Planning the BMP

Region 2000 Planning District Commission
Lynchburg, VA
December 13, 20013
PLANNING THE BMP

AGENDA

BMP Selection
BMP Design
SWM Plan Preparation
BMP SELECTION

• Types of BMPs
  – Structural BMPs
  – Non-structural BMPs

• BMP Performance
  – Runoff Reduction (RR) BMPs
  – Pollutant Removal (PR) BMPs
  – Total Load Reduction (TR = RR + PR)
BMP SELECTION

Relevant guidance in the VA SWM handbook:

**CHAPTER 6**: Environmental Site Design
- Appendix 6-B: SW Design in Karst;
- Appendix 6-C: Sustainable Sites Initiative (SSI)

**Chapter 8**: BMP Overview and Selection
<table>
<thead>
<tr>
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<td>Rooftop Disconnect</td>
<td>1 ²</td>
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<td>Can be used to Decrease Runoff Coefficient for Turf Cover at Site. See the design specs for Rooftop Disconnection, Sheet Flow to Vegetated Filter or Conserved Open Space, and Grass Channel</td>
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<td>Up to 90 ³ ⁵</td>
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<td>25</td>
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<td>13</td>
<td>Constructed Wetlands</td>
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<td>25</td>
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<td>30 (20)</td>
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<td>50 (45)</td>
<td>50 (45)</td>
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<tr>
<td></td>
<td></td>
<td>2</td>
<td>0</td>
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<td>40 (30)</td>
<td>75 (65)</td>
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<td>10</td>
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<td>31</td>
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</tbody>
</table>
BMP SELECTION

DEQ Stormwater Design Specifications (Version 2.0; 2013)

1. Description

2. Performance:

Table 1 – Summary of Stormwater Functions

<table>
<thead>
<tr>
<th>Stormwater Function</th>
<th>Level 1 Design</th>
<th>Level 2 Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Runoff Volume Reduction (RR)</td>
<td>40%</td>
<td>80%</td>
</tr>
<tr>
<td>Total Phosphorus (TP) EMC Reduction(^1) by BMP Treatment Process</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Total Phosphorus (TP) Mass Load Removal</td>
<td>55%</td>
<td>90%</td>
</tr>
<tr>
<td>Total Nitrogen (TN) EMC Reduction(^1) by BMP Treatment Process</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Total Nitrogen (TN) Mass Load Removal</td>
<td>64%</td>
<td>90%</td>
</tr>
<tr>
<td>Channel and Flood Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Use the Virginia Runoff Reduction Method (VRBM) Compliance Spreadsheet to calculate the Curve Number (CN) Adjustment OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Design extra storage (optional; as needed) on the surface, in the engineered soil matrix, and in the stone/underdrain layer to accommodate a larger storm, and use NRCS TR-55 Runoff Equations(^2) to compute the CN Adjustment.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 – Potential LEED Credits
BMP SELECTION (CONTINUED)

DEQ Stormwater Design Specifications (Version 2.0; 2013)

3. Design Tables: Level 1 and Level 2

Table 3 or 4 – Design Criteria
### General Rules:

<table>
<thead>
<tr>
<th>Sizing;</th>
<th>Max DA</th>
<th>Surface Area;</th>
<th>Ponding Depth;</th>
<th>Filter Media;</th>
<th>Soil Testing;</th>
<th>Geometry;</th>
<th>Pre-Treatment;</th>
<th>Conveyance</th>
<th>Planting Plan</th>
</tr>
</thead>
</table>

**General Rules:**

- **Sizing:**
  - Max DA
  - Surface Area;
  - Ponding Depth;
  - Filter Media;
  - Soil Testing;
  - Geometry;
  - Pre-Treatment;
  - Conveyance;
  - Planting Plan

### Design Criteria

<table>
<thead>
<tr>
<th>Level 1 Design (RR 40 TP: 25)</th>
<th>Level 2 Design (RR: 80 TP: 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sizing (Section 6.1):</strong></td>
<td><strong>Sizing (Section 6.1):</strong></td>
</tr>
</tbody>
</table>
| $T_{V_{BMP}} = [(1.5)(R)(V)(A)/12] + 
  any remaining volume from 
  upstream BMP 
  Surface Area (sq. ft.) = $T_{V_{BMP}} / $Storage Depth$ |
| **Recommended maximum contributing drainage area = 2.5 acres, or with local approval up to 5 acres and a maximum of 50% impervious** |
| **Maximum Ponding Depth = 6 to 12 inches** |
| **Filter Media Depth**
  - minimum = 24 inches;
  - recommended maximum = 48 inches |
| **Media & Surface Cover (Section 6.6):** supplied by vendor; tested for acceptable hydraulic conductivity (or permeability) and phosphorus content |
| **Sub-soil Testing (Section 6.2):**
  - not needed if an underdrain used; Min infiltration rate > 1/2 inch/hour in order to remove the underdrain requirement. |
| **Underdrain (Section 6.7):**
  - Schedule 40 PVC with clean-outs |
| **Inflow:**
  - sheetflow, curb cuts, trench drains, concentrated flow, or the equivalent |
| **Geometry (Section 6.3):**
  - Length of shortest flow path/Overall length = 0.3;
  - OR, other design methods used to prevent short-circuiting; a one-cell design (not including the pretreatment cell). |
| **Pre-treatment (Section 6.4):**
  - a pretreatment cell, grass filter strip, gravel diaphragm, gravel flow spreader, or another approved (manufactured) pre-treatment structure. |
| **Conveyance & Overflow (Section 6.5):**
  - a planting template to include turf, herbaceous vegetation, shrubs, and/or trees to achieve surface area coverage of at least 75% within 2 years. |
| **Building Setbacks**
  - 10 feet if down-gradient from building or level (coastal plain); 50 feet if up-gradient. 
  (Refer to additional setback criteria in Section 5) |
| **Deeded Maintenance** | **O&M Plan (Section 8)** |

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*Note: Sections and criteria may vary based on specific project requirements and local regulations.*
BMP SELECTION (CONTINUED)

DEQ Stormwater Design Specifications (Version 2.0; 2013)

Section 4: Typical Details
5. **Physical Feasibility:**

- Available Space
- Site Topography
- Contributing Drainage Area
- Available Hydraulic Head
- Depth to Water Table / Bedrock
- Utilities
- Soil
- Hotspots
- Setbacks
BMP DESIGN

DEQ Stormwater Design Specifications (Version 2.0; 2013)

Section 6: Design

Additional Guidance:

• SWM Handbook Chapter 8 - BMP Overview and Selection
• Appendix 8-A: BMP Design Checklists
BMP DESIGN

CONTRIBUTING DRAINAGE AREA

The little infiltration trench that could . . . .
The big Bio-detention basin that couldn’t . . . .
BMP DESIGN

BMP GEOMETRY

• General flow path
• Relation of inlets to outlets
• Length/width ratio
• Shortest flow path
BMP DESIGN

LENGTH-TO-WIDTH RATIO

Length/Width Ratio = L/W, where:
L = Length from inlet to outlet
W = Average width
BMP DESIGN

SHORTEST FLOW PATH

Outlet Structure

Curb Inlets

L

SFP

Shortest Flow Path Ratio = SFP/L

SFP = Length of shortest flow path from an inlet to outlet

L = Overall length of facility
L/W = 3.4:1
L/W = 8.9:1
Multiple Cells
SFP = 25’/315’
SFP = almost none
## BMP Design

### BMP Geometry Recommendations

<table>
<thead>
<tr>
<th>BMP Type</th>
<th>L/W Ratio</th>
<th>Shortest Flow Path Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Pond</td>
<td>Level 1 = 2.0, Level 2 = 3.0 or multi-cell</td>
<td>Level 1 = 0.5, Level 2 = 0.8</td>
</tr>
<tr>
<td>Dry Pond</td>
<td>Level 1 = 2.0, Level 2 = 3.0 or multi-cell</td>
<td>Level 1 = 0.4, Level 2 = 0.7</td>
</tr>
<tr>
<td>SW Wetland</td>
<td>Level 1 = 2.0, Level 2 = 3.0 or multi-cell</td>
<td>Level 1 = 0.5, Level 2 = 0.8</td>
</tr>
<tr>
<td>Bioretention</td>
<td>Level 1 = 3.0, Level 2 = 3.5</td>
<td>Level 1 = 0.3, Level 2 = 0.8, OR flow distribution</td>
</tr>
</tbody>
</table>
Rip-rap aprons / channels
BMP DESIGN
FILTER STRIPS

• Works as a BMP;

• Should work for pre-treatment
BMP DESIGN
PRETREATMENT MEASURES

Feasibility: Grass filter strips
BMP DESIGN

PRETREATMENT MEASURES

Feasibility: Sediment forebays
BMP DESIGN
PRETREATMENT MEASURES

Feasibility: Sediment forebays
BMP DESIGN

PRETREATMENT BY DESIGN
PERMEABLE PAVEMENT DESIGN

Limit ‘Run-on’ to:

• Impervious cover; and
• a ratio of 2.5:1 (allows for the opposite parking space and the drive aisle to drain into one parking space of permeable pavement).

‘Run-on’ Ratio (R) = $A_c/A_p$ where

• $A_c$ = contributing area; and
• $A_p$ = permeable pavement area
BMP DESIGN

CONVEYANCE

• On-line; Off-line;
• Design storm;
• Inlet Channel
• By-pass
• Overflow
ED Pond (L2) wet features:

- Forebay
- Outlet ‘Micro-pool’
- Shallow marsh/wetland
7. Design Adaptations

- Coastal Plain;
- Karst;
- Steep terrain;
- Cold Climate;
- Linear Design
SWM PLAN PREPARATION

Chapter 8: BMP Overview and Selection

• Appendix 8-A: BMP Design Checklists
9VAC25-870-55: Stormwater Management Plans

B. A complete SW Plan includes the following elements:

General Info:

1. Information on the type and location of discharges, with Pre- and post-developed drainage areas;
2. Owner contact information;
3. A narrative (or documentation) of the pre- and post-developed site conditions;
4. A general description of the proposed BMPs and long term maintenance provisions;
5. BMP Data: i) type; ii) location (coordinates); iii) acres treated; and iv) surface waters into which they discharge.
SWM PLAN PREPARATION

9VAC25-870-55: Stormwater Management Plans

B. A complete SW Plan includes the following elements (contd.):

BMP Design Info:

6. Hydrologic & Hydraulic Computations;

7. Documentation and calculations verifying compliance with quality and quantity requirements;

8. Map(s) showing topography and the following:
   a. Drainage areas;
   b. Streams, ponds, wetlands, culverts, floodplains, etc.;
   c. Soil types, geologic formations, trees and/or vegetative cover;
   d. Current land use (and any improvements on the land);
SWM PLAN PREPARATION

9VAC25-870-55: Stormwater Management Plans

B. A complete SW Plan includes the following elements (contd.):

BMP Design Info (continued):

8. Map(s) showing topography and the following (contd.):
   e. Sufficient information on adjacent parcels to assess any stormwater impacts;
   f. Limits of clearing and grading (ESC plan - ELGs), and proposed drainage patterns;
   g. Proposed improvements: buildings, roads, parking, utilities, drainage, and SWM facilities;
   h. Tabulation of the percentage of proposed land uses:

9. Offsite compliance information (if applicable)

10. Plan review fee form
9VAC25-870-55. STORMWATER MANAGEMENT PLANS

1. A stormwater management plan shall apply the stormwater management technical criteria to the entire **common plan of development** or sale where applicable. Individual lots or parcels in a residential, commercial, or industrial common plan of development or sale shall not be considered to be separate land-disturbing activities. Instead, the common plan, as a whole, shall be considered to be a single land-disturbing activity.
COMMON PLAN OF DEVELOPMENT OR SALE

- Means a contiguous area where separate and distinct construction activities may be taking place at different times on different schedules.
COMMON PLAN OF DEVELOPMENT

Individual LDA’s within a larger common plan of development require permit coverage, e.g.:

• Building on four ½-acre lots in a 20 acre development, or

• Building a fast-food restaurant on a ¾ acre pad that is part of a 20 acre retail center
C. Construction of a single-family residence separately built, disturbing less than one acre and part of a larger common plan of development or sale is authorized to discharge under this general permit and is not required to submit a registration statement or the department portion of the permit fee, provided that the stormwater management plan for the larger common plan of development or sale provides permanent control measures (i.e., Stormwater management facilities) encompassing the single-family residence.
PROJECT EXAMPLE

20 acre residential subdivision development

• 45 1/4 to 1/3 acre lots (zoned R3)
COMMON PLAN OF DEVELOPMENT

• 20 acre Common Plan of Development

• 13 acres of lots
  – 35% impervious (~4.5 ac)
  – 50% (avg) managed turf (~6.5 ac)
  – 15% open space (undisturbed buffers) (~2 ac)

• 3 acres right of way
  – 18 ft pavement width; 6 ft shoulder (~ 2.4 ac)
  – 30 ft right of way; (~0.6 ac turf/grass channel)

• 4 acres open space (buffers, park, floodplain)

• Total: 6.0 acres forest/open space
         7.1 acres managed turf
         6.9 acres impervious
<table>
<thead>
<tr>
<th>Land Cover (acres)</th>
<th>A soils</th>
<th>B Soils</th>
<th>C Soils</th>
<th>D Soils</th>
<th>Totals</th>
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<tbody>
<tr>
<td>Forest/Open Space -- undisturbed, protected forest/open space or reforested land</td>
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<td>0.00</td>
<td>6.00</td>
<td>0.00</td>
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<tr>
<td>Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed</td>
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<td>0.00</td>
<td>7.10</td>
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<td>Impervious Cover</td>
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<td>6.90</td>
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<tr>
<td>Impervious Cover</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
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</tbody>
</table>

| Land Cover Summary                        |         |         |         |         |        |
|-------------------------------------------|---------|---------|---------|---------|
| Forest/Open Space Cover (acres)           | 6.00    |         |         |         |
| Weighted Rv(forest)                       | 0.04    |         |         |         |
| % Forest                                  | 30%     |         |         |         |
| Managed Turf Cover (acres)                | 7.10    |         |         |         |
| Weighted Rv(turf)                         | 0.22    |         |         |         |
| % Managed Turf                            | 36%     |         |         |         |
| Impervious Cover                          | 6.90    |         |         |         |
| Rv.impervious                             | 0.95    |         |         |         |
| % Impervious                              | 35%     |         |         |         |
| Total Site Area (acres)                   | 20.00   |         |         |         |

TP Reduction Requirement = 10.86 lb/yr
INITIAL PLAN SUBMITTAL & PERMIT REGISTRATION

~ 3.75 acres of land disturbance

- 3 ac right-of-way
  - Impervious; pavement & shoulders ~ 2.4 ac;
  - Grass drainage ditch ~0.6 ac turf; or BMP??
- 0.75 ac BMP footprint ~ 0.75 ac open space.
INITIAL PLAN SUBMITTAL & PERMIT REGISTRATION

Initial Land Disturbing Activity = 3.0 acres of right of way; and 0.75 acres for BMPs
BMP Design: 2 x (Bioretention Level 2 & ED L2)

- Entire acreage of right of way (½ to each);
- 12 lots (~3.2 ac); 6 to each practice:
  - Impervious ~ 1.1 ac;
  - Managed Turf ~ 1.6 ac;
  - Forest/Open Space ~0.5 ac.
- Total acreage to Combined BMP: 12 lots plus right of way
  - $2.4 + 1.1 = 3.5$ ac impervious
  - $0.6 + 1.6 = 2.2$ ac managed turf;
  - $0.75 + 0.5 = 1.25$ ac Forest/Open Space

Total DA A = 6.95 acres
Proposed DA A
= 3.2 acres of lots (12 lots); 3.0 acres of right of way; and 0.75 acres for BMPs

BMP Treatment trains – Bioretention L2 & ED L2
BMP 1: Bioretention Level 2
BMP 2: ED L2
DA B:

- 15 lots draining to ED L2 (~4.4 ac: 2.2 ac to each ED)
  - Impervious ~ 1.5 ac;
  - Managed Turf ~ 2.2 ac;
  - Forest/Open Space ~0.7 ac.

- Treatment Train Performance Goal (each lot):
  - Each lot consists of approx 0.1 ac impervious
  - Treat minimum 50% of impervious cover with Rain Garden Level 1; or
  - Equivalent = TP reduction of 0.06 lb/yr and RR = 69 ft³
  - Remaining Imp and Turf drains to ED L2
INITIAL PLAN SUBMITTAL & PERMIT REGISTRATION

Proposed DA B
= 4.4 acres of lots (15 lots);

BMP Treatment trains
BMP 1: Each lot 50% Imp to (min) Rain Garden L1 (TP 0.06 lb/yr; RR 69 ft³/yr)
BMP 2: ED L2
DA C:

• 18 Remaining Lots (~5.4 ac)
  – Impervious ~ 1.9 ac;
  – Managed Turf ~ 2.7 ac;
  – Forest/Open Space ~0.8 ac.

• Performance Goal (each lot):
  – Each lot consists of approx 0.1 ac impervious
  – Treat minimum 50% of impervious cover with Rain Garden Level 1; or
  – Equivalent = TP reduction of 0.06 lb/yr and
    \[ RR = 69 \text{ ft}^3 \]
INITIAL PLAN SUBMITTAL & PERMIT REGISTRATION

Proposed DA C
= 5.4 acres of lots (18 lots);

BMP (No Treatment trains)
Each lot 50% Imp to (min) Rain Garden L1 (TP 0.06 lb/yr; RR 69 ft³/yr)
Virginia Runoff Reduction Method New Development Worksheet -- v2.7 Revised April 2013

Site Data Summary
Total Rainfall = 43 inches

Site Land Cover Summary

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>A Soils (acres)</th>
<th>B Soils (acres)</th>
<th>C Soils (acres)</th>
<th>D Soils (acres)</th>
<th>Total (acres)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>0.00</td>
<td>0.00</td>
<td>6.00</td>
<td>0.00</td>
<td>6.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Turf</td>
<td>0.00</td>
<td>0.00</td>
<td>7.10</td>
<td>0.00</td>
<td>7.10</td>
<td>35.50</td>
</tr>
<tr>
<td>Impervious</td>
<td>0.00</td>
<td>0.00</td>
<td>6.90</td>
<td>0.00</td>
<td>6.90</td>
<td>34.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Drainage Area A Summary

Land Cover Summary

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>A Soils (acres)</th>
<th>B Soils (acres)</th>
<th>C Soils (acres)</th>
<th>D Soils (acres)</th>
<th>Total (acres)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>0.00</td>
<td>0.00</td>
<td>1.25</td>
<td>0.00</td>
<td>1.25</td>
<td>17.99</td>
</tr>
<tr>
<td>Turf</td>
<td>0.00</td>
<td>0.00</td>
<td>2.20</td>
<td>0.00</td>
<td>2.20</td>
<td>31.65</td>
</tr>
<tr>
<td>Impervious</td>
<td>0.00</td>
<td>0.00</td>
<td>3.50</td>
<td>0.00</td>
<td>3.50</td>
<td>50.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.95</td>
<td></td>
</tr>
</tbody>
</table>

BMP Selections

<table>
<thead>
<tr>
<th>Practice</th>
<th>Credit Area (acres)</th>
<th>Downstream Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.b. Bioretention #2 (Spec #9)</td>
<td>Impervious: 3.5</td>
<td>8.b. ED #2</td>
</tr>
<tr>
<td></td>
<td>Turf (Pervious): 2.2</td>
<td>8.b. ED #2</td>
</tr>
<tr>
<td>8.b. ED #2 (Spec #15)</td>
<td>Impervious: 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Turf (Pervious): 0</td>
<td></td>
</tr>
</tbody>
</table>

Total Impervious Cover Treated (acres) | 3.50
Total Turf Area Treated (acres)      | 2.20
Total TP Load Reduction Achieved in D.A. A (lb/yr) | 8.05
Total TN Load Reduction Achieved in D.A. A (lb/yr) | 62.08
## Drainage Area B Summary

### Land Cover Summary

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>A Soils</th>
<th>B Soils</th>
<th>C Soils</th>
<th>D Soils</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.70</td>
<td>0.00</td>
<td>0.70</td>
<td>10.07</td>
</tr>
<tr>
<td>Turf (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>2.20</td>
<td>0.00</td>
<td>2.20</td>
<td>31.65</td>
</tr>
<tr>
<td>Impervious (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>1.50</td>
<td>0.00</td>
<td>1.50</td>
<td>21.58</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.40</strong></td>
<td><strong>4.40</strong></td>
<td><strong>4.40</strong></td>
<td><strong>4.40</strong></td>
<td><strong>4.40</strong></td>
<td><strong>4.40</strong></td>
</tr>
</tbody>
</table>

### BMP Selections

<table>
<thead>
<tr>
<th>Practice</th>
<th>Credit Area (acres)</th>
<th>Downstream Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.f. To Rain Garden #1 (Micro-Bioretention #1) (Spec #9)</td>
<td>impervious acres disconnected</td>
<td>0.75</td>
</tr>
<tr>
<td>8.b. ED #2 (Spec #15)</td>
<td>Impervious:</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Turf (Pervious):</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Total Impervious Cover Treated (acres): 1.50
Total Turf Area Treated (acres): 2.20
Total TP Load Reduction Achieved in D.A. A (lb/yr): 1.85
Total TN Load Reduction Achieved in D.A. A (lb/yr): 31.11
## Drainage Area C Summary

### Land Cover Summary

<table>
<thead>
<tr>
<th></th>
<th>A Soils</th>
<th>B Soils</th>
<th>C Soils</th>
<th>D Soils</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.80</td>
<td>0.00</td>
<td>0.80</td>
<td>11.51</td>
</tr>
<tr>
<td>Turf (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>2.70</td>
<td>0.00</td>
<td>2.70</td>
<td>38.85</td>
</tr>
<tr>
<td>Impervious (acres)</td>
<td>0.00</td>
<td>0.10</td>
<td>1.90</td>
<td>0.00</td>
<td>1.90</td>
<td>27.34</td>
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### BMP Selections

<table>
<thead>
<tr>
<th>Practice</th>
<th>Credit Area (acres)</th>
<th>Downstream Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.f. To Rain Garden #1 (Micro-Bioretention #1) (Spec #9)</td>
<td>Impervious acres disconnected</td>
<td>0.95</td>
</tr>
</tbody>
</table>

| Total Impervious Cover Treated (acres) | 0.95 |
| Total Turf Area Treated (acres)       | 0.00 |
| Total TP Load Reduction Achieved in D.A. A (lb/yr) | 1.13 |
| Total TN Load Reduction Achieved in D.A. A (lb/yr) | 14.71 |
CURVE NUMBER ADJUSTMENT
(ENERGY BALANCE)

<table>
<thead>
<tr>
<th>Target Rainfall Event (in)</th>
<th>Weighted CN</th>
<th>1-year storm Adjusted CN</th>
<th>2-year storm Adjusted CN</th>
<th>10-year storm Adjusted CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.A. A CN</td>
<td>85</td>
<td>77</td>
<td>78</td>
<td>80</td>
</tr>
<tr>
<td>D.A. B CN</td>
<td>82</td>
<td>80</td>
<td>80</td>
<td>81</td>
</tr>
<tr>
<td>D.A. C CN</td>
<td>82</td>
<td>81</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>D.A. D CN</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>D.A. E CN</td>
<td>0</td>
<td>43</td>
<td>#N/A</td>
<td>#N/A</td>
</tr>
</tbody>
</table>
INITIAL PLAN SUBMITTAL & PERMIT REGISTRATION

VSMP land disturbing activity (≥ 1 ac):

STORMWATER POLLUTION PREVENTION PLAN:

• GENERAL REQMTS
• EROSION & SEDIMENT CONTROL PLAN
• STORMWATER MANAGEMENT PLAN
  – Including performance goals/general details for on-lot bmps
• POLLUTION PREVENTION PLAN
• ADDITIONAL MEASURES TO ADDRESS TMDL
COMMON PLAN OF DEVELOPMENT

Plan Submittal Requirements for single family lots in CPD?
INDIVIDUAL SF LOT WITHIN LARGER CPD

• Local ESC Permit Application;

• Agreement in Lieu of ESC Plan;

• SWPPP Template;
  – General Information on BMPs;
  – BMP Implementation Plan (found in larger CPD SWPPP; or new SWPPP);
  – PP

• BMP Maintenance Agreement;