DINWIDDIE COUNTY

PLANNING, ZONING, CODE COMPLIANCE AND ENVIRONMENTAL

CONSTRUCTED WETLANDS

Site Design Checklist

Plan Name: _____ Date Submitted: _____

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

☐ Level 1 ☐ Level 2

LEVEL 1 MINMUM DESIGN CRITERIA:

The treatment volume of the SWM facility must be calculated using the following equation: Tv = [(1.0)(Rv)(A)]/12 – the volume reduced by an upstream SWM facility.	
The overall basin length to width must be 2:1 or larger.	
The design must be a single cell design with a forebay.	
Extended detention (24 hrs.) of the Tv is allowed but must be limited 12” above the normal pool.	
The ratio of the shortest flow path (closest inlet to the outlet) to the overall length must be 0.5 or more.	
The wetland must have an emergent wetland design.	
At least 50% of the Tv must be contained in the permanent pools (wetland and forebay).	
The Tv cannot be stored in any County maintained storm sewer or right-of-way.	
Permanent pool depths (including those in forebays) cannot exceed 3 feet in residential areas.	

LEVEL 2 MINMUM DESIGN CRITERIA:

The treatment volume of the swale must be calculated using the following equation: Tv = [(1.5)(Rv)(A)]/12 – the volume reduced by an upstream SWM facility.	
The design must incorporate multiple cells (which may include the forebay(s)) or a multi-cell pond/ wetland combination.	

LEVEL 2 MINMUM DESIGN CRITERIA:

For multi-cell pond/wetland combinations, no more than one-third of the Tv can be provided in a separate pond cell and no more than one-third of the Tv can be in extended detention storage above the pool. (At least one-third of the Tv must be contained in the wetland.)	
The one-year storm elevation cannot be more than 8 inches above the normal water surface elevation	
Approximately 25% of the Tv must be provided in at least three pools ranging in depth of 18 to 48 inches (not to exceed 36 inches in residential areas).	
Approximately 70 % of the wetland surface area must exist in the high marsh zone (-6 inches to +6 inches relative to the normal pool elevation).	
No extended detention is allowed.	
Diverse micro-topography with varying depths is required.	
The mean wetland depth must be less than or equal to 1 foot.	
The surface area of the wetland must be more than 3% of the CDA.	
The overall basin length to width must be 3:1 or larger.	
The ratio of the shortest flow path (closest inlet to the outlet) to the overall length must be 0.8 or more.	
The wetland must be a mixed wetland design.	
The Tv cannot be stored in any County maintained storm sewer or right-of-way.	
Permanent pool depths (including those in forebays) cannot exceed 3 feet in residential areas.	

PLAN REQUIREMENTS:

Provide a site map identifying pertinent information regarding the Wet Pond..	
- The contributing drainage area (CDA) boundaries, acreage, and land cover;	
- Topography of the site area including the constructed wetland area, its CDA, and any pre-treatment practices;	
- There must be at least 50 feet between any buildable area and the permanent pool elevation.	
- There must be at least 100 feet between any well and the permanent pool elevation.	
- The locations of all conveyance system outfalls into basin must be shown.	

PLAN REQUIREMENTS:

- Inlet pipe inverts must be designed to be located at or slightly below the forebay pool elevation.	
- The location and dimensions of the riser and barrel must be shown.	
- All cells or features (normal pool, upper shelf wetland, wetland cell, forebays, etc.) must be identified.	
- A 16' wide drainage easement must be provided from all inlets to the outlet(s) if the SWM facility contains public water.	
Provide profiles and section views that show the following:	
- Top of dam	
- Side slopes	
- 10-year storm elevation	
- Tv (detention) volume elevation	
- Energy balance volume detention elevation	
- Safety and aquatic benches	
- Basin bottom and water surface elevations for permanent pool(s), including forebays, micropools, deep pools, and/or wetlands.	
- Emergency spillway elevation	
- Principal spillway crest	
- 100-year storm elevation	
- Volumes of various cells	
- Internal baffles including material and elevation information	
- Principal spillway and embankment	
Provide a plan view showing:	
- Overall basin grading	
- Deep pools	
- Internal baffles/barriers	
- Emergency spillway and exit channel	
- Forebays	

PLAN REQUIREMENTS:

- Wetland cells	○
- Shortest flow path	
- Sizing and dimensions for all components	○
- Micropools	
- Safety and aquatic benches	○
- Discharge points into the basin	
- Delineation of the 50-year (if applicable) and 100-year storm elevation in and around the basin	○
Provide a detail of the principal outlet structure showing:	
- Embankment elevations	○
- Riser crest elevation	
- Trash racks	○
- Water quality orifice sizing and elevations	
- Tv, 1-year, 10-year, 50-year, and 100-year storm elevations, where applicable	○
- Dewatering device anti-clogging information	
- Material and sizing information for all components	○
If the forebay discharges to a pool, the elevation of the stabilized overflow spillway component of the forebay must be set at the permanent pool elevation.	
If the forebay does not discharge to a pool, the stabilized overflow spillway component of the forebay must be designed to allow flow to exit the forebay at non-erosive velocities during the 2-year design storm.	○
Inlet pipe inverts must be located at or slightly above the stabilized overflow spillway component of the forebay.	

COMPUTATIONS:

A water balance analysis using the Hunt Water Balance Equation for Acceptable Water Depth in a Stormwater Wetland must be provided as follows: **DP = RFm × EF × WS/WL – ET – INF – RES** Where: Dp = Depth of pool (inches) RFm = Monthly rainfall during drought (inches) EF = Fraction of rainfall that enters the stormwater wetland (CDA × Rv) WS/WL = Ration of contributing drainage are to wetland surface area ET = Summer evapotranspiration rate (inches; assume 8) INF = Monthly infiltration loss (assume 7.2 inches @ 0.01 inch/hour) RES = Reservoir of water for a factor of safety (assume 6 inches)	
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 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, for all constructed wetlands.	
Provide pre- and post-development hydrologic, hydraulic, and routing information for the 1- year, 2-year, 10- year, 50-year, and 100-year, 24-hour storms, as needed, for 50/10 detention facilities.	
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	
Provide calculations to show that the forebays are sized to hold 0.25 inch of runoff per impervious acre of contributing drainage area.	
Provide calculations to show how the required treatment volume (Tv) is determined.	

EARTHEN EMBANKMENTS AND BASIN GRADING:

For earthen embankments where the vertical distance from the natural bed of the stream or watercourse, measured at the downstream toe of the embankment, to the top of the embankment is 3 feet or more, the following notes must be included on the plans:	
- The earthen embankment must be designed with consideration given to: specific site and foundation conditions; construction material characteristics; purpose of the impoundment; and hazard potential associated with the particular site or impoundment.	
- The material used for the embankment must be sufficiently impervious to provide an adequate water barrier.	
- The earthen embankment must be designed to be stable against any force condition or combination of force conditions that may develop during the life of the structure.	
- Character and distribution of the foundation material must be considered for its shear strength, compressibility, and permeability.	
- Fill materials must be sufficiently plastic to deform without cracking.	
- The minimum required density of the fill material is 95% of maximum dry density with a moisture content within 2% of optimum unless otherwise specified by the engineer.	
The minimum allowable width for any embankment is 12 feet unless a greater width is required by the Virginia Dam Safety regulations.	
The top of the embankment must be level to prevent possible overtopping in one location in cases of extreme storms or spillway failure.	
Gravel bedding is not allowed under any conduits through the embankment.	
At least 1 foot of freeboard is required between the 100-year water surface elevation and the top of the basin if there is an emergency spillway.	
At least 2 feet of freeboard is required between the 100-year water surface elevation and the top of the basin if there is no emergency spillway.	
The basin side slopes must be 4:1 or flatter.	
To evaluate whether or not dams/impoundments are subject to the Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 of the Code of Virginia and Dam Safety Regulations, the following information must be provided:	
- dam height (vertical distance from the streambed at the downstream toe to the top of dam)	
- the impoundment capacity (the volume capable of being impounded at the top of the dam)	
The dam/impoundment appears to be exempt from the Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 of the Code of Virginia and Dam Safety Regulations because:	
- the dam height is less than 6 feet, or	

EARTHEN EMBANKMENTS AND BASIN GRADING:

- the capacity is less than 50 acre-feet and the dam height is less than 25 feet, or	
- the capacity is less than 15 acre-feet and the dam height is more than 25 feet	
The dam/impoundment appears to be subject to the Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 of the Code of Virginia and Dam Safety Regulations. Regulated dams/impounding structures cannot be constructed or altered prior to issuance of a Virginia Soil and Water Conservation Board construction permit. Contact the Virginia Department of Conservation and Recreation at (804) 371-6095.	
If the dam height is greater than three (3), a geotechnical certification must be submitted stating that construction compaction requirements have been achieved. This must be submitted as part of the BMP as-built certification prior to ESC bond release.	

PRINCIPAL SPILLWAYS:

The principal spillway crest elevation must be at least one foot below the emergency spillway elevation.	
The outfall riser must have a larger cross-sectional area than the barrel pipe.	
Must have outlet structures constructed of Reinforced Concrete Pipe (RCP), Class III, or better, with a minimum diameter of 15 inches.	
Corrugated metal pipe (CMP) must meet or exceed the minimum thickness requirements specified in Table B-1 of Appendix B in the Virginia BMP Clearinghouse at http://vwrrc.vt.edu/swc/NonProprietaryBMPs.html	
The principal spillway (riser and barrel) must be constructed with watertight joints to prevent infiltration of embankment soils into the conduit. All joints must be constructed as specified by the pipe manufacturer.	
If the barrel discharges into the receiving channel at an angle, the opposite bank must be protected up to the 10-year storm elevation.	
Self-cleaning trash racks are required for all outlet structures, including dewatering orifices. Trash racks may have flat tops if the top of the trash rack is located above the 100-year storm elevation.	
The primary outlet structure must be designed with acceptable anti-flotation devices.	
Anti-vortex devices are required for the primary outlet structure.	
To minimize clogging, an orifice plate is required for all orifices that are 3” diameter or smaller.	
The 10-year post-development flow must be passed by the principal outlet structure and contained within the basin.	

PRINCIPAL SPILLWAYS:

The 100-year post-development flow must be passed through the basin by the principal outlet structure, the emergency spillway, or both.	

EMERGENCY SPILLWAYS:

Emergency spillways located in fill sections must be lined with rip rap.	
The exit channel must be sized to convey the 100-year storm down gradient to a point beyond the embankment limits	
Spillway side slopes must be no steeper than 3H:1V.	
At least 6 inches of freeboard is required between the 10-year water surface elevation and the emergency spillway elevation.	
The emergency spillway must be located so that downstream structures will not be impacted by spillway discharges.	

SEDIMENT FOREBAYS:

Sediment forebays do not provide any pollutant removal credit.	
Forebays are required at each incoming storm sewer discharge point and must be constructed as a separate cell.	
Forebays must be formed by an acceptable barrier such as an earthen berm, concrete weir, gabion baskets, etc.	
All forebays with permanent pools deeper than 18 inches must be equipped with a 5’ wide aquatic bench around the perimeter, ranging in depth from 0 inches at the water’s edge to 6 inches deep at the outer limit of the aquatic bench.	
The forebay must be sized to hold 0.25 inch of runoff per impervious acre of the contributing drainage area.	

LANDSCAPING:

Provide a landscape plan that specifies the following:	
- Delineation of wetland zones within both the SWM facility;	
- The selection of corresponding plant species is shown;	
- The planting plan is provided;	
- The sequence for preparing the wetland benches;	
- Sources of native plant material;	
- Woody vegetation may not be planted or allowed to grow within 15 feet of the toe of the embankment, nor within 25 feet of the principal spillway structure.	
Landscape plants must be selected from appropriate tables contained in the appropriate tables in VA DEQ SWM Design Specification #13 and Appendix E: Landscaping located in the Virginia BMP Clearinghouse (http://vwrrc.vt.edu/swc/NonProprietaryBMPs.html).	
Trees, shrubs or any other woody vegetation are not permitted on the embankment or adjacent areas extending at least 25 feet beyond the embankment toe and abutment contacts.	
The construction sequence must specify that a 6” layer of topsoil is required for all areas of the basin that will be stabilized with a permanent stand of vegetation. The topsoil layer must be clearly shown on all basin related details to ensure that all post-construction elevations reflect the topsoil application.	
Landscaping that requires mulching, spraying, etc. must be limited to areas above the elevation of the top of the principal outlet structure elevation and must be done in a manner that does not inhibit maintenance access.	
SWM facilities that are visible from the right-of-way must be effectively screened from the public right-of-way or less intense uses of adjacent properties. Examples of acceptable screening include fencing, landscaping, or a combination of these features.	

SAFETY FEATURES:

End walls above pipe outfalls greater than 48 inches in diameter must be fenced (or railing) to minimize falling risks.	
The principal spillway opening must be designed to prevent access by small children (i.e. – trash racks with small enough openings to prevent access).	
The perimeter of all permanent pool areas deeper than 18 inches must be surrounded by an aquatic bench (below the permanent water surface elevation) that is:	
- 10 feet wide if the permanent pool is less than 10 feet deep.	

SAFETY FEATURES:

- 20 feet wide if the permanent pool is 10 feet or more deep.	
The perimeter of all permanent pool areas deeper than 18 inches must be surrounded by a safety bench (above the permanent water surface elevation) that is at least 8 feet wide and is no steeper than 20:1. Safety benches are not required if the side slopes are 5:1 or flatter.	
Fencing is required at or above the maximum water surface elevation in the rare situations when the pond slope is a vertical wall.	

MAINTENANCE:

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

ACCESS:

All SWM facilities shall be designed to provide the following for adequate access for maintenance activities:.	
- An access area at least 20 feet in width must be provided to the SWM facility from a public road	
- An access area 20 feet in width must be provided around the SWM facility that encompasses the highest continuous contour within the SWM facility, embankment, principal spillway outlet, emergency spillway and exit channel.	
- The access areas must either be in common area or located completely on an individual lot	
- The access areas cannot contain any obstacles, or vegetation that would prevent access of maintenance equipment;	
- The access areas shall not exceed a grade or cross-slope of 12:1.	
- The access area to the SWM facility must be constructed of load bearing materials.	
- The access area must provide sufficient turn-around area.	
The access areas identified above must be in an easement that provides access to the County for SWM facilities located in single-family residential developments.	
SWM facilities cannot be located within the public right-of-way limits.	

LOCATION:

The SWM facility must be located as follows:	
- The highest continuous contour on the inside of the SWM facility must be located at least 25' from the ultimate right-of-way limits for non-residential projects.	
- The highest continuous contour on the inside of the SWM facility must be located outside of the front yard setback in residential development.	
- The highest continuous contour on the inside of the SWM facility must be located at least 25' from the ultimate right-of-way in the side yard in residential development.	
- There must be a distance equivalent to the rear yard setback between the rear of the buildable area and the highest continuous contour within the SWM facility for all facilities located in the rear lots of residential development.	
- The SWM facility must be located outside of all transitional or proffered buffer areas or planting strip easements.	
- SWM facilities must be located outside of the 25-year floodplain.	
- The SWM facility must be located to the rear of all residential units or in common area that is controlled and maintained by a Homeowners Association.	
- The highest continuous contour on the inside of the SWM facility must be located at least 20' from the principal structures in residential development where the proposed SWM facility is located to the side of the principal structure.	

CONSTRUCTION:

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 emergency spillway. 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.	
The sequence of construction must clearly state that a geotechnical certification must be provided prior to ECB release stating that construction compaction requirements have been achieved because the dam height is greater than three (3) feet.	

Engineer Signature:_____ Date:_____