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Stormwater Management Plan Review Course

Virginia Department of Environmental Quality

Brief Discussion of Coastal Plain BMP Considerations

Coastal Plain Concerns

- Higher Nutrient Concentrations
- Shallow Water Table
- Waterfowl/Bacteria
- BMP Depth Constraints
- Mosquitos

- Specifications (Section 7 of each spec) address: *"Regional and Special Case Design Adaptation"*

Table 1: Comparison of Nutrient Storm Event Mean Concentrations in the Virginia Piedmont versus Coastal Plain (N=753 storm events)		
Nutrients	Coastal Plain	Piedmont
Total Nitrogen [1]	2.13 mg/l	1.70 mg/l
Total Phosphorus	0.27 mg/l	0.22 mg/l
[1] Residential TN in Coastal plain is 2.96 mg/l		
Source: Appendix G of Hirschman et al 2008		

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Table 1. Special Considerations for Managing Stormwater Runoff in the Coastal Plain

Coastal Plain Characteristic	Effect on Stormwater BMP Design
Flat terrain	• Lack of head constrains the use of BMPs such as extended detention ponds and filters
High groundwater table	• Facilitates the movement of pollutants into shallow groundwater • Diminishes the performance or feasibility of some BMPs such as wet ponds and extended detention ponds
Poorly drained soils	• Limits use of large-scale infiltration BMPs
Sandy soils	• Increased risk of groundwater contamination from stormwater pollutants
Intense rainfall events and high annual rainfall	• Datasets that reflect coastal rainfall patterns should be used to calculate treatment volumes when designing stormwater BMPs • May need to consider how to design stormwater BMPs to withstand hurricanes

Watershed Protection Techniques Vol. 4, No. 1,Coastal Plain Watershed Management, Center for Watershed Protection, 2010

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Table 1. Special Considerations for Managing Stormwater Runoff in the Coastal Plain

Coastal Plain Characteristic	Effect on Stormwater BMP Design
Proximity to tidal waters	• Regional differences in tidal height strongly influence flooding and the resulting effectiveness of BMPs • Stormwater pond tidal flushing can contribute to harmful algal blooms and select for dominant bloom species in areas with excessive nutrient pollution • Increased vulnerability to sea level rise requires forethought and potential adjustments when designing stormwater BMPs • Some states (e.g., MD, VA) have more stringent stormwater requirements for development in the tidal zone, resulting in reliance on micro stormwater practices in this zone
Greater frequency of bankfull flows	• These 'channel-forming' flows can greatly contribute to channel erosion, yet some states (MD, VA) exempt the coastal plain from channel protection requirements
Pollutants of concern include: sediment, nitrogen, bacteria	• Use BMPs that perform well to remove the pollutants of interest • Stormwater ponds can serve as incubators for fecal coliform bacteria
Roadside ditches are prevalent	• Designers of upland developments may need to obtain both a local and highway agency approval to discharge to the drainage system, which may already be at or over capacity, and can lead to conflicting design requirements
Reliance on wells for drinking water	• Increased risk of groundwater contamination from stormwater pollutants

BMP Considerations In Coastal Plain

Recommendations:

- Variations to allow shallower depths
- Certain practices acceptable but not preferred
- Wet ponds receive slightly lower removal crediting
- Shoreline vegetation to discourage waterfowl
- Depth and residence time for bacterial removal and to encourage predatory insects

Microbial Reduction

Table 3: Design strategies to increase microbial reduction strategies
• Create high light conditions to promote UV in areas of standing water • Design to prevent re-suspension of bottom sediments in treatment system • Reduce turf around open water to prevent geese and waterfowl • Use shallow wetlands and benches to create natural micro-predators for bacteria • Add a layer of organic matter into sand filter media • Avoid use of grass channels (dry or wet swales are preferred) • Maximize infiltration and filtration of runoff through soils • Maintain setbacks to prevent interaction of stormwater and septic leaching fields • Utilize filter strips at edge of shoreline and stream buffers • Avoid use of turf around ponds and wetlands to prevent geese colonization • Address all bacteria source areas
Adapted from Schueler (2000)

Wet Ponds - Spec 14

Table 14.1. Summary of Stormwater Functions Provided by Wet Ponds

Stormwater Function	Level 1 Design	Level 2 Design
Annual Runoff Volume Reduction (RR) [1]	0%	0%
Total Phosphorus (TP) EMC Reduction[2] **by BMP Treatment Process**	50% (45%) [3]	75% (65%) [3]
Total Phosphorus (TP) Mass Load Removal	50% (45%) [3]	75% (65%) [3]
Total Nitrogen (TN) EMC Reduction[2] **by BMP Treatment Process**	30% (20%) [3]	40% (30%) [3]
Total Nitrogen (TN) Mass Load Removal	30% (20%) [3]	40% (30%) [3]
Channel Protection	Yes; detention storage can be provided above the permanent pool.	
Flood Mitigation	Yes; flood control storage can be provided above the permanent pool.	

[1] Runoff Reduction rates for ponds used for year round irrigation can be determined through a water budget computation.

[2] Change in event mean concentration (EMC) through the practice.

[3] Note that EMC removal rate is slightly lower in the coastal plain if the wet pond is influenced by groundwater. See **Section 6.2** of this design specification and CSN Technical Bulletin No. 2. (2009).

Dugout Ponds and Wet Ponds

Stormwater ponds are by far the most common stormwater management practice used in coastal stormwater management. Stormwater ponds can reduce localized flooding and capture sediments that would otherwise be carried by surface runoff into receiving waters. However, if not designed or maintained properly, stormwater pond water quality can be poor and the pond's ability to remove pollutants can be low (Figure 2).

Figure 2. Pond B has better pollutant removal efficiency than pond A (Source: Messersmith, 2007)