED TO SUIT CONDITIONS AS SPECIFIED BY THE ENGINEER.

2. ALWAYS INSTALL COMPOST SOCK PERPENDICULAR TO SLOPE AND ALONG CONTOUR LINES.

3. REMOVE SEDIMENT FROM THE UP SLOPE SIDE OF THE COMPOST SOCK WHEN ACCUMULATION HAS REACHED 1/2 OF THE EFFECTIVE HEIGHT OF THE COMPOST SOCK.

4. MAY BE USED IN PLACE OF FILTER FENCE FOR PREMIER CONTROL.
Examples
Small Site BMP Plan

- Targeted towards single-family residential and small commercial development

- Two components:
  - Checklist/narrative
  - CAD template with commonly used BMPs
Examples
Small Site BMP Plan

INfiltrating Bioretention Cell - Sloped Sides

- HORIZONTAL SETBACK FOR INFLTRATING FACILITIES
- SEE SEATTLE STORMWATER MANUAL VOL 3, SECTION 5.4.4

MIN. MEASURED INFILTRATION RATE = 0.6/Hr
(OR 0.3/Hr IF AN UNDERDRAIN IS USED)

OVERFLOW PIPE TO APPROVED DISCHARGE POINT 4" DIA MIN

FACILITY BOTTOM: SCARIFY
SUBGRADE 4" MIN

BERM (IF NEEDED)

NATIVE SOIL

12" MIN BIORETENTION SOIL
(18" MIN IF USING FOR WATER QUALITY)

NOTES:
1. BOTTOM AND TOP CELL DIMENSIONS MUST BE SHOWN ON DRAINAGE CONTROL PLAN.
2. PONDING DEPTH AND FREEBOARD SHALL BE NOTED ON THE DRAINAGE CONTROL PLAN.
3. FLOWS MUST ENTER THE CELL ABOVE THE MULCH LAYER. PROVIDE ENERGY DISSIPATION SUCH AS A SPLASH BLOCK OR ROCK PAD.
4. MINIMUM FREEBOARD SHALL BE 2 INCHES FOR CONTRIBUTING DRAINAGE AREAS LESS THAN 3,000 SF, 4 INCHES FOR AREAS 3,000 SF TO 5,000 SF AND 6 INCHES FOR AREAS GREATER THAN 5,000 SF. FREEBOARD SHALL BE NOTED ON THE DRAINAGE CONTROL PLAN.
5. SEE THE SEATTLE STORMWATER MANUAL VOL 3, SECTION 5.4.4, FOR ADDITIONAL REQUIREMENTS.
Examples
Small Site BMP Plan

PERMEABLE PAVEMENT SURFACE

WEARING COURSE MINIMUMS
ASPHALT = 4"
CONCRETE DRIVEWAY = 8"
CONCRETE SIDEWALK = 5"

NOTES:
1. PERMEABLE PAVEMENT SURFACE AREA DIMENSIONS AND PAVEMENT SLOPE MUST BE SHOWN ON DRAINAGE CONTROL PLAN.
2. AGGREGATE SUBBASE SHALL BE CLEAN, CRUSHED GRAVEL OR CRUSHED ROCK – TYPE 22 OR 24 FOR WALKWAYS AND TYPE 13 FOR VEHICULAR APPLICATIONS.
3. THE LEVELING COURSE SHALL BE A FREE DRAINING AGGREGATE AND SHALL NOT RESTRICT THE INFILTRATION RATE THROUGH THE SYSTEM. FRACTURED JOINTING SAND IS NOT ALLOWED.
4. THE SUBGRADE SLOPE MUST BE LESS THAN 6% SLOPE TO BE USED FOR ON-SITE STORMWATER MANAGEMENT.
5. PERMEABLE PAVEMENT SURFACES DO NOT REQUIRE THE SETBACKS FOR INFILTRATING FACILITIES.
6. SEE WORKSHEET C FOR INFEASIBILITY CRITERIA.
7. SEE THE DOE MANUAL, VOLUME 3, FOR ADDITIONAL REQUIREMENTS.
Examples
Small Site BMP Plan

Minimum Requirement # 5: On-site Stormwater Management (continued)

**LIST # 1** (Proceed with this page if you answered YES on page 5)
For each category (A-C) select the *first feasible* item on the list below. Document your justification for each infeasible BMP using Worksheet C.

Check **One Option** for **Each Category** Below:

Using the City Stormwater Discharge Map, is your project located in the “blue” area which discharges directly or indirectly to a creek?

- [ ] Yes - Proceed to **LIST #1** to select your on-site stormwater management BMPs. (Page 6)
- [ ] No - Proceed to **LIST #3** to select your on-site stormwater management BMPs. (Page 7)
Examples
Simplified Sizing Tools/Calculators

- Excel spreadsheets with built-in macros that help users to select the appropriate BMPs and sizing based on:
  - Drainage basin
  - Standards (treatment and flow control)
  - Amount of area requiring management
### Examples

**Simplified Sizing Tools/Calculators**

#### On-site Stormwater Management - List Approach Calculator

**Site Information**

- **Note:** If required for your project, reference the Preliminary Assessment Report (PAR) to complete this section. If the total areas proposed are different from those provided in the PAR, requirements may change.

<table>
<thead>
<tr>
<th>Approved Point of Stormwater Discharge</th>
<th>Listed Creek Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Basin</td>
<td></td>
</tr>
<tr>
<td>Is the downstream drainage system considered Capacity Constrained by SPU?</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approved Point of Wastewater Discharge</th>
<th>Public Sanitary Sewer Main</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Point of Sub-Surface Discharge</td>
<td>Public Storm Drain Main</td>
</tr>
<tr>
<td>Flow Control is required</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow Control Standard</th>
<th>Pre-Developed Pasture Standard</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Water Treatment for pollution-generating surfaces is required</th>
<th>Yes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Select required treatment</th>
<th>Oil Control</th>
<th>Phosphorus</th>
<th>Enhanced</th>
<th>Basic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Pollution Generating Hard Surface Area</td>
<td>sf</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Pollution Generating Pervious Surface Area</td>
<td>sf</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Examples
Simplified Sizing Tools/Calculators

<table>
<thead>
<tr>
<th>On-site Runoff Reduction Methods</th>
<th>Facility Size</th>
<th>Credit</th>
<th>Area Managed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retained Trees</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retained Evergreen</td>
<td>No.</td>
<td>Total Canopy Area</td>
<td>sf</td>
</tr>
<tr>
<td>Retained Deciduous</td>
<td>No.</td>
<td>Total Canopy Area</td>
<td>sf</td>
</tr>
<tr>
<td><strong>New Trees</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Evergreen</td>
<td>No. Trees</td>
<td>x</td>
<td>50 sf / tree</td>
</tr>
<tr>
<td>New Deciduous</td>
<td>No. Trees</td>
<td>x</td>
<td>20 sf / tree</td>
</tr>
<tr>
<td><strong>Dispersion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Dispersion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Dispersed Impervious Area</td>
<td></td>
<td>x</td>
<td>100%</td>
</tr>
<tr>
<td>Downspout, Sheet Flow, or Concentrated Flow Dispersion</td>
<td></td>
<td>Dispersed Impervious Area</td>
<td>sf</td>
</tr>
</tbody>
</table>
Examples
Infiltration Testing

- Documents the requirements for infiltration testing in a checklist format
  - Simple Infiltration Test
  - Pilot Infiltration Test (PIT)
Examples

Infiltration Testing

City of Seattle
Simple Infiltration Test Checklist
Call before you dig – Utility Locates 811

INfiltrATION TESTING:
1. Is the infiltration test within the footprint of the proposed infiltration facility? □ Yes □ No
2. If “no,” is the test within 50 feet of the proposed infiltration facility? □ Yes □ No
   Explain why: ____________________________________________________________
3. What is the total proposed new plus replaced impervious area (not including permeable pavement surfaces) infiltrated on the site? _________________ ft²
Examples
Infiltration Testing

City of Seattle
Pilot Infiltration Test (PIT) Checklist

Call before you dig – Utility Locates 811

SMALL PILOT INFILTRATION TEST (SMALL PIT) AND LARGE PILOT INFILTRATION TEST (LARGE PIT):

Note: The test methods outlined below may be modified due to site conditions if recommended by the licensed professional and the reasoning is documented in the testing report.

1. Indicate type of test:
   - Small PIT
   - Large PIT

2. Date and time of tests:

3. Is the infiltration test within the footprint of the proposed infiltration facility? (Yes / No)

4. If “no,” is testing being conducted within 50 feet of the proposed infiltration facility? (Yes / No)

   Explain why: ________________________________
Examples
Plan Review Checklists

- Includes items required by Ecology as well as City/County-specific items in a checklist format
- Helpful for project proponents and plan review staff
Examples
Plan Review Checklists

Section 5 – Onsite Stormwater Management

- Summarize results of onsite stormwater management feasibility results. Describe the infeasibility criteria that cannot be met. Summarize associated soils report if applicable.
- Identify type and size of proposed onsite stormwater facility.
- Include calculations for all onsite stormwater management BMPs as applicable. If using presized tables, describe how the final facility size was determined.
- Provide a drawing of the proposed onsite facility and its appurtenances, including:
  - Dimensions
  - Location of inflow, outflow, and overflow
  - Location of the facility on the project site
  - Pipe material and diameter
  - Vegetated flowpath
  - Location and type of soil amendment used to meet BMP L613
Examples
Construction Site Inspection Checklist

- Ecology has developed a checklist that includes the new Element #13 (Protect LID BMPs)

- Potential enhancements include:
  - Adding a column for construction phase
  - Developing more detailed information for inspectors related to this new element
### Examples

**Construction Site Inspection Checklist**

<table>
<thead>
<tr>
<th>Element #</th>
<th>Inspection</th>
<th>BMPs Inspected</th>
<th>BMP needs maintenance</th>
<th>BMP failed</th>
<th>Action required (describe in section F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Protect LID</td>
<td>yes</td>
<td>no</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Examples**

Construction Site Inspection Checklist

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**Inspection of Erosion and Sediment Control**

*During Construction*

Project Address: ____________________  Permit Number: __________  Date: __________

Project Representative: ______________ Evaluated by Construction Inspector: ______________

**Project Overview**

- How Many Acres Total Does the Project Disturb? _____ < 1 Acre  OR  _____ > 1 Acre

**Site Inspection**

<table>
<thead>
<tr>
<th>BMP</th>
<th>Status</th>
<th>General Notes (BMP Location and Condition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mark Clearing Limits:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are visibility &amp; perimeter fences in good condition?</td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2. Construction Access:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is track-out of sediment prevented?</td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3. Control Flow Rates:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are flow rates causing erosion in outlets, etc.?</td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>4. Sediment Controls:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are sediment controls in place &amp; functioning properly?</td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>5. Stabilize Soils:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has bare soil been protected and is</td>
<td>Ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Ok</td>
<td></td>
</tr>
</tbody>
</table>
Examples

Construction Site Inspection Checklist

D. Check the observed status of all items. Provide “Action Required” details and dates.

<table>
<thead>
<tr>
<th>Element</th>
<th>Phase</th>
<th>Inspection</th>
<th>BMPs Inspected?</th>
<th>BMP Needs Maintenance?</th>
<th>BMP Failed?</th>
<th>Action Required (describe in section F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing Limits</td>
<td>1</td>
<td>Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees), and locations for infiltration or dispersion BMPs protected with barriers or similar BMPs? (high visibility recommended)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Phase refers to the following City of Sequim Construction Phases:

- Phase 1 - Pre-construction (prior to site clearing and construction)
- Phase 2 - During construction
- Phase 3 - Post-construction (upon completion of project construction and prior to final approval)
# Examples

**Construction Site Inspection Checklist**

## Checklist 39

**Protection of LID Facilities During Construction**

This checklist reflects most, but not necessarily all of the items that will be reviewed by the Development Engineering Section. It is intended to be used as an aid by us to provide a consistent review of development work in Pierce County. All items may not be applicable in the review of each project and all items of concern to this office may not be covered on this checklist.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **Additional Bioretention Area and Rain Garden Techniques**  
(Volume II, Section 3.3 and Volume III, Section 3.4.7 and 3.8.7) |   |
| 52* | Meets applicable general construction techniques above for infiltration, dispersion, and soil amendment. |
| 53* | If machinery is operated in the bioretention area for excavation, lightweight, low ground-contact pressure equipment are utilized and the base soil is scarified to a minimum of 12 inches. |
| 54* | Clogging and over compaction of the subgrade and bioretention soils/rain garden is prevented during construction. |
| 55* | Bioretention soil/rain garden soil mix is not placed during saturated or during wet periods. |
| 56* | Compaction is inspected prior to planting. If compaction occurs during construction, the bioretention soil/rain garden soil is aerated prior to planting. |
Examples
Post-construction Soil Quality and Depth

- Basic information on the 5-step implementation process and options for soil amendment
- Exemptions (infeasibility criteria)
- Worksheet with checkboxes and calculations is a useful component
- Example calculations
Examples
Post-construction Soil Quality and Depth

Exemptions
The following portions of the project area are exempt from soil amendment requirements:
- Areas covered by an impervious surface, or
- Areas incorporated into a drainage facility, or
- Structural fill or engineered slopes
- On till slopes greater than 33%

- Stockpile and reuse existing topsoil if it meets the organic matter content requirements
- 1.75” of compost or 6” of compost-amended topsoil tilled in to an 8” depth
- 3” of compost or 6” of compost-amended topsoil tilled in to an 8” depth
- Turf
- Planting bed
- Native, undisturbed soil
- 1”-2” of mulch
Examples

Maintenance Checklists

■ Builds on the maintenance standards and procedures in the Stormwater Management Manual for Western Washington

■ Potential enhancements include:
  ■ Column(s) for documenting inspection findings
  ■ Column(s) for documenting maintenance/repair activities performed
### Examples

**Maintenance Checklists**

#### Inspection and Maintenance Requirements for Bioretention Facilities

<table>
<thead>
<tr>
<th>Maintenance Component</th>
<th>Conditions When Maintenance is Needed</th>
<th>Action Needed</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlets/Outlets/Pipes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Splash block inlet</td>
<td>Water is not being directed properly to the facility and away from the inlet structure</td>
<td>Reconfigure/repair blocks to direct water to facility and away from structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curb cut inlet/outlet</td>
<td>Accumulated leaves at curb cuts</td>
<td>Clear leaves (particularly important for key inlets and low points along long, linear facilities)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe inlet/outlet</td>
<td>Pipe is damaged</td>
<td>Repair/replace</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pipe is clogged</td>
<td>Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sediment, debris, trash, or mulch reducing capacity of inlet/outlet</td>
<td>Clear the blockage</td>
<td>Identify the source of the blockage and take actions to prevent future blockages</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bioretention Cell:
A shallow stormwater system with a designed soil mix and plants. Bioretention is a “low-impact development” (LID) practice that is integrated into a site to retain stormwater near its source. Bioretention cells are designed to mimic a forested condition by controlling stormwater through detention, infiltration, and evapotranspiration. They also provide water quality treatment through sedimentation, filtration, adsorption, and phytoremediation. Bioretention cells function by storing stormwater as surface ponding before it filters through the underlying amended soil.

Actions to keep bioretention cells functioning:
- Remove litter, weeds and fallen leaves. Do not use herbicides or pesticides.
- Check inflow and outflow systems, and remove any obstructions.
- Repair erosion, cover bare spots with organic mulch.
- Perform plant maintenance as needed, such as pruning branches.
- Remove dead vegetation and replace dead plants with same varieties.
### 1m. Bioretention Cells, Swales, and Planter Boxes

Bioretention areas are shallow stormwater systems with a designed soil mix and plants adapted to the local climate and soil moisture conditions. They are designed to mimic a forested condition by controlling stormwater through detention, infiltration, and evapotranspiration. Most routine maintenance procedures are typical landscape care activities.

<table>
<thead>
<tr>
<th>Drainage System Feature</th>
<th>Problem or Defect</th>
<th>Conditions To Check For</th>
<th>Check</th>
<th>What To Do for Desired Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash</td>
<td>Trash and debris present.</td>
<td></td>
<td>No trash and debris present. Remove and properly dispose of all trash and debris.</td>
</tr>
<tr>
<td>Concrete Sidewalls</td>
<td>Cracks or Failure in Concrete Planter Reservoir</td>
<td>Cracks wider than 0.5 inch or maintenance/inspection personnel determine that the planter is not structurally sound.</td>
<td></td>
<td>Concrete repaired or replaced.</td>
</tr>
<tr>
<td>Rockery Sidewalls</td>
<td>Unstable Rockery</td>
<td>Rock walls are insecure.</td>
<td></td>
<td>Rockery sidewalls are stable (may require consultation with professional engineer, particularly for walls 4 feet or greater in height).</td>
</tr>
</tbody>
</table>


References

- City of Sequim

- City of Port Angeles
  - Small Project Stormwater Factsheet: https://wa-portangeles.civicplus.com/documentcenter/view/3551
  - Urban Services Standards (appendices to Ch. 5 and Ch. 6): https://wa-portangeles.civicplus.com/277/Urban-Services-Standards-Guidelines

- City of Lacey
References (cont.)

- City of Seattle
  - [www.seattle.gov/dpd/codesrules/codes/stormwater](http://www.seattle.gov/dpd/codesrules/codes/stormwater)

- City of Tacoma

- Ecology
Acknowledgements

- City of Port Angeles – Jonathan Boehme
- City of Arlington – Bill Blake
- City of Sequim – Ann Soule
- City of Lacey – Doug Christenson
- City of Seattle – Sherell Ehlers
- City of Tacoma
- Pierce County
Questions?

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