



# DINWIDDIE COUNTY

PLANNING, ZONING, CODE COMPLIANCE AND ENVIRONMENTAL

## BIORETENTION PRACTICES

Plan Name: \_\_\_\_\_ Date Submitted: \_\_\_\_\_

The following checklist only identifies the information and details that must be included in the SWM plan

**Mark the appropriate BMP that is being reviewed:**

**Micro-Bioretention**

**Bioretention Filter or Basin**

**Level 1**

**Level 2**

**LEVEL 1 MICRO-BIORETENTION MINIMUM DESIGN CRITERIA:**

	SELECT
The filter surface area must be at least 3% of the CDA, or 5% of the rooftop drainage area if used as an alternative practice for rooftop disconnection.	
The CDA must be 5 acres or less with no more than 25% impervious cover, or 1,000 sq. ft. of 100% impervious cover (rooftop disconnection).	
The maximum ponding depth must be 6 inches or less.	
The filter media depth must be at least 18 inches and less than 36 inches.	
The media mix must be tested and have a phosphorus index (P-Index) between 10 and 30 or between 7-21 mg/kg P in the soil media.	
Sub-soil testing must be provided showing the infiltration rate > 1 inch/hour, unless an underdrain is incorporated.	
The inflow to the practice must be either sheet flow or roof leader.	
External pre-treatment must be incorporated into the design.	

**LEVEL 2 MICRO-BIORETENTION MINMUM DESIGN CRITERIA:**

	SELECT
The filter surface area must be at least 4% of the CDA, or 6% of the rooftop drainage area if used as an alternative practice for rooftop disconnection.	
The CDA must be 5 acres or less with no more than 25% impervious cover, or 1,000 sq. ft. of 100% impervious cover (rooftop disconnection).	
The maximum ponding depth must be 6 inches or less.	
The filter media depth must be at least 24 inches and less than 36 inches.	
The media must be supplied by a vendor.	
The media must be supplied by a vendor with a phosphorus index (P-Index) between 10 and 30 or between 7-21 mg/kg P in the soil media.	
Sub-soil testing must be provided showing the infiltration rate is > 1 in/hr, unless an underdrain is used.	
If an underdrain is used in the design, it must be made of corrugated HDPE or an equivalent material with a 6-inch or more stone sump.	
The inflow to the practice must be either sheet flow or roof leader.	
External pre-treatment and a grass filter strip pre-treatment must incorporated into the design.	

**LEVEL 1 BIORETENTION FILTER MINMUM DESIGN CRITERIA:**

	SELECT
The filter surface area must be determined by the following equation: $SA \text{ (sq. ft.)} = Tv - \text{the volume reduced by an upstream BMP}/\text{Storage Depth.}$	
The maximum CDA is 5 acres (maximum 50% impervious area).	
The maximum ponding depth must be 6 inches or less.	
The filter media depth must be at least 24 inches (maximum is 6 feet).	
The media must be supplied by a vendor with a phosphorus index (P-Index) between 10 and 30 or between 7-21 mg/kg P in the soil media.	
Sub-soil testing must be provided showing the infiltration rate is > 0.5 in/hr, unless an underdrain is used.	
Underdrains must be specified as 4-inch diameter perforated Schedule 40 PVC with clean outs in a six inch minimum stone layer.	

**LEVEL 1 BIORETENTION FILTER MINMUM DESIGN CRITERIA:**

	SELECT
Short-circuiting must be prevented (a ratio of 0.3 for the shortest flow length to the overall length is acceptable).	
Pre-treatment must be provided to trap course sediment and spread flow evenly over the practice filtering area.	

**LEVEL 2 BIORETENTION FILTER MINMUM DESIGN CRITERIA:**

	SELECT
The filter surface area is determined by the following equation: $SA \text{ (sq. ft.)} = 1.25Tv - \text{the volume reduced by an upstream BMP}/\text{Storage Depth.}$	
The maximum CDA is 5 acres (maximum 50% impervious area).	
The maximum ponding depth must be 6 inches or less.	
The filter media depth must be at least 36 inches (maximum is 6 feet).	
The media must be supplied by a vendor with a phosphorus index (P-Index) between 10 and 30 or between 7-21 mg/kg P in the soil media.	
Sub-soil testing must be provided showing the infiltration rate is $> 0.5$ in/hr, unless an underdrain is used.	
Underdrains must be specified as 4-inch diameter perforated Schedule 40 PVC with clean outs in a six inch minimum stone layer with a 12 inch stone sump layer below the invert (not required if soil infiltration rates are met).	
Short-circuiting must be prevented (a ratio of 0.8 for the shortest flow length to the overall length is acceptable).	
Pre-treatment must be provided to trap course sediment and spread flow evenly over the practice filtering area.	

**PLAN REQUIREMENTS:**

	SELECT
The bioretention basin must incorporate 5 design components: pre-treatment, treatment volume, filter media, underground storage layer, and surface cover. Channel protection and flood control volume may be provided, as well.	

**PLAN REQUIREMENTS:**

	SELECT
Provide a site map identifying pertinent information regarding the Bioretention Practice:	
- The contributing drainage area (CDA) boundaries, acreage, and land cover (recommended CDA slope is 1%-5%);	
- Topography of the site area including the bioretention practice, its CDA, and pre-treatment practices;	
- Provide soil infiltration test locations, including the results of the soil infiltration rate tests, if no underdrain is specified.	
Provide a plan view showing:	
- The layout and dimensions of the bioretention practice filter area; <ul style="list-style-type: none"> <li>a) The width must be at least 15 feet and the length must be at least 40 feet (for widths greater than or equal to 20, the length must be at least twice the width);</li> <li>b) The ratio of the length of shortest flow path / overall length is 0.3 for Level 1 and 0.8 for Level 2 designs.</li> </ul>	
- The buffer strip must be at least 10 feet wide;	
- A 1 foot wide sand wall must extend around all sides of the bioretention area that receive surface runoff;	
- A bypass must be designed to take runoff around the BMP once the ponding area has filled to capacity;	
- Overall basin grading, including: the top-of-bank, basin bottom, embankment area;	
- The treatment volume and maximum water surface elevations for all appropriate design storms and safety storms;	
- The location of the underdrain (if applicable);	
- The location of the observation well(s);	
- The location of all conveyance system outfalls (inlets) into the facility with pre-treatment and outlet protection designed in accordance with the VE&SCH and shown.	
Provide profiles, section views and details showing the following:	
- Provide detail of appropriate pre-treatment (external pre-treatment for Level 1; external pre-treatment plus a grass filter strip for Level 2);	
- Provide inflow locations, types, materials and inverts;	
- The maximum ponding depth;	
- The elevations of treatment volume and maximum design water surface elevations for all appropriate design storms and safety storms;	

**PLAN REQUIREMENTS:**

	SELECT
- The Bioretention Practice overflow structure details;	
- The facility rim elevations, both constructed and settled, allowing for up to 10% settlement showing adequate freeboard;	
- A typical section through the filter media complying with the minimum design criteria;	
- Design of the underdrain and cleanouts in accordance with minimum design criteria, including stone sump;	
- The filter bed and underdrain pipe extended below the frost line and/or the drain pipe is oversized;	
- The depth to bedrock, if encountered (minimum of 2 feet below the design bottom of the Bioretention Practice);	
- The water table (at least 2 feet below the bottom of the BMP);	
- Filter fabric placed between the sand and planting soil layers.	

**COMPUTATIONS:**

	SELECT
Hydrologic analysis must be based on a 24-hour storm event using site specific rainfall precipitation frequency data recommended by the U.S. National Oceanic and Atmospheric Administration (NOAA) Atlas 14.	
The U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) synthetic 24-hour rainfall distribution and models, including but not limited to TR-55 and TR-20; hydrologic and hydraulic methods developed by the U.S. Army Corps of Engineers; or other standard hydrologic and hydraulic methods must be to conduct the analyses necessary to demonstrate compliance with the stormwater quality and quantity requirements.	
The Rational Method may only be used for evaluating peak discharges such as pipe sizing.	
The Modified Rational Method may only be used for evaluating volumetric flows to stormwater conveyances and may not be used to perform basin routings.	
Provide calculations to show how the required treatment volume (Tv) is determined.	
Verify that there is 4 – 5 feet of hydraulic head provided above the bottom elevation needed to tie the underdrain into the storm drain system in order to drive runoff through the filter bed.	
Surface area of the filter must be calculated using accepted void ratios for each type of media.	
Account for a large storm overflow or bypass.	

**COMPUTATIONS:**

	SELECT
If the bioretention practice is used for water quantity compliance, provide pre- and post-development hydrologic, hydraulic, and routing information for the 1- year, 2- year, 10- year, and 100-year, 24-hour storms, as needed:	
- Provide the complete input used for the hydrograph generation on the plans;	
- Provide a stage/storage table;	
- Provide a stage/discharge for each component of the outlet structure;	
- Provide a composite stage/discharge table;	
- Provide an outlet control analysis.	

**LANDSCAPING:**

	SELECT
Provide a landscape plan prepared by a qualified landscape architect that specifies the following:	
- For Level 1 Micro-bioretention, the vegetative cover must include at least one of the following: turf, herbaceous cover, and shrubs.	
- For Level 2 Micro-bioretention, the vegetative cover must include at least two of the following: turf, herbaceous cover, and shrubs.	
- For Level 1 Bioretention Filter or Basin, a planting template must be provided including turf, herbaceous vegetation, shrubs, and/or trees to achieve surface area coverage of at least 75% within 2 years.	
- For Level 2 Bioretention Filter or Basin, a planting template must be provided including turf, herbaceous vegetation, shrubs, and/or trees to achieve surface area coverage of at least 90% within 2 years for Level 2 designs.	
The planting material is chosen and placed to replicate a forest community structure and the layout follows two basic guidelines: woody plant material is not placed within the immediate area where flow will be entering the BMP and trees are planted primarily on the perimeter of the bioretention area;	
At installation, trees must be specified at 2.5 inches in caliper and shrubs at 3 – 4 feet in spread.	

**MAINTENANCE:**

	SELECT
Provide a summary of the long term maintenance requirements for the SWM facility on the SWM plan.	

**ACCESS AND LOCATION:**

	SELECT
Provide sufficient access from the public ROW or roadway to facilitate inspection and provide maintenance.	
The following proper setbacks from building foundations, down-gradient slopes, etc., are shown:	
- CDA ≤ 0.5 acres: 10 feet down-gradient and 50 feet up-gradient;	
- CDA > 0.5 acres: 25 feet down-gradient and 100 feet up-gradient;	
- 5 feet down-gradient and 25 feet up-gradient from building foundations for micro-bioretenment;	
- 5 down-gradient from wet utility lines;	
- 25 feet from roadways to prevent potential frost heaving of the pavement;	
- 100 feet from any water supply well (50 feet if the biofilter is lined);	
- If an in-ground basement or other special conditions exist, the design will be reviewed by a licensed engineer.	

**CONSTRUCTION:**

	SELECT
The sequence of construction must address the SWM facility installation and appropriate inspections, including: initial site preparation, excavation/grading, and installation of the embankment, principal outlet structure, and overflow considerations. We recommend the County staff be involved in these inspections	
The sequence of construction must clearly state that a construction record drawing and certification that the stormwater management facility has been constructed in accordance with the approved plan must be submitted to the County and approved prior to Environmental Compliance Bond (ECB) release.	

Engineer Signature: \_\_\_\_\_ Date: \_\_\_\_\_