Project ID: Out_04

Total Treated Drainage Area: 120.7 acres
Total Treated Impervious Area: 54.6 acres
Total Water Quality Volume (WQv):
~200,323 cubic feet; 4.60 acre-feet
Rainfall Depth Treated (Pe): 1 inch
Annual Nutrient Removal:

- TN: 805.1 lbs
- TP: 54.2 lbs
- TSS: 15.2 tons

Existing Site Description

The existing outfall pipes include two 72-inch RCPs located south of Bay Ridge Avenue and a 24-inch RCP located north of Alder Road. Stormwater runoff from medium- and low-density residential and commercial land uses is collected by the stormdrain system and discharged from the outfalls directly to Back Creek. The proposed Ambridge retention pond retrofit (BMP 21), also selected by the City as a potential project, is located upstream of the outfalls. The collected stormwater runoff from the outfalls converges approximately 100 feet east of the 72-inch RCP pipes and is discharged into Back Creek. The outfalls are approximately 250 feet from the existing FEMA 100-year floodplain. Several trees are located along the stream banks. A sewer line crosses the stream approximately 250 feet from the outfalls. The sewer pipe crosses approximately 8 feet above the stream and is held up by wooden cross bracing. The soils in the drainage area and downstream of the outfall area are hydrologic soil groups B, C, C/D, and D. The outfalls are on privately owned parcels. Figure 46 shows the existing conditions map with drainage area.

Proposed Project Description

The proposed project involves converting the existing outfalls to a SPSC. The SPSC would be designed using the Anne Arundel County *Regenerative Step Pool Storm Conveyance Design Guidelines* (Revised December 2012) and MDE's *Stormwater Design Manual*. In accordance with the design guidance, the existing slope of 1.6 percent is suitable to implement the SPSC system. A SPSC of approximately 550 feet is recommended. Approximately six pools with a sand filter surface area of approximately 11,800 square feet will be required to capture and treat the entire water quality volume from the drainage area. The pools would have a maximum depth of 3 feet with 3 to 1 side slopes.

Implementation of the SPSC would reduce pollutants such as TN, TP, and TSS. This project will help the City of Annapolis achieve approximately 54.6 acres of impervious area credits toward its upcoming NPDES MS4 requirements. Figure 47 provides the schematic of the proposed SPSC system, and Figure 48 provides a typical profile.

Feasibility Assessment

Property Ownership	The proposed project is located on privately owned properties and the property owned by Society for the Prevention of Cruelty to Animals; the City would need to coordinate with the property owners to obtain permission to implement this project.
Construction Access	The site can be access from Bay Ridge Avenue. Open area is available to stage construction activities. Existing slopes are navigable by construction equipment.
Utility Conflicts	There is an existing water pipe 80 feet upstream of the outfall, but this project will not affect this water pipe. A sewer line supported by wooden cross bracing approximately 8 feet above the stream crosses the stream approximately 250 feet from the outfalls. Implementation of this project will affect the sewer line, and the sewer line may need to be relocated. Though there were no indicators of underground electric utilities at the project site (i.e., no light poles or utility boxes), confirmation should be obtained during final design.
Environmental Impacts	Potential tree impacts are anticipated to be a challenge for this project. Several mature trees along the banks would be affected during project implementation.
Design/Construction	Geotechnical investigation will be required to determine the infiltration rates of the soils in the project area during final design.

Plans and Permits

The following plans and permits may be required for the implementation of this project:

- Site/Schematic Development Application
- Stormwater Management Plan
- Natural Resources and Forest Stand Delineation
- Forest Conservation Plan/Buffer Management Plan
- Grading and Erosion Sediment Control Plan
- Temporary Traffic Control Plan
- MDSPGP for activities in US waters
- General Permit for Stormwater Discharge Associated with Construction Activity (if the area disturbed is greater than 1 acre)

Cost Estimate

Table 29: Cost Estimate for Outfall 04 Retrofit

Item	Quantity	Units	Unit Cost	Total
Clear and Grub	5110	SY	$2.00	$10,220.00
Excavation and Hauling	3400	CY	$50.00	$170,000.00
Grading	3400	SY	$3.50	$11,900.00
Sand	2190	CY	$70.00	$153,300.00
Filter Fabric	100	SY	$4.00	$400.00
Tree Removal	40	EA	$800.00	$32,000.00
Plantings	2500	SY	$10.00	$25,000.00
Sand Stone Boulders	70	CY	$240.00	$16,800.00
Cobble Weir	50	CY	$90.00	$4,500.00
Wood Chips	660	CY	$25.00	$16,500.00
Rip-Rap	300	CY	$130.00	$39,000.00
Clear Water Diversion Pipe	600	LF	$30.00	$18,000.00
Stabilized Construction Entrance	2	EA	$2,000	$4,000.00
CY - Cubic Yards SY - Square Yards EA - Each LF - Linear Feet			Initial Project Costs	$501,620
		Contingency	20%	$100,324
		Erosion and Sediment Control	15%	$75,243
			Base Construction Costs	$677,187
		Mobilization	10%	$67,719
			Total Construction Cost[29]	**$744,906**
			20 Years Life Cycle Maintenance Cost[30] (Average Annual Maintenance Cost of $891)	$17,820

[29] Additional cost of approximately $100,000 for design, environmental services, geotechnical investigation, survey, and permitting is assumed.

[30] University of Maryland. October 2011. Cost of Stormwater Management Practices in Maryland Counties.

Computations

Table 30: Water Quality Volume (WQv) Calculations

Design Parameters	**Site Value**
Treated Drainage Area (ac), A	120.7
Percent Impervious Cover, I	45.2
Rainfall Depth (inches), P	1
Volumetric Runoff Coefficient, R_v	0.46
Water Quality Volume (acre-feet), WQ_v	**4.60**
Water Quality Volume (cubic-feet), WQ_v	**200,323**

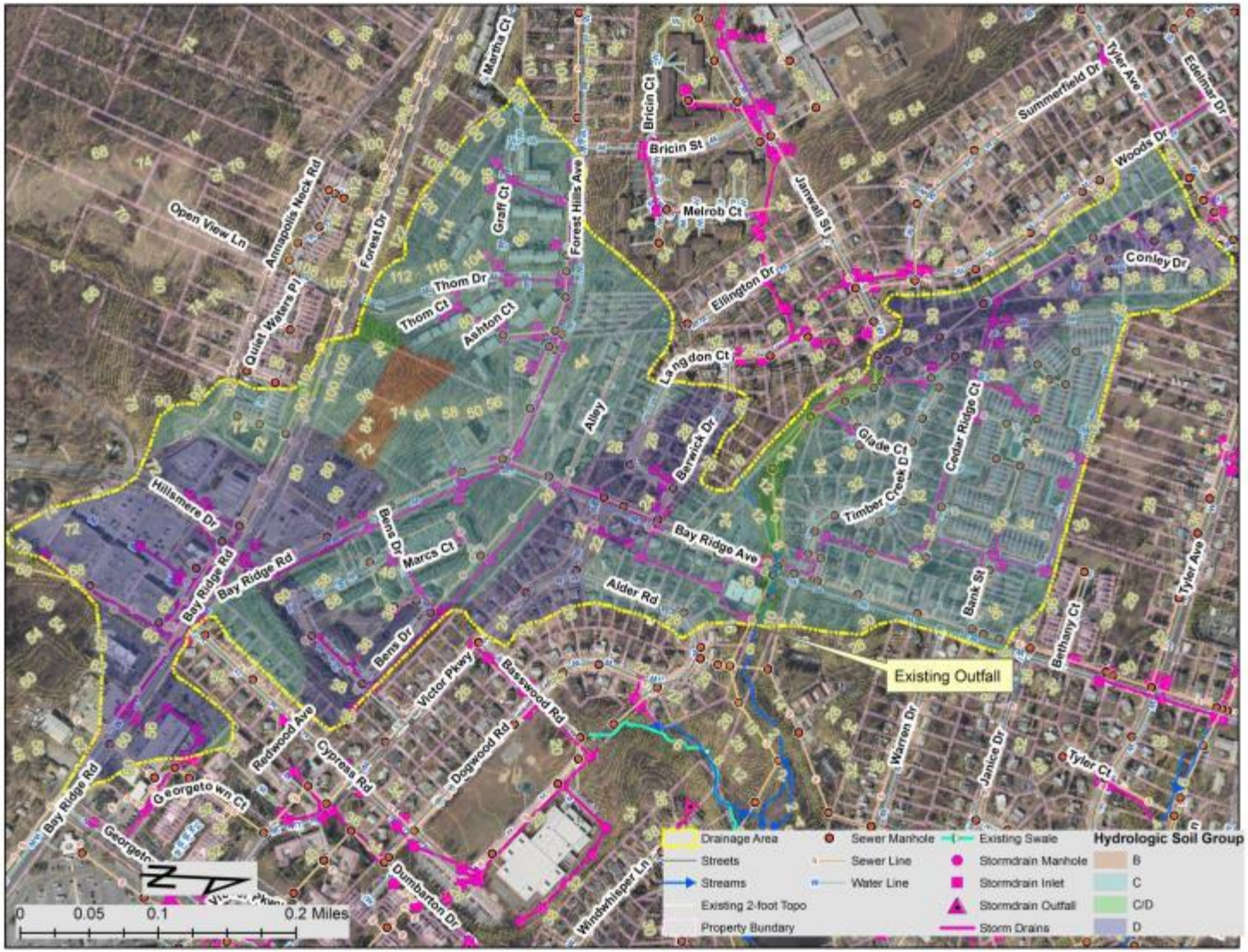

Figure 46: Existing Conditions and Drainage Area

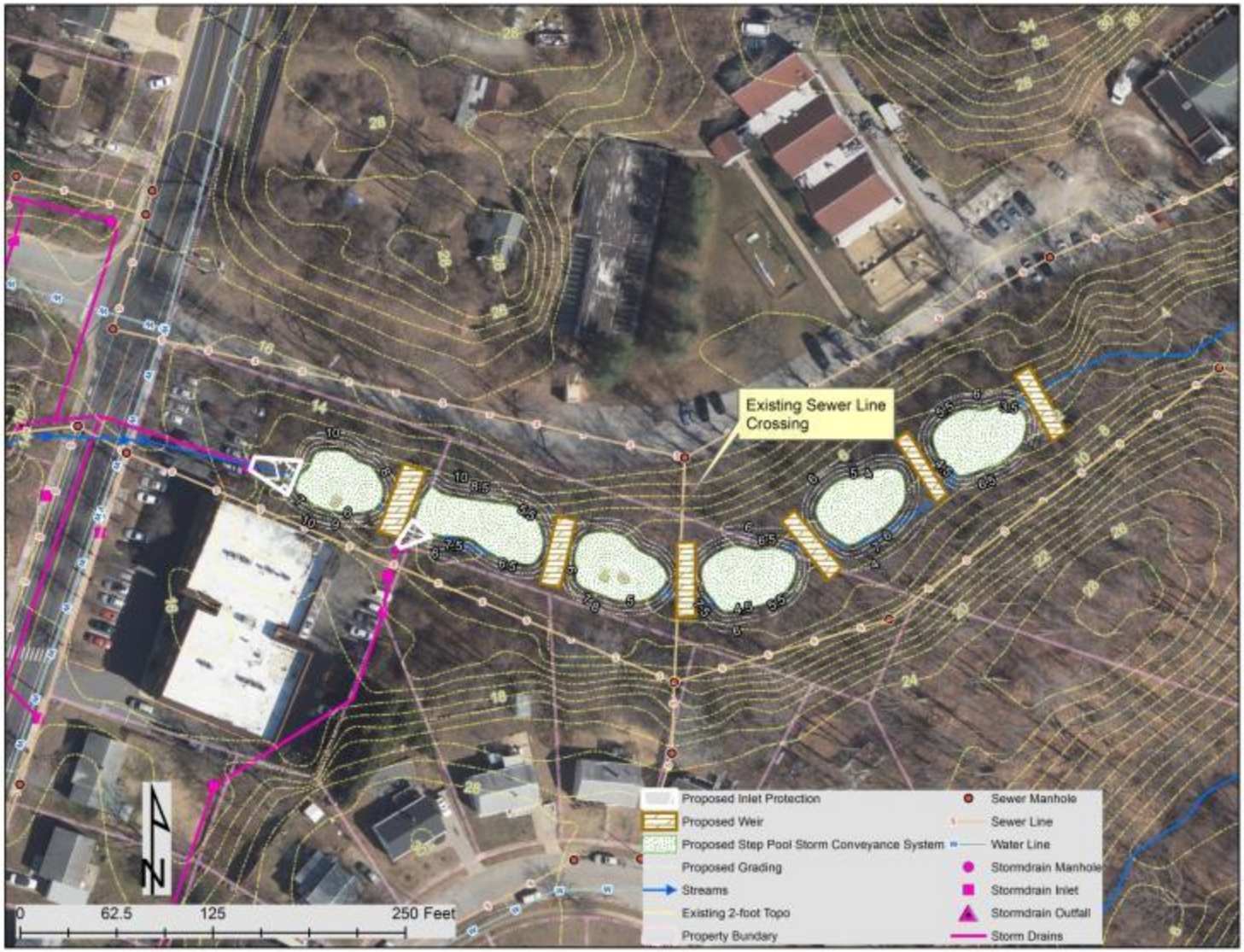

Figure 47: Proposed Retrofit Concept Design

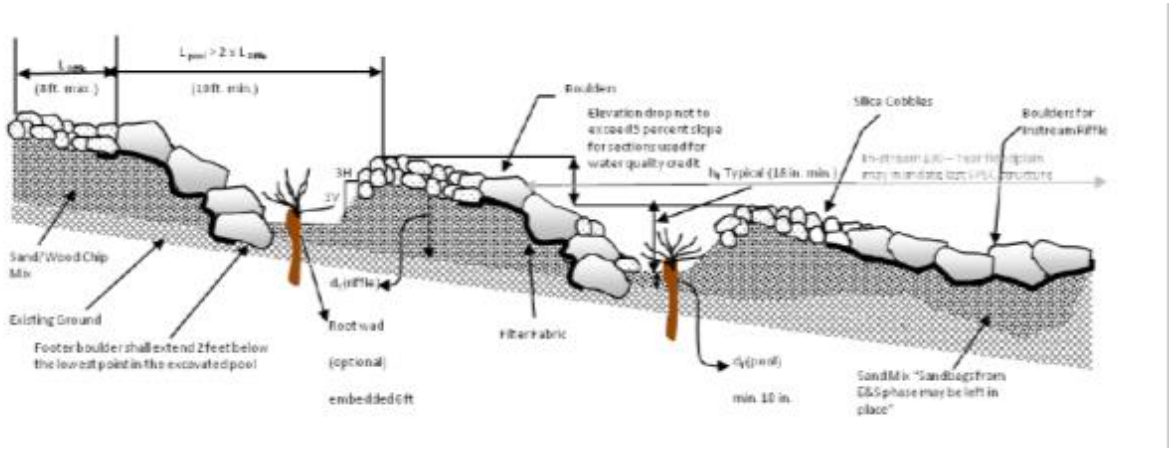

Figure 48: Typical Profile of SPSC (Anne Arundel County's *Regenerative Step Pool Storm Conveyance Design Guidelines* (Revised December 2012)

Site Photographs

Existing 72-inch RCP Outfalls Crossing Bay Ridge Avenue

Downstream of Outfall 04