Cooper's Ditch BMP - Level 2 Wet Pond					
Description	Type	Rate	Unit	Quantity	Total Cost
Construction Entrance	Fixed	$ 28.00	SY	330	$ 9,240.00
Erosion Control	Fixed	$ 10,000.00	LS	1	$ 10,000.00
Construct New Outlet Structure	Fixed	$ 9,000.00	EA	1	$ 9,000.00
*Excavate (for volume)	Variable	$ 20.00	CY	1775	$ 35,500.00
Haul Away Excavated Material	Variable	$ 16.00	CY	1550	$ 24,800.00
Emergency spillway	Fixed	$ 15,000.00	EA	1	$ 15,000.00
Grading	Variable	$ 2.00	SY	800	$ 1,600.00
Plantings	Variable	$ 10.00	SY	735	$ 7,350.00
New Piping (24" RCP)	Fixed	$ 120.00	LF	30	$ 3,600.00
Subtotal					$ 116,090.00
Design and Permitting				35%	$ 40,631.50
Subtotal					$ 156,721.50
Contingency Markup				30%	$ 47,016.45
Total					$ 203,700.00
Phosphorus removed					1.37
Cost Per lb of Phosphorus					$ 148,686.13

Edinburgh Parkway - Level 1 Wet Pond					
Description	Type	Rate	Unit	Quantity	Total Cost
Construction Entrance	Fixed	$ 28.00	SY	330	$ 9,240.00
Erosion Control	Fixed	$ 10,000.00	LS	1	$ 10,000.00
Construct New Outlet Structure	Fixed	$ 9,000.00	EA	1	$ 9,000.00
*Excavate (for volume)	Variable	$ 20.00	CY	2810	$ 56,200.00
Haul Away Excavated Material	Variable	$ 16.00	CY	2790	$ 44,640.00
Emergency spillway	Fixed	$ 15,000.00	EA	1	$ 15,000.00
Grading	Variable	$ 2.00	SY	2790	$ 5,580.00
Plantings	Variable	$ 10.00	SY	800	$ 8,000.00
New Piping (24" RCP)	Fixed	$ 120.00	LF	30	$ 3,600.00
Subtotal					$ 161,260.00
Design and Permitting				35%	$ 56,441.00
Subtotal					$ 217,701.00
Contingency Markup				30%	$ 65,310.30
Total					$ 283,000.00
Phosphorus removed					23.81
Cost Per lb of Phosphorus					$ 11,885.76

Hickory High School - Level 2 Wet Pond					
Description	Type	Rate	Unit	Quantity	Total Cost
Construction Entrance	Fixed	$ 28.00	SY	330	$ 9,240.00
Erosion Control	Fixed	$ 10,000.00	LS	1	$ 10,000.00
Construct New Outlet Structure	Fixed	$ 9,000.00	EA	1	$ 9,000.00
*Excavate (for volume)	Variable	$ 20.00	CY	2200	$ 44,000.00
Haul Away Excavated Material	Variable	$ 16.00	CY	2100	$ 33,600.00
Emergency spillway	Fixed	$ 15,000.00	EA	1	$ 15,000.00
Grading	Variable	$ 2.00	SY	2100	$ 4,200.00
Plantings	Variable	$ 10.00	SY	1025	$ 10,250.00
New Piping (24" RCP)	Fixed	$ 120.00	LF	30	$ 3,600.00
Subtotal					$ 138,890.00
Design and Permitting				35%	$ 48,611.50
Subtotal					$ 187,501.50
Contingency Markup				30%	$ 56,250.45
Total					$ 243,800.00
Phosphorus removed					10.9
Cost Per lb of Phosphorus					$ 22,366.97

Sign Pine Road - Level 2 Wet Pond					
Description	Type	Rate	Unit	Quantity	Total Cost
Construction Entrance	Fixed	$ 28.00	SY	330	$ 9,240.00
Erosion Control	Fixed	$ 10,000.00	LS	1	$ 10,000.00
Construct New Outlet Structure	Fixed	$ 9,000.00	EA	1	$ 9,000.00
*Excavate (for volume)	Variable	$ 20.00	CY	1800	$ 36,000.00
Haul Away Excavated Material	Variable	$ 16.00	CY	1650	$ 26,400.00
Emergency spillway	Fixed	$ 15,000.00	EA	1	$ 15,000.00
Grading	Variable	$ 2.00	SY	810	$ 1,620.00
Plantings	Variable	$ 10.00	SY	745	$ 7,450.00
New Piping (24" RCP)	Fixed	$ 120.00	LF	30	$ 3,600.00
Subtotal					$ 118,310.00
Design and Permitting				35%	$ 41,408.50
Subtotal					$ 159,718.50
Contingency Markup				30%	$ 47,915.55
Total					$ 207,600.00
Phosphorus removed					1.5
Cost Per lb of Phosphorus					$ 138,400.00

Whittamore Road - Level 2 Wet Pond					
Description	Type	Rate	Unit	Quantity	Total Cost
Construction Entrance	Fixed	$ 28.00	SY	330	$ 9,240.00
Erosion Control	Fixed	$ 20,000.00	LS	1	$ 20,000.00
Construct New Outlet Structure	Fixed	$ 9,000.00	EA	1	$ 9,000.00
*Excavate (for volume)	Variable	$ 20.00	CY	15655	$ 313,100.00
Haul Away Excavated Material	Variable	$ 16.00	CY	15200	$ 243,200.00
Emergency spillway	Fixed	$ 15,000.00	EA	1	$ 15,000.00
Grading	Variable	$ 2.00	SY	14455	$ 28,910.00
Plantings	Variable	$ 10.00	SY	13000	$ 130,000.00
New Piping (24" RCP)	Fixed	$ 120.00	LF	30	$ 3,600.00
Subtotal					$ 772,050.00
Design and Permitting				35%	$ 270,217.50
Subtotal					$ 1,042,267.50
Contingency Markup				30%	$ 312,680.25
Total					$ 1,354,900.00
Phosphorus removed					126.7
Cost Per lb of Phosphorus					$ 10,693.76

Cooper's Ditch Dredging BMP

Watershed
Albermarle and Chesapeake Canal

Concept Description
A series of drainage ditches run through the residential lots along Woodards Ford Road. A stormwater pipe running under the road outfalls to a ditch to the west. This outfall is currently clogged with vegetation and debris. This ditch could be converted to a level two dry swale in order to remove excess nutrients from the runoff before it continues through the storm system.

Drainage Area
3.0 acres

BMP Recommendation
Level 2 Dry Swale

Components of Proposed BMPs
Level 2 Dry Swale:

- Grass Filter Strip
- Tree Islands
- Underdrain
- Gravel Sump

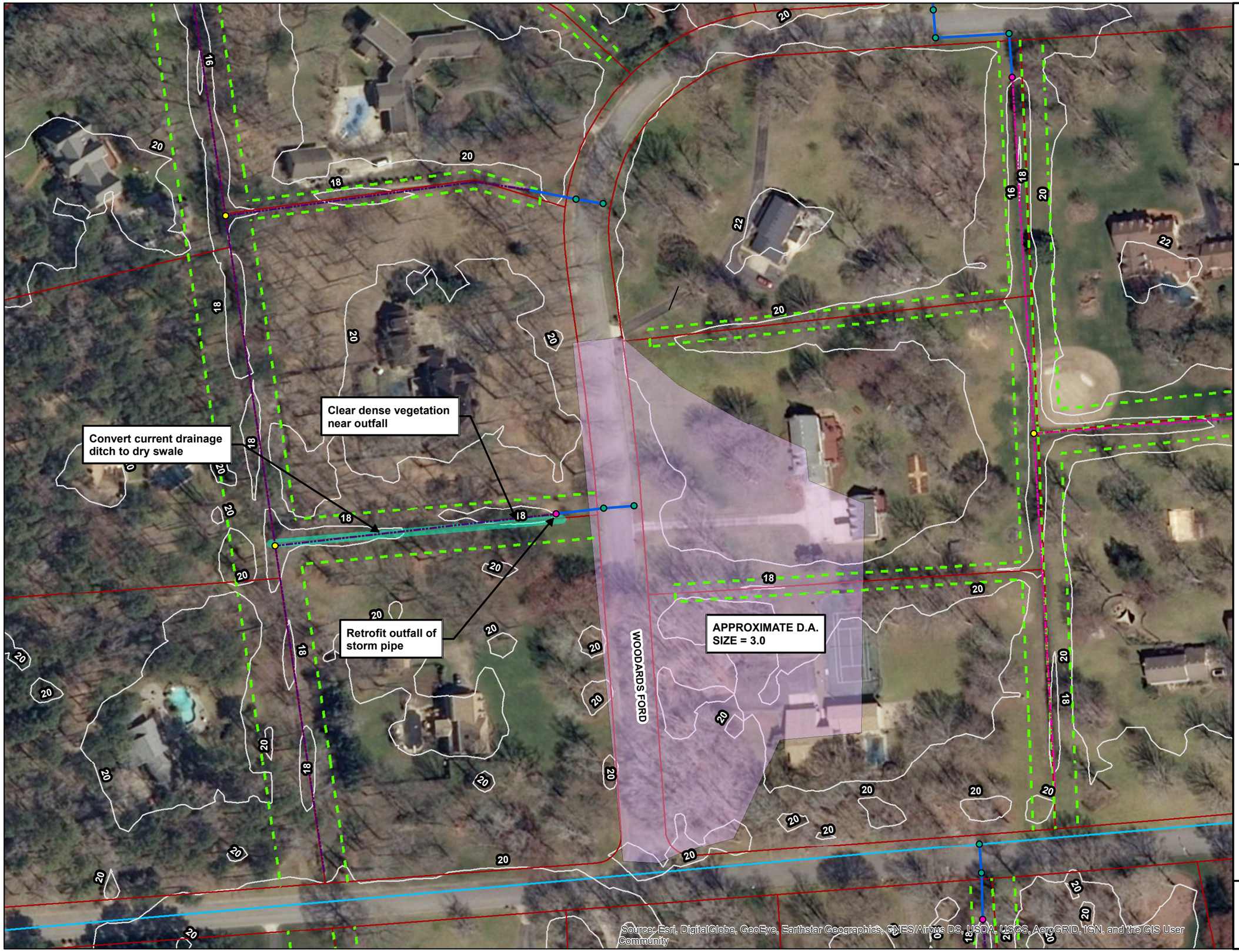
Total BMP Credit
The total phosphorus removed by each BMP (lb.) was determined by inputting the land cover and soil characteristics of each site into the VRRM spreadsheet. The bacteria removal efficiencies (%) were determined using DEQ's TMDL Implementation Plan Guidance Manual.

Dry Swale: Phosphorus Removal Summary Table	
Pollutant of Concern	Total Phosphorus Removed by BMP (lb)
Total Phosphorus	1.37

Dry Swale: Bacteria Removal Efficiency Summary Table	
Pollutant of Concern	Efficiency (%)
Bacteria	80

SWMF Cost Estimate

Dry Swale: Cost Calculations	
Approximate Cost	Approximate Cost Per Pound of Phosphorus ($/lb/yr)
$203,700	$148,690



Concept Plan

Cooper's Ditch Dredging
Dry Swale

N

Legend

- Proposed Dry Swale
- Approximate Drainage Area
- Parcels
- Easements
- Contours
- Storm Pipe
- Ditch (Not Roadside)
- Ditch (Private)

Storm Points

Point_Type

- Catch Basin
- Ditch Junction
- Pipe End (Specialized)

1 in = 100 ft

Edinburgh Parkway BMP

Watershed
Northwest River

Concept Description
There is a large conveyance ditch to the north of the proposed site that outfalls to a stormwater pipe that runs under Edinburgh Parkway. There is currently a large amount of vegetation (i.e. cattails) clogging the ditch. Directly to the south of the ditch is an open piece of land where a wet pond or constructed wetland could be constructed. The drainage area to the proposed BMP consists primarily of residential landuse. Runoff from the ditch would be redirected into the BMP and then outfall into the ditch in the northern portion of the lot. There are two options presented for consideration to treat the described area; a wet pond and a constructed wetland. Both options are presented in the attached maps for consideration, however, considering soil and water table properties present in the surrounding area, a wet pond may not be feasible due to high water tables. Furthermore, a level one wet pond and wetland were suggested due to the limited size of the proposed site. A survey will need to be conducted to determine feasibility.

Drainage Area
92.4 acres

BMP Recommendation
Level 1 Wet Pond

Components of Proposed BMPs
Level 1 Wet Pond:
- Forebay
- Wetland Plantings
- Permanent Pool
- Extended Detention
- Riser Structure Sized to Control the 100-yr Storm Event

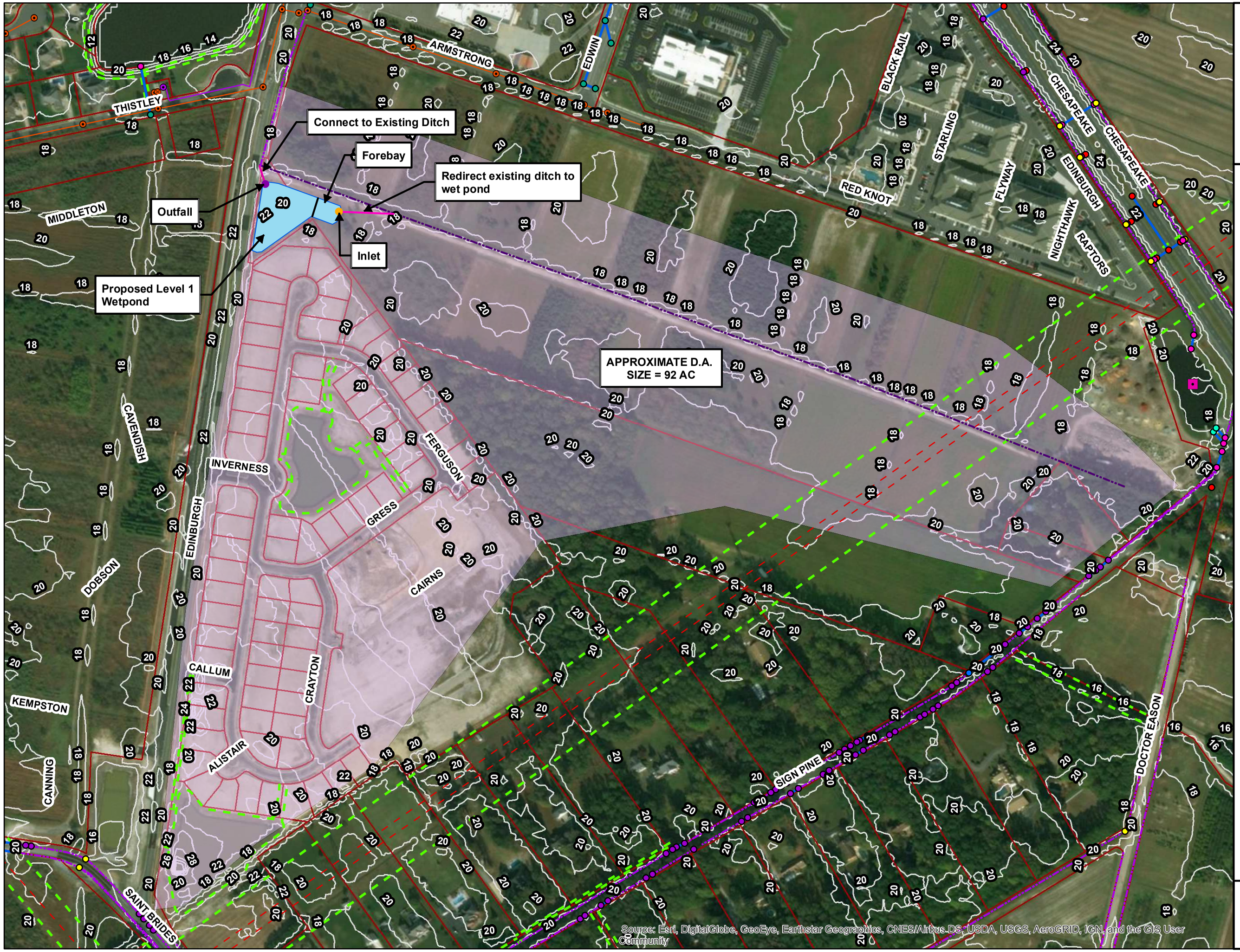
Total BMP Credit
The total phosphorus removed by each BMP (lb.) was determined by inputting the land cover and soil characteristics of each site into the VRRM spreadsheet. The bacteria removal efficiencies (%) were determined using DEQ's TMDL Implementation Plan Guidance Manual.

Wet Pond: Phosphorus Removal Summary Table	
Pollutant of Concern	Total Phosphorus Removed by BMP (lb)
Total Phosphorus	23.81

Wet Pond: Bacteria Removal Efficiency Summary Table	
Pollutant of Concern	Efficiency (%)
Bacteria	70

SWMF Cost Estimate

Wet Pond: Cost Calculations	
Approximate Cost	Approximate Cost Per Pound of Phosphorus ($/lb/yr)
$283,000	$11,900



Concept Plan

Edinburgh Parkway Wet Pond

N

Legend

- Proposed Wet Ponds
- Approximate Drainage Area
- Parcels
- Easements
- Electric Line
- Contours
- Gravity Sewer Lines
- Storm Pipe
- Ditch (Not Roadside)
- Ditch (Roadside)
- Force Main

Gravity Sewer Points

Gravity Sewer Pt Type

- Sewer Manhole
- Sewer Pump Station

Storm Points

Storm Pt Type

- Multiple Catch Basins
- Catch Basin
- Ditch High Point
- Drop Inlet
- Ditch Junction
- Other
- Pipe End (Headwall)
- Open Pipe End
- Pipe End (Specialized)

Force Main Points

Force Main Pt Type

- Valve

1 in = 300 ft

Hickory High School BMP

Watershed
Northwest River

Concept Description
Stormwater from the parking lots and buildings within the school parcel drain to a natural wetland to the west of the school property which outfalls to a ditch to the south. The City may need to evaluate the classification of the wetland area to confirm whether it is a protected wetland in order to determine the feasibility of the project. If the area is not protected, the depth of the current natural retention pond could be increased and converted into a linear wet pond to more effectively treat the runoff.

Drainage Area
22.6 acres

BMP Recommendation
Level 2 Wet Pond

Components of Proposed BMPs
Level 2 Wet Pond:

- Forebay
- Wetland Cell
- Permanent Pool
- Aquatic Bench
- Riser Structure Sized to Control the 100-yr Storm Event

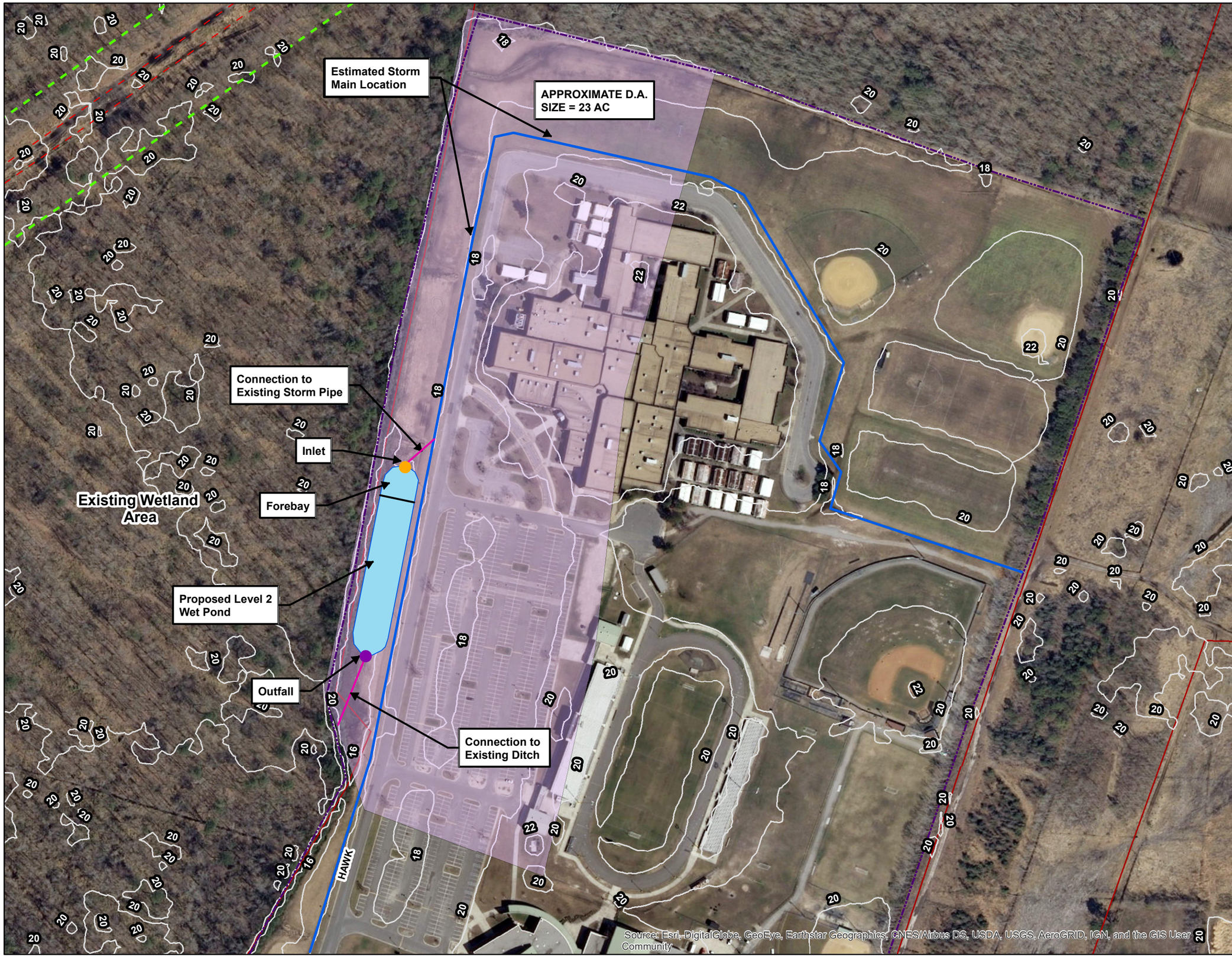
Total BMP Credit
The total phosphorus removed by each BMP (lb.) was determined by inputting the land cover and soil characteristics of each site into the VRRM spreadsheet. The bacteria removal efficiencies (%) were determined using DEQ's TMDL Implementation Plan Guidance Manual.

Wet Pond: Phosphorus Removal Summary Table	
Pollutant of Concern	Total Phosphorus Removed by BMP (lb)
Total Phosphorus	10.9

Wet Pond: Bacteria Removal Efficiency Summary Table	
Pollutant of Concern	Efficiency (%)
Bacteria	70

SWMF Cost Estimate

Wet Pond: Cost Calculations	
Approximate Cost	Approximate Cost Per Pound of Phosphorus ($/lb/yr)
$243,800	$22,400



Concept Plan

Hickory High School Wet Pond

N

Legend

- Proposed Wet Ponds
- Approximate Drainage Area
- Parcels
- Easements
- Electric Line
- Contours
- Storm Pipe
- Ditch (Not Roadside)

1 in = 200 ft

Sign Pine Road BMP

Watershed
Northwest River

Concept Description

Ditches run alongside both sides of Sign Pine Road. There is little flow in the ditches and they contain overgrown vegetation. There is a wooded area west of Sign Pine where a level two wet pond could be constructed. The ditch west of the road could be redirected to the wet pond and then the wet pond could outfall the runoff to the existing ditch to the west. A wet pond may not be feasible due to high water tables on site and a survey will need to be conducted to determine feasibility. The drainage area of the site is also small and may not be enough to support a wet pond.

Drainage Area
4.1 acres

BMP Recommendation
Level 2 Wet Pond

Components of Proposed BMPs
Level 2 Wet Pond:

- Forebay
- Wetland Cell
- Permanent Pool
- Aquatic Bench
- Riser Structure Sized to Control the 100-yr Storm Event

Total BMP Credit

The total phosphorus removed by each BMP (lb.) was determined by inputting the land cover and soil characteristics of each site into the VRRM spreadsheet. The bacteria removal efficiencies (%) were determined using DEQ's TMDL Implementation Plan Guidance Manual.

Wet Pond: Phosphorus Removal Summary Table	
Pollutant of Concern	Total Phosphorus Removed by BMP (lb)
Total Phosphorus	1.5

Wet Pond: Bacteria Removal Efficiency Summary Table	
Pollutant of Concern	Efficiency (%)
Bacteria	70

SWMF Cost Estimate

Wet Pond: Cost Calculations	
Approximate Cost	Approximate Cost Per Pound of Phosphorus ($/lb/yr)
$207,600	$139,400

Concept Plan

Sign Pine Road
Wet Pond

N

Legend

- Proposed Wet Ponds
- Approximate Drainage Area
- Parcels
- Easements
- Contours
- Storm Pipe
- Ditch (Not Roadside)
- Ditch (Roadside)

Storm Points

Point Type

- Ditch Junction
- Other
- Open Pipe End

1 in = 150 ft

Whittamore Road BMP

Watershed
North Landing River

Concept Description

A large ditch runs west to east from Centerville Turnpike to Whittamore Road. Runoff then flows through two storm pipes that run under Whittamore Road and then continues to flow through a ditch east of the road. There are two monitoring wells located where the storm pipes run underneath the road. Since there is a significant quantity of managed turf surrounding the ditch, this site has the potential to remove a significant amount of phosphorus and bacteria from the runoff. There is a large wooded area to the east of Whittamore Road and south of the ditch where a level two wet pond could be constructed. A wet pond may not be feasible due to high water tables on site and a survey will need to be conducted to determine feasibility.

Drainage Area
337.6 acres

BMP Recommendation
Level 2 Wet Pond

Components of Proposed BMPs
Level 2 Wet Pond:

- Forebay
- Wetland Cell
- Permanent Pool
- Aquatic Bench
- Riser Structure Sized to Control the 100-yr Storm Event

Total BMP Credit

The total phosphorus removed by each BMP (lb.) was determined by inputting the land cover and soil characteristics of each site into the VRRM spreadsheet. The bacteria removal efficiencies (%) were determined using DEQ's TMDL Implementation Plan Guidance Manual.

Wet Pond: Phosphorus Removal Summary Table	
Pollutant of Concern	Total Phosphorus Removed by BMP (lb)
Total Phosphorus	126.7

Wet Pond: Bacteria Removal Efficiency Summary Table	
Pollutant of Concern	Efficiency (%)
Bacteria	70

SWMF Cost Estimate

Wet Pond: Cost Calculations	
Approximate Cost	Approximate Cost Per Pound of Phosphorus ($/lb/yr)
$1,354,900	$10,700

Concept Plan

Whittamore Road Wet Pond

N

Legend

- Proposed Wet Ponds
- Approximate Drainage Area
- Parcels
- Easements
- Electric Line
- Contours
- Gravity Sewer Lines
- Storm Pipe
- Culvert
- Ditch (Not Roadside)
- Ditch (Private)
- Ditch (Roadside)
- Natural Waterway
- Private Pipe

Gravity Sewer Points

Gravity Sewer Pt Type

- Sewer Inspection Box
- Sewer Manhole

Storm Points

Point Type

- Multiple Catch Basins
- Catch Basin
- Ditch High Point
- Drop Inlet
- Junction Box
- Ditch Junction
- Manhole
- Other
- BMP Outfall
- Pipe End (Headwall)
- Open Pipe End
- Pipe End (Specialized)

1 in = 800 ft