

## **Appendix C: Concept Designs**

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**Drainage Area Data**

Contributing Drainage Area to Practice (A):	3.60	ac	Stream Use:	I
Impervious Area:	2.20	ac	County:	Frederick
% Impervious (I):	61%			
Minimum WQv*:	0.06	ac-ft		*If %IA<15%
Existing RCN:	88	Existing tc:		0.09
Post Development RCN:	88	Pose Development tc:		0.09

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**      Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 61.11

$R_v = 0.600$

**WQv =** 0.16 ac-ft  
7056.72 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.50	14%
B	0.26	2.45	68%
C	0.13	0.65	18%
D	0.06	0.00	0%

S = 0.2534

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

**Rev = 0.008 ac/ft**  
**327.8 cu ft**

Design Firm: Maryland Environmental Site Design Calculations

Project# BMP 000015

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv

0.02 **ac-ft**

705.672 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
419.00	525.00	0.012				0.000	0.00
420.00	823.00	0.019	1.00	0.015	0.015	0.015	674.00
421.00	1177.00	0.027	1.00	0.023	0.023	0.038	1,674.00
			0.00	0.000	0.000	0.038	1,674.00
			0.00	0.000	0.000	0.038	1,674.00
			0.00	0.000	0.000	0.038	1,674.00

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
416.00	2069.00	0.047				0.000	0.00
417.00	2762.00	0.063	1.00	0.055	0.055	0.055	2,415.50
418.00	3515.00	0.081	1.00	0.072	0.072	0.128	5,554.00
419.00	4340.00	0.100	1.00	0.090	0.090	0.218	9,481.50
420.00	5215.00	0.120	1.00	0.110	0.110	0.327	14,259.00
421.00	6220.00	0.143	1.00	0.131	0.131	0.459	19,976.50
			0.00	0.000	0.000	0.459	19,976.50
			0.00	0.000	0.000	0.459	19,976.50
			0.00	0.000	0.000	0.459	19,976.50
			0.00	0.000	0.000	0.459	19,976.50
			0.00	0.000	0.000	0.459	19,976.50

\*\*\*

WQv Check\*\*\*: OK  
 10 Yr-Storm Volume (cf): 39204  
 10 Yr-Storm Check: NOT OK

\*\*\*Includes both permanent and forebay storage.

# BMP #15 – Stanford Industrial Park, Lot 6

**Prioritization Ranking:** 5  
**Planning Level Cost Estimate:** \$80,634  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Southern side of Hawker Road
Northing/Easting:	613,385/1,171,213
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond
Management Type:	Quality, Quantity
Total Drainage Area (ac):	3.6
Total Impervious Area (ac):	2.2
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	6,998
Total Treated Drainage Area (ac):	3.6
Total Treated Impervious Area (ac):	2.2
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	15.5
TP (lbs/yr):	2.2
TSS (lbs/yr):	1,383.1



Existing site conditions for BMP # 15



Site map for BMP # 15

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 15 is an extended detention dry pond. The facility was constructed on the southern side of Hawker Road in the northwest corner of Lot 6 of the Stanford Industrial Park, as shown in the BMP Location map (see Figure 1). The BMP Database indicates that the original design was intended to provide management for quantity for 3.6 acres of total drainage area including 2.2 acres of impervious. The drainage area encompasses the Stanford Industrial Park, Lot 6 property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed via the nearby commercial parking lot/ storage area. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with business operations.

## PROPOSED RETROFIT

The proposed retrofit for BMP # 15 is wet pond (P-2). The proposed retrofit will provide quantity and quality management for the original 3.6 acre drainage area including 2.2 acres of impervious area. The concept retrofit plan proposes adding a forebay in the southeast corner of the facility as well as installing a new concrete riser in place of the existing concrete weir wall. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. This retrofit design was intended to limit thermal impacts using a riser with an inverted low flow pipe, however modification of the existing weir wall to create a permanent pool is also an option.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X

# BMP #15 – Stanford Industrial Park, Lot 6

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 15 is an extended detention dry pond. The facility was constructed on the southern side of Hawker Road in the northwest corner of Lot 6 of the Stanford Industrial Park, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quantity for 3.6 acres of total drainage area including 2.2 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses a large portion of the Lot 6 Stanford Industrial Park property. According to as-builts, there is currently a single 24” inflow pipe into the facility. The facility has a notched weir wall with a 6” PVC low flow orifice with a stone jacket.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has one inflow point and a large amount of ponding, erosion, and overgrown vegetation. The as-builts provided by Frederick County shows an existing 24” CMP. The condition of the inflow could not be determined. All other flow is received via sheet flow from the surrounding areas.

### Pretreatment:

This facility has a rip rapped plunge pool that provides some pretreatment.

### Control Structure and Spillways:

The control structure for this facility is a notched weir with a low flow orifice. At the time of the site visit, the spillway could not be assessed due to dense vegetation.

### Embankment:

A fill embankment is present between the pond and outfall to the southwest of the pond. The embankment was observed to be stable and have sufficient vegetative cover on both the upstream and downstream side of the 6-foot tall embankment.

### Outflow:

The weir outfalls to a one-foot wide rip rapped channel to the southwest of the embankment and into an unnamed stream. The outfall was observed to be in good condition with minor displacement of riprap.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria for water quality treatment and is a candidate for retrofit. Maintenance may be warranted as the inflow is experiencing some erosion and the spillway condition could not be assessed due to the density of vegetation.

## Access, Right-of-Way, and MOT:

The site can be accessed via the nearby commercial parking lot and storage area. Access and material storage and staging should be placed in a way to not interrupt business operations. Stakeholder input should be obtained prior to establishing these areas.

## Proposed Retrofit:

BMP # 15 was originally designed as an extended detention dry pond. This facility was identified as a potential wet pond retrofit. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 3.6 acres, including 2.2 acres of impervious. Much of the on-site parking and storage areas are comprised of gravel, which have a higher potential to clog certain BMP types such as infiltration BMPs and submerged gravel wetlands, making a wet pond retrofit a feasible retrofit choice.

The concept retrofit plan proposes to provide permanent storage by excavating two feet below the existing BMP bottom elevation and removing the existing weir wall to be replaced with a concrete riser with an inverted low flow pipe. The facility was designed with the intent of limiting thermal impacts to a downstream III-P stream, however the stream was recently re-designated as I-P. With the new stream designation, modification of the existing weir structure may be a more appropriate means of creating a permanent pool. While the facility is already in a forested area; additional tree plantings may be added to further reduce thermal impacts.

In order to limit a reduction in the facility's volume the surrounding area will need to be graded at a stable 3 to 1 slope. There is an estimated 500 square feet of impact beyond the property line of the facility's owner and into a roadway right of way. During the final design process attempt to both limit any impacts to neighboring property while maximizing the WQv treated.

### **Step 1: Watershed Factors**

BMP #15 is in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019, but was previously designated as III-P. There are no special watershed factors and/or constraints that must be considered for retrofit design for BMP #15 due to the stream use designation.

### **Step 2: Terrain Factors**

BMP # 15 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The permanent pool elevation in the retrofit pond is proposed at an elevation below the existing pond bottom (based on information available) to avoid major modification to the fill embankment and maintain freeboard in the facility. A fill embankment within the pond will be needed to create the necessary sediment forebay. The riser structure will need to be redesigned further in the design process. There is not adequate space for the proposed retrofit within the facility's existing footprint. Additional area will need to be added due to the forebay.

### **Step 4: Physical Feasibility Factors**

Much of the parking and storage areas are comprised of gravel, which have a higher potential to clog certain BMP types such as infiltration BMPs and submerged gravel wetlands, making a wet pond retrofit a feasible retrofit choice. The proposed drainage area to BMP #15 is 3.6 acres and is composed of largely B soils with a portion of C and A soils. The likelihood of BMP # 15 receiving hotspot runoff is moderate as it is located near a storage lot that uses heavy equipment every day. Additional investigation will be necessary to determine if there is enough separation from the water table. Impacts to mature, healthy trees in the area should be limited.

### **Step 5: Community and Environmental Factors**

BMP # 15 is located on the south side of Hawker Road but has low visibility. Wet ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

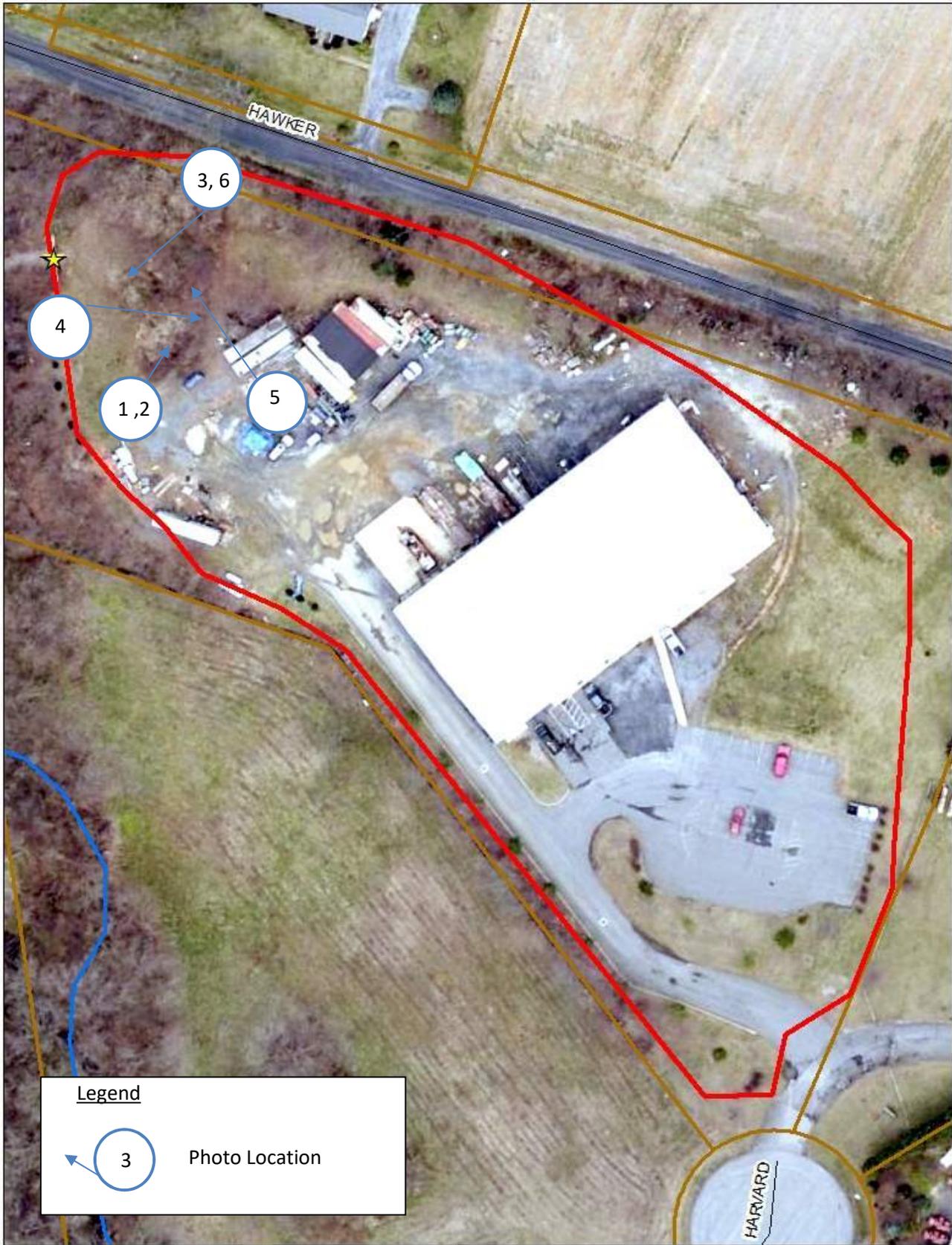
### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP# 15 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) Joint Permit Application (JPA)/General Waterway Construction Permit (GWCP): It is anticipated that a JPA/GWCP will be required. The stream closure period for Use I waters is March 1 through June 15. A portion of this BMP is located in floodprone areas per Digital Flood Insurance Rate Maps (DFIRMs); therefore, it is located within the FEMA 100-year floodplain.



Figure 1: BMP 15 Location Map – Existing Conditions



**Figure 2: BMP 15 Photo Locations**



**Photo 1: View of low flow control structure.**



**Photo 2: View of facility's weir wall.**



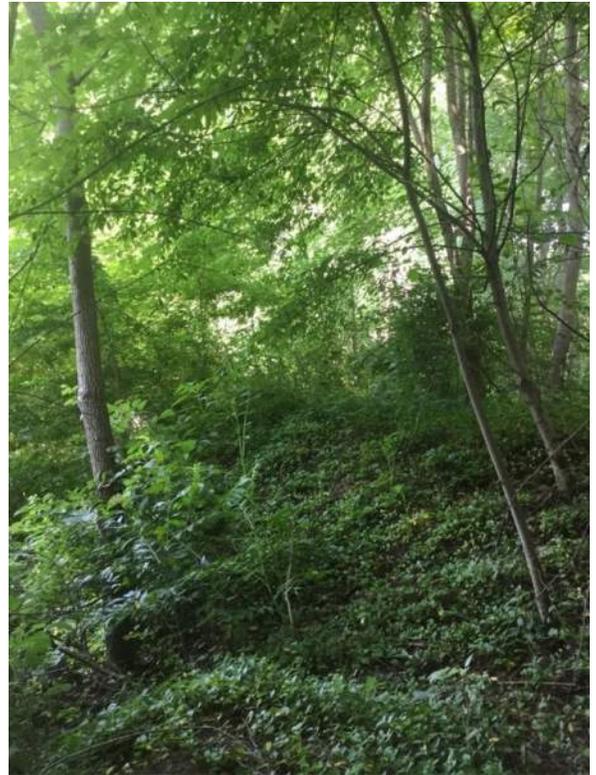
**Photo 3: Overall view of facility looking south.**



**Photo 4: View of ponding in inflow area.**



**Photo 5: Overall view of facility looking North**



**Photo 6: View of existing fill embankment.**

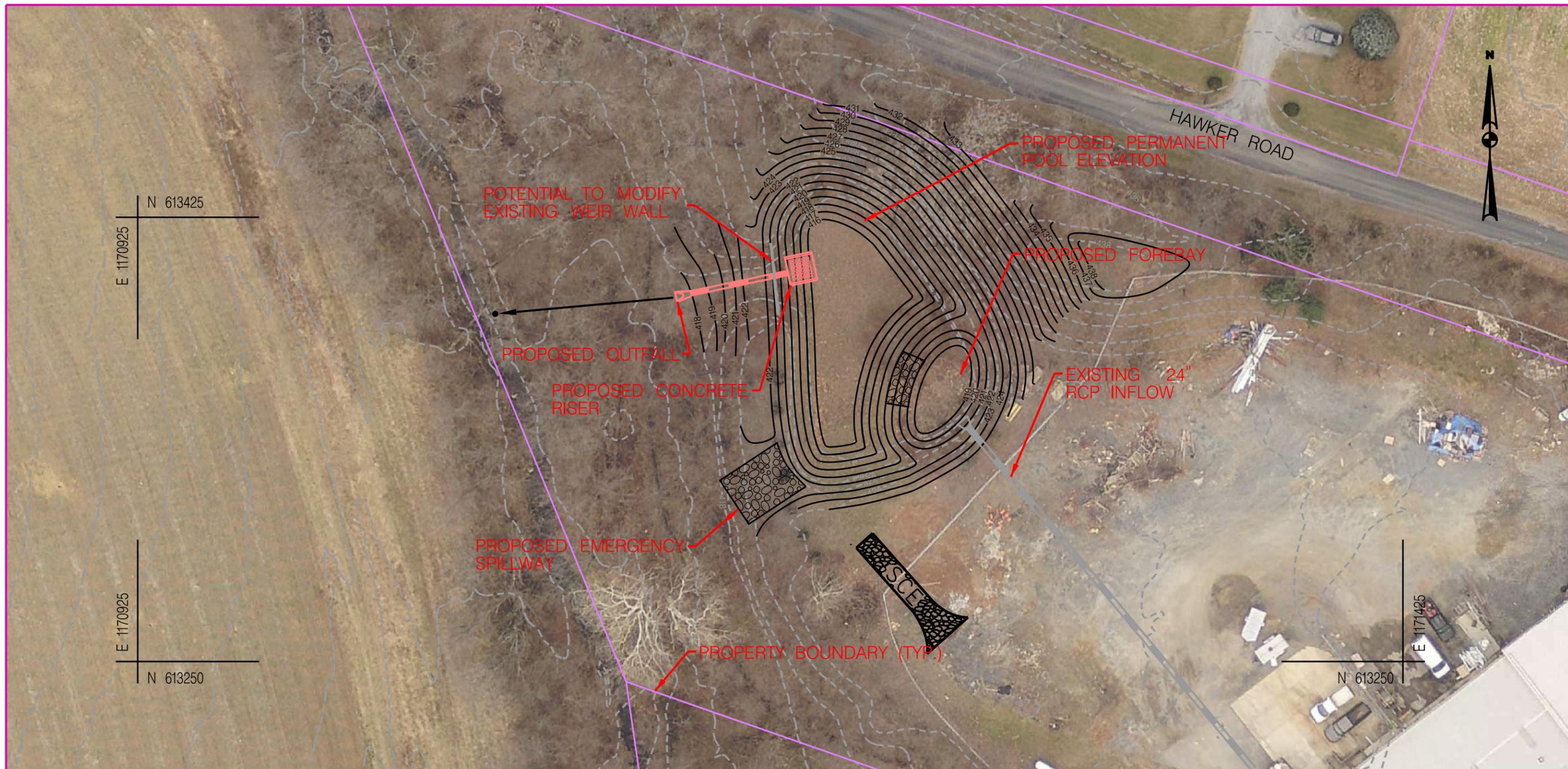


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 15	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Stanford Industrial Park, Section 2, Lot 6	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Off Harvard Place Cul-de-sac - to the left	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.35, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	613,386/1,171,213	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/18/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/11/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	3.6		3.6
Total Impervious Area within Drainage Area (acres):	2.2		2.2
WQv Required:	Unknown		6,998
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	6,998 cu.ft.      0.16 ac-ft
Total Treated Drainage Area (acres):	3.6	0	3.6
Total Treated Impervious Area within Drainage Area (acres):	2.2	0	2.2
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.88
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		15.5
TP (lbs/yr):	0		2.2
TSS (lbs/yr):	0		1383.1

<b>Projected Retrofit Cost:</b>	\$80,634
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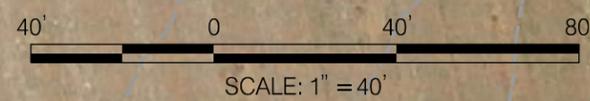




N 613425  
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N 613250  
E 1170925

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E 1171425



**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	POCKET POND (P-5)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	3.6
TOTAL IMPERVIOUS AREA (ACRES)	2.2
WQv REQUIRED (CU. FT)	6.997
WQv REQUIRED (AC. FT)	0.16
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	6.997
TOTAL TREATED DA (ACRES)	3.6
TOTAL TREATED IMPERVIOUS AREA (ACRES)	2.2

<b>BMP 15: PROPOSED RETROFIT</b>	
SCALE: 1" = 40'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____



Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000068  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 16.21 ac  
 Impervious Area: 11.56 ac  
 % Impervious (I): 71%  
 Minimum WQv\*: 0.27 ac-ft

Stream Use: I  
 County: Frederick  
 \*If %IA<15%

Existing RCN: N/A Existing tc: N/A  
 Post Development RCN: N/A Pose Development tc: N/A

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**

Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

$$P = 0.90 \text{ inches}$$

$$R_v = 0.05 + (0.009)(I); \text{ where}$$

$$I = 71.31$$

$$R_v = 0.692$$

$$WQv = 0.84 \text{ ac-ft}$$

$$36637.77 \text{ cf}$$

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.97	6%
B	0.26	9.73	60%
C	0.13	5.03	31%
D	0.06	0.49	3%

$$S = 0.2209$$

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

$$Rev = 0.179 \text{ ac/ft}$$

$$7796.5 \text{ cu ft}$$

Design Firm:

Maryland Environmental Site Design Calculations

Project# BMP 000068

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv:

0.08 **ac-ft**

3663.777 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
353.00	870.00	0.020				0.000	0.00
354.00	1540.00	0.035	1.00	0.028	0.028	0.028	1,205.00
355.00	2330.00	0.053	1.00	0.044	0.044	0.072	3,140.00
356.00	3230.00	0.074	1.00	0.064	0.064	0.136	5,920.00
			0.00	0.000	0.000	0.136	5,920.00
			0.00	0.000	0.000	0.136	5,920.00

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
351.00	9000.00	0.207				0.000	0.00
352.00	10102.00	0.232	1.00	0.219	0.219	0.219	9,551.00
353.00	11255.00	0.258	1.00	0.245	0.245	0.464	20,229.50
354.00	12465.00	0.286	1.00	0.272	0.272	0.737	32,089.50
355.00	14245.00	0.327	1.00	0.307	0.307	1.043	45,444.50
356.00	16565.00	0.380	1.00	0.354	0.354	1.397	60,849.50
357.00	23075.00	0.530	1.00	0.455	0.455	1.852	80,669.50
			0.00	0.000	0.000	1.852	80,669.50
			0.00	0.000	0.000	1.852	80,669.50
			0.00	0.000	0.000	1.852	80,669.50
			0.00	0.000	0.000	1.852	80,669.50

\*\*\*

WQv Check\*\*\*: OK  
 10 Yr-Storm Volume (cf): 203543.175  
 10 Yr-Storm Check: NOT OK

\*\*\*Includes both permanent and forebay storage.

# BMP# 68 – BUILDERS SUPPLY & LUMBER

**Prioritization Ranking:** 4  
**Planning Level Cost Estimate:** \$425,163  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	North side of Montville Road
Northing/Easting:	603,825/1,173,472
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond (P-2)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	16.2
Total Impervious Area (ac):	11.6
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	36,638
Total Treated Drainage Area (ac):	16.2
Total Treated Impervious Area (ac):	11.6
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	118.1
TP (lbs/yr):	7.1
TSS (lbs/yr):	7,143.7



Existing site conditions for BMP# 68



Site map for BMP# 68

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 68 is an extended detention dry pond. The facility was constructed on the northern side of Mountville Road in the southeastern corner of the Builders Supply & Lumber campus. The BMP Database indicates that the original design for BMP# 68 provides water quantity management and the total drainage area for the BMP is 16.2 acres with 11.6 acres of impervious. The drainage area encompasses the Builders Supply & Lumber property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the Builders Supply & Lumber storage lot. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with Building Supply & Lumber business.

## PROPOSED RETROFIT

The proposed retrofit for BMP# 68 is wet pond (P-2). The proposed retrofit will provide quantity and quality management for the original 16.2 acres and 11.6 acres of impervious area. The concept retrofit plan proposes adding a forebay in the northeast corner of the facility as well as installing a new concrete riser in place of the existing corrugated metal pipe riser. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. The CMP riser will need to be replaced to receive full treatment credit, the new proposed concrete riser can include an inverted low flow pipe to reduce thermal impacts but with the current stream use it is not necessary.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X
Other: MDE Dam Safety	X

# BMP #68 – Builder Supply & Lumber

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP# 68 is an extended detention dry pond. The facility was constructed on the northern side of Mountville Road in the southwest corner of the Builder Supply & Lumber property, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quantity for 16.2 acres of total drainage area including 11.6 acres of impervious. Figure 1 shows the drainage area for the facility, which primarily encompasses the Builder Supply and Lumber property. According to as-builts, there is a single 24" P.E.P. inflow pipe into the facility. The facility has a corrugated metal pipe (CMP) riser with an 8" low flow orifice.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has one inflow point that could not be observed due to dense vegetation. The as-builts provided by Frederick County shows an existing 24" P.E.P. The condition of the inflow could not be determined. All other flow is received via sheet flow from the surrounding areas.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the County's BMP Database, the control structure for this facility is a 60" CMP riser with a low flow orifice. At the time of the site visit there was flow observable at the downstream outfall.

### Embankment:

A fill embankment is present between the pond and outfall to the southwest of the pond. The embankment was observed to be stable with sufficient vegetative cover on both the upstream and downstream side of the embankment.

### Outflow:

The 48" CMP principal spillway outfalls to the southwest of the embankment into Doubs Branch. The outfall and pipe were observed to be in good condition with minor displacement of riprap.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not receive treatment credit for water quality due to its use of a CMP riser. Flow could not be observed entering the facility during the site visit but was observed at the facility's outfall. The downstream channel was in moderate condition with small portions of erosion. No major problems were observed in the BMP but would make a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from the Builders Supply & Lumber storage lot. This access is from the northeast of the facility. Stakeholder input for material storage and staging be placed in a way to not interrupt business operations will be recommended.

## Proposed Retrofit:

BMP# 68 was originally designed as an extended detention dry pond. This facility has been identified as a potential wet pond retrofit. A wet pond was selected for several reasons including the size and nature of the drainage area. The drainage area exceeds 10 acres, therefore eliminating many of the environmental site design (ESD) options. Additionally, much of the parking and storage areas are comprised of gravel, which have a higher potential to clog certain BMP types such as infiltration BMPs and submerged gravel wetlands.

The proposed retrofit will provide both water quality and quantity treatment for the originally designed 16.2 acres, including 11.6 acres of impervious. The concept retrofit plan proposes to provide permanent storage by excavating approximately one foot below the existing BMP bottom elevation and replace the existing CMP riser with a new concrete riser and with a low flow orifice for extended detention as shown in the **Concept Plan**. Minor alterations to the downstream channel should be considered to reset riprap.

### **Step 1: Watershed Factors**

BMP# 68 is located in Doubs Branch subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is use I-P but was re-designated from III-P in January 2019. Thermal impacts can be reduced through the inclusion of a 2 ft. deep permanent pool with an inverted low flow pipe to draw from the bottom. Tree plantings just outside the embankment will provide shading.

### **Step 2: Terrain Factors**

BMP# 68 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit proposed the permanent pool elevation below the existing pond bottom (based on information available) to avoid major modification to the fill embankment and maintain freeboard in the facility. A fill embankment will need to be created in order to create the necessary sediment forebay. The proposed concrete riser structure will need to be redesigned further in the design process. There is potentially inadequate space for the proposed retrofit within the facility's existing footprint some additional footprint will be added due to the forebay. The concept design level calculation for the proposed retrofit are provided the attached spreadsheet.

### **Step 4: Physical Feasibility Factors**

According to the Maryland Stormwater Design Manual, the minimum drainage area for a wet pond is 10 acres. The proposed drainage area to BMP# 68 is 16.2 acres and is composed of C, D, and a small portion of B soils. The likelihood of BMP# 68 receiving hotspot runoff is moderate as it is located near a storage lot that uses heavy equipment every day. There may need to be some consideration into separation from the water table.

### **Step 5: Community and Environmental Factors**

BMP #68 is located on the north side of Mountville Road but has low visibility. Wet ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP# 68 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) Joint Permit Application (JPA)/General Waterway Construction Permit (GWCP): It is anticipated that a JPA/GWCP will be required. The stream closure period for Use I waters is March 1 through June 15. This BMP is located in non-floodprone areas per Digital Flood Insurance Rate Maps (DFIRMs); therefore, it is not located within the FEMA 100-year flood plain.
- 5) MDE Dam Safety



Figure 1: BMP 68 Location Map – Existing Conditions

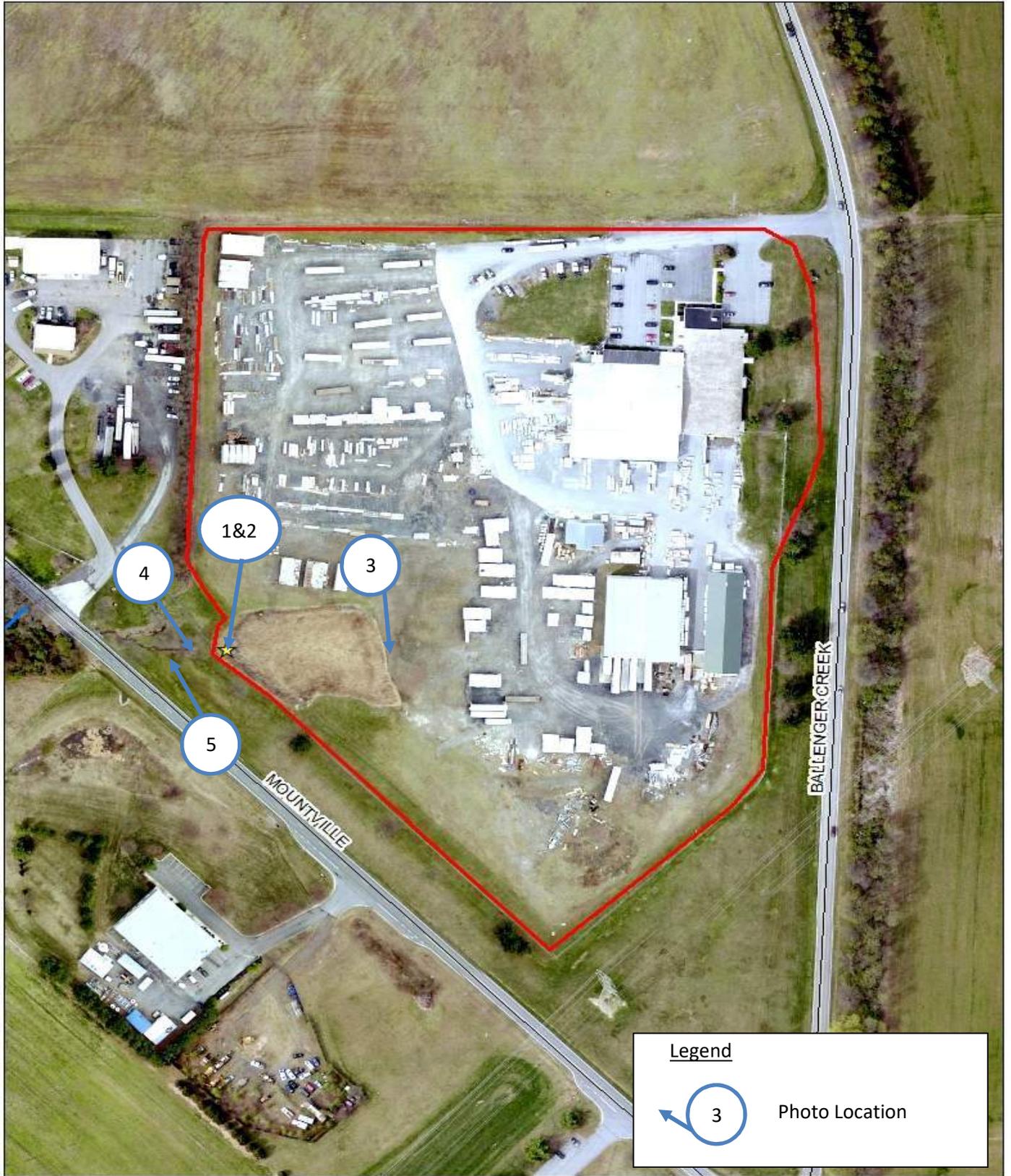


Figure 2: BMP 68 Photo Locations



**Photo 1: View of CMP Riser, looking southeast**



**Photo 2: Low flow orifice buried under vegetation**



**Photo 3: Overall view of BMP, looking to the south**



**Photo 4: Overall view of BMP, looking to the south of the facility**



**Photo 5: View of downstream channel, looking south**

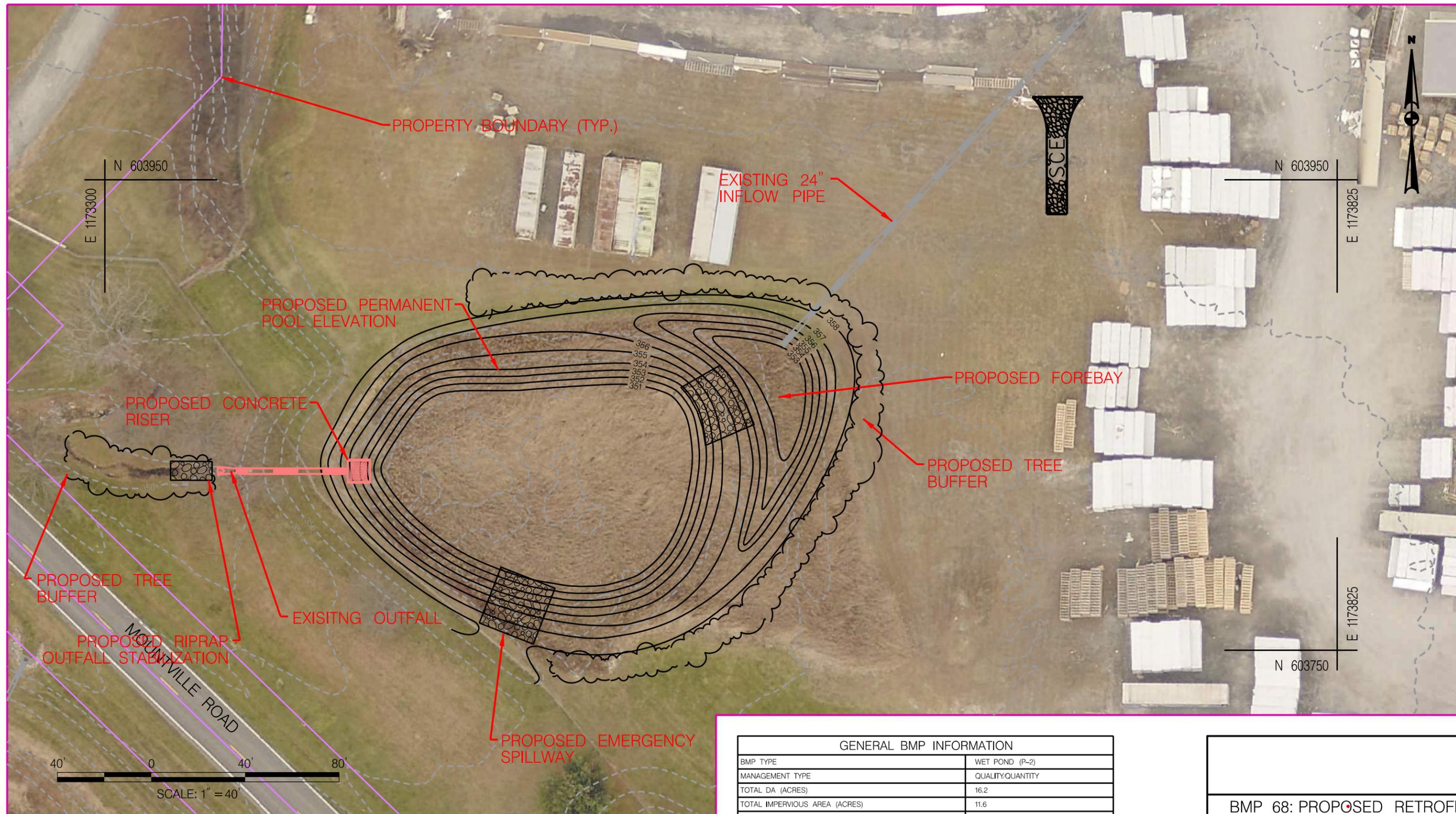


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	10/29/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 68	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Builders Supply & Lumber	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	North side of Mountville Road	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.32, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	603,825/1,173,472	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/21/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	16.2		16.2
Total Impervious Area within Drainage Area (acres):	11.6		11.6
WQv Required:	Unknown		36,638
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
<b>Estimated Treatment Provided</b>	<b>Per Design</b>	<b>Per MDE 2000 Standards</b>	
WQv Provided:	Unknown	0	36,638 cu.ft.      0.86 ac-ft
Total Treated Drainage Area (acres):	16.2	0	16.2
Total Treated Impervious Area within Drainage Area (acres):	11.6	0	11.6
<b>Estimated Pollutant Removal Rates</b>			
Runoff Volume Treated per Impervious Acre (in.)			0.89
Total Nitrogen:	N/A		52%
Total Phosphorus:			33%
Sediment:			66%
<b>Estimated Pollutant Load Reduction</b>			
TN (lbs/yr):	0		118.1
TP (lbs/yr):	0		7.1
TSS (lbs/yr):	0		7143.7

<b>Projected Retrofit Cost:</b>	\$425,163
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**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	16.2
TOTAL IMPERVIOUS AREA (ACRES)	11.6
WQv REQUIRED (CU. FT)	36,638
WQv REQUIRED (AC. FT)	0.84
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	36,638
TOTAL TREATED DA (ACRES)	16.2
TOTAL TREATED IMPERVIOUS AREA (ACRES)	11.6

<b>BMP 68: PROPOSED RETROFIT</b>	
SCALE: 1" = 40'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____



Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000090  
 Brown and Caldwell F-1 Sand Filter Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 5.18 ac Stream Use: I  
 Impervious Area: 2.16 ac  
 % Impervious (I): 42%  
 Minimum WQv\*: 0.09 ac-ft \*If %IA<15%  
 Existing RCN: 83 Existing tc: 0.3  
 Post Development RCN: 83 Pose Development tc: 0.3

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or Western  
 WQv = Water Quality Volume BMP Type: Sand Filter  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 41.70  
 $R_v = 0.425$   
**WQv = 0.17 ac-ft**  
**7197.201 cf**

**2. Compute Recharge Volume Requirement\*\***

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	4.82	93%
C	0.13	0.31	6%
D	0.06	0.05	1%

S = 0.2502

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$   
**Rev = 0.019 ac/ft**  
**834.320 cu.ft**

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**  
 25% WQv:  
 0.04 ac-ft  
 1799.3003 cf

**B. Sedimentation Surface Area**  
 $As = (Qo/W) \times E'$   
 $Qo = WQv / 60 = 0.083300938$   
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 478.9803906$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
388.00	526.15	0.012				0.000	0.00
389.00	884.56	0.020	1.00	0.016	0.016	0.016	705.36
390.00	1304.00	0.030	1.00	0.025	0.025	0.041	1,799.64
			0.00	0.000	0.000	0.041	1,799.64
			0.00	0.000	0.000	0.041	1,799.64
			0.00	0.000	0.000	0.041	1,799.64

WQv: OK As: OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQ_v(df) / [(k)(hf+df)(tf)]$$

df (ft) =	3	Af (sf) =	923.5074
k (ft/day) =	3.5		
hf (ft) =	1		
tf (days) =	1.67	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)	
385.00	1650.00	0.038				0.000	0.00	
386.00	1650.00	0.038	1.00	0.038	0.038	0.038	1,650.00	
387.00	1650.00	0.038	1.00	0.038	0.038	0.076	3,300.00	
388.00	1650.00	0.038	1.00	0.038	0.038	0.114	4,950.00	Filter Media
389.00	2175.00	0.050	1.00	0.044	0.044	0.158	6,862.50	
390.00	2770.00	0.064	1.00	0.057	0.057	0.214	9,335.00	Top of Grade
			0.00	0.000	0.000			
			0.00	0.000	0.000			
			0.00	0.000	0.000			
			0.00	0.000	0.000			

75% Storage Check:	OK	Subsurface Storage	1237.5
WQv Check***:	OK	Surface Storage	4385

\*\*\*Includes both permanent and forebay storage.

# BMP # 90 – Standard Equipment Company, Inc

**Prioritization Ranking:** 16  
**Planning Level Cost Estimate:** \$274,890  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Southern side of Agro Road
Northing/Easting:	609,145/1,175,746
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Sand Filter
Management Type:	Quality
Total Drainage Area (ac):	4.5
Total Impervious Area (ac):	2.2
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	7,838
Total Treated Drainage Area (ac):	4.5
Total Treated Impervious Area (ac):	2.2
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	19.0
TP (lbs/yr):	2.7
TSS (lbs/yr):	3,161.4



Existing site conditions for BMP # 90



Site map for BMP # 90

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 90 is an extended detention dry pond. The facility was constructed on the southern side of Agro Road, Northwest of Ballenger Creek Road. The BMP Database indicates that the original design was intended to provide management for quantity for 4.5 acres of total drainage area including 2.2 acres of impervious. The drainage area encompasses the Standard Equipment Company property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material in and out from the Standard Equipment Company storage lot. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with Standard Equipment Company business.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP #90 is a sand filter with a sedimentation forebay. The proposed retrofit will provide quantity and quality management for the original 4.5 acre drainage area including 2.2 acres of impervious area. The concept retrofit proposes adding two feet of filter media and raising the fill embankment two feet to allow for proper storage. A proposed yard inlet control structure is to serve as the facility’s outfall.

# BMP #90 – Standard Equipment Company, Inc.

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 90 is an extended detention dry pond. The facility was constructed on the southern side of Agro Road, Northwest of Ballenger Creek Road, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quantity for 4.5 acres of total drainage area including 2.2 acres of impervious. Figure 1 shows the drainage area for the facility, which primarily encompasses the Standard Equipment Company property. According to as-builts, there is currently a 15” inflow pipe into the facility.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The inflow for this facility could not be located due to dense vegetation. The as-builts provided by Frederick County show an existing 15” RCP. The condition of the inflow could not be determined. All other flow is received via sheet flow from the surrounding areas.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the as-builts, the facility has a 24” corrugated metal pipe (CMP) spillway that could not be located in the field due to overgrown vegetation.

### Embankment:

A fill embankment is present between the pond and outfall to the southwest of the pond. The embankment for this site was observed to have heavy vegetation.

### Outflow:

The outflow for this BMP was not assessed due to heavy vegetation, making it inaccessible.

### Overall BMP:

Many features of this BMP were inaccessible due to heavy vegetation and could not be assessed. This facility does not currently meet criteria to treat for water quality and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from the Standard Equipment Company storage lot. This access is from the east of the stormwater facility. Stakeholder input for material storage and staging is recommended so that regular business operations are not interrupted during construction.

## Proposed Retrofit:

BMP # 90 was originally designed as an extended detention dry pond. This facility was identified as a potential sand filter retrofit. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 4.5 acres, including 2.2 acres of impervious. The concept retrofit plan proposes to provide water quality by a sedimentation forebay and filling approximately two feet above the existing grade with filter media. Minor And underdrain is to be installed and connected to a proposed yard inlet which outfalls to a downstream channel.

In order to maintain the existing grass wale bypass northwest of the facility an estimated 500 square feet of impact to neighboring property. Temporary easement will be necessary to perform the currently proposed grading. During the final design process an effort should be made to limit any impacts to neighboring properties while maximizing WQv treated.

### **Step 1: Watershed Factors**

BMP #90 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P. There are no special watershed factors and/or constraints that must be considered for retrofit design for BMP #90 due to the stream use designation. The surface sand filter, by filtering stormwater runoff through a sand media, will help to minimize thermal impacts.

### **Step 2: Terrain Factors**

BMP # 90 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes filter media two feet above the existing grade (based on information available) and the fill embankment is raised two feet to allow for full water quality treatment and to meet storage needs. Another embankment will also need to be created to construct the forebay. The yard inlet will need more detailed design to appropriately size it for outfall requirements.

### **Step 4: Physical Feasibility Factors**

According to the Maryland Stormwater Design Manual, the maximum drainage area for a surface sand filter is 10 acres. Other filter practices having a maximum drainage area of 2 or 5 acres, therefore a surface sand filter is the most appropriate BMP selection. The proposed drainage area to BMP #90 is 4.5 acres and is composed of primarily C soils with a small amount of B and D soils. The likelihood of BMP # 90 receiving hotspot runoff is moderate as it is located near a storage lot that uses heavy equipment every day. Additional assessment will be required to determine if there is adequate separation from the water table.

### **Step 5: Community and Environmental Factors**

BMP # 90 has low public visibility. Sand filters tend to have medium maintenance requirements, medium community acceptance, high construction costs relative to the drainage area, and provide relatively low habitat value. Because the facility will have grass plantings on the surface the maintenance requirements will be less extensive.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 90 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 90 Location Map – Existing Conditions



**Figure 2: BMP 90 Photo Locations**



**Photo 1: View of outfall area looking southwest.**



**Photo 2: Overall view of facility looking southwest.**



**Photo 3: View of inflow channel looking northeast.**



**Photo 4: View of drainage area looking northeast.**



**Photo 5: Overall view of facility looking northwest.**



**Photo 6: Overall view of facility looking west.**

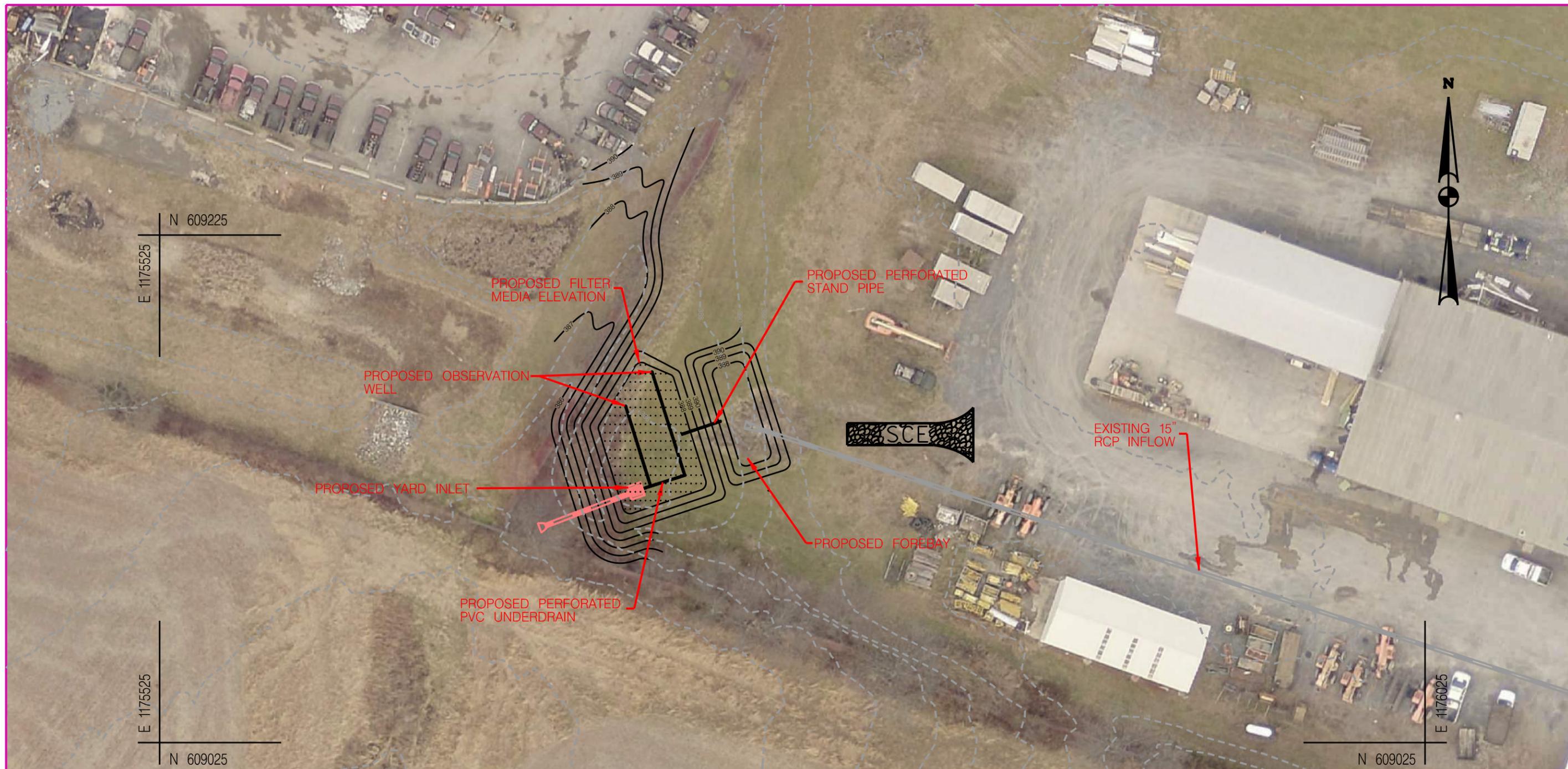


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 90	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Standard Equipment Company, Inc	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	5399 Argo Drive	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.48	<b>Name/#:</b>	
<b>Northing/Easting:</b>	609,145/1,175,746	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/19/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Surface Sand Filter (F-1)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	4.5		4.5
Total Impervious Area within Drainage Area (acres):	2.2		2.2
WQv Required:	Unknown		7,838
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	7,838 cu.ft. .18 ac-ft
Total Treated Drainage Area (acres):	4.5	0	4.5
Total Treated Impervious Area within Drainage Area (acres):	2.2	0	2.2
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.9
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		19.0
TP (lbs/yr):	0		2.7
TSS (lbs/yr):	0		3161.4

<b>Projected Retrofit Cost:</b>	\$274,890
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N 609225  
E 1175525

E 1175525  
N 609025

E 1176025  
N 609025



GENERAL BMP INFORMATION	
BMP TYPE	SAND FILTER (F-1)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	4.5
TOTAL IMPERVIOUS AREA (ACRES)	2.2
WQv REQUIRED (CU. FT)	7,838
WQv REQUIRED (AC. FT)	0.18
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	7,838
TOTAL TREATED DA (ACRES)	4.5
TOTAL TREATED IMPERVIOUS AREA (ACRES)	2.2

BMP 90: PROPOSED RETROFIT	
SCALE: 1" = 40'	
DESIGNED BY: NCW	COUNTY: FREDERICK
DRAWN BY: NCW	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

GENERAL NOTES:  
1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000103  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 1.07 ac Stream Use: I  
 Impervious Area: 0.86 ac  
 % Impervious (I): 80%  
 Minimum WQv\*: 0.02 ac-ft \*If %IA<15%  
 Existing RCN: 86 Existing tc: 0.1  
 Post Development RCN: 86 Pose Development tc: 0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A)/12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 80.37  
 $R_v = 0.773$   
 WQv = 0.06 ac-ft  
 2703.4425 cf

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	0.89	83%
C	0.13	0.18	17%
D	0.06	0.00	0%

S = 0.2379

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  Rev = 0.099 ac/ft  
 4307.696 cu.ft

**3. Forebay Sizing:** Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**  
 25% WQv:  
 0.02 ac-ft  
 675.86063 cf

**B. Sedimentation Surface Area**  
 $As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.031289844  
 $W \text{ (ft/sec)} = 0.0033$   
 $E' = 2.3$   
 $As \text{ (sf)} = 21.80807292$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	3	Af (sf) =	2027.5819
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	NOT OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
243.00	2005.00	0.046				0.000	0.00
244.00	2005.00	0.046	1.00	0.046	0.046	0.046	2,005.00
245.00	2005.00	0.046	1.00	0.046	0.046	0.092	4,010.00
246.00	2005.00	0.046	1.00	0.046	0.046	0.138	6,015.00
247.00	2558.00	0.059	1.00	0.052	0.052	0.190	8,296.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1503.75
WQv Check***:	OK	Surface Storage	2281.5

\*\*\*Includes forebay, subsurface, and surface storage

# BMP # 103 – Point of Rocks Convenience Center

**Prioritization Ranking:** 24  
**Planning Level Cost Estimate:** \$112,455  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Northern side of Clay Street
Northing/Easting:	586,433/1,162,734
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention
Management Type:	Quality
Total Drainage Area (ac):	1.1
Total Impervious Area (ac):	0.9
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	2,969
Total Treated Drainage Area (ac):	1.1
Total Treated Impervious Area (ac):	0.9
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	5.0
TP (lbs/yr):	0.8
TSS (lbs/yr):	513.1



Existing site conditions for BMP # 103



Site map for BMP # 103

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 103 is an infiltration basin. The facility was constructed to the north of Clay Street, near the intersection of Bowis Drive and Red Leaf Court. The BMP Database indicates that the original design was intended to provide management for quantity and quality for 1.4 acres of total drainage area including 0.9 acres of impervious. The drainage area for the facility encompasses the Point of Rocks Convenience Center area.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material in and out from the adjacent parking lot. A Maintenance of Traffic (MOT) may be required to identify traffic controls in the adjacent parking lot, just off Clay Street. The staging area will be planned to not interfere with local business operations. Multiple utility conflicts may exist, including a gas line and underground electric.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP #103 is a bioretention area. The proposed retrofit will provide quality management for the original 1.1 acre drainage area with 0.9 acres of impervious area. The concept retrofit plan proposes using a stone diaphragm and grass strip for pretreatment. An underdrain system is not included because the facility is located on well-draining A and B soils.

# BMP #103 – Point of Rocks Convenience Center, Infiltration Basin

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 103 is an infiltration basin. The facility was constructed to the north of Clay Street, near the intersection of Bowis Drive and Red Leaf Court as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quantity and quality for 1.1 acres of total drainage area including 0.9 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses the Point of Rocks Convenience Center area.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has two inflow points. The first is a curb cut draining runoff from the convenience center parking lot, located on the south side of the BMP. The as-builts provided by Frederick County also shows a 15" CMP coming into the west side of the BMP but could not be located during the site visit and is believed to have been removed. The curb cut channel is filled with debris.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

A control structure is not applicable. A spillway was not observed in the field or on as-builts.

### Embankment:

An embankment is not present for this BMP type.

### Outflow:

An outflow for this BMP type is not applicable.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality as there are no current as-builts. The BMP is next to a gas station which could present hotspot concerns. Debris cleanout is needed in the curb cut inflow channel. The facility is a candidate for retrofit or may receive credit if current as-builts are created.

## Access, Right-of-Way, and MOT:

This site can be accessed for maintenance and hauling material in and out from the adjacent parking lot entrance for Point of Rocks Convenience center. Access is to the west side of the facility., Limited Maintenance of Traffic (MOT) will be necessary.

## Proposed Retrofit:

BMP # 103 was originally designed as an infiltration basin. This facility has been identified as an opportunity for a bioretention area. The proposed retrofit will provide both water quality treatment for the originally designed 1.1 acres, including 0.9 acres of impervious. The concept retrofit plan proposes to provide permanent storage by adding two feet of bioretention mix above the existing BMP bottom elevation. According to USDA soil survey information the BMP is on an area with well-draining A and B soils, therefore an underdrain and outfall configuration may not be necessary. Detailed soil studies will be necessary for final design.

Because the facility is an infiltration basin and can qualify for treatment credit there is potential for current as-builts to be created and receive credit.

### **Step 1: Watershed Factors**

BMP #103 is located in the Washington Run subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

### **Step 2: Terrain Factors**

BMP # 103 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit proposed filter media elevation will be two feet above the existing facility bottom (based on information available) and there will be limited changes to the current grading. The retrofit will utilize a stone diaphragm and grass filter strip for pretreatment. No underdrain or riser structure was added to the concept because of the presence of A and B soils.

### **Step 4: Physical Feasibility Factors**

According to the Maryland Stormwater Design Manual, maximum drainage area to a bioretention area is 5 acres, making this a suitable BMP selection. The proposed drainage area to BMP #103 is 1.1 acres and is composed of largely B soils with a portion of C soils. The likelihood of BMP # 103 receiving hotspot runoff is moderate as it is drains gas station runoff. Additional assessment is necessary to determine if there is adequate separation from the water table.

### **Step 5: Community and Environmental Factors**

BMP # 103 has high public visibility, as it is adjacent to and visible from a gas station. Bioretention areas tends to have medium maintenance requirements, medium community acceptance, and medium construction costs relative to the drainage area.

### **Step 6: Location and Permitting Factors**

Several potential utility conflicts exist including a gas line and underground electric.

The anticipated permits/reviews required for the retrofit of BMP # 103 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 103 Location Map – Existing Conditions

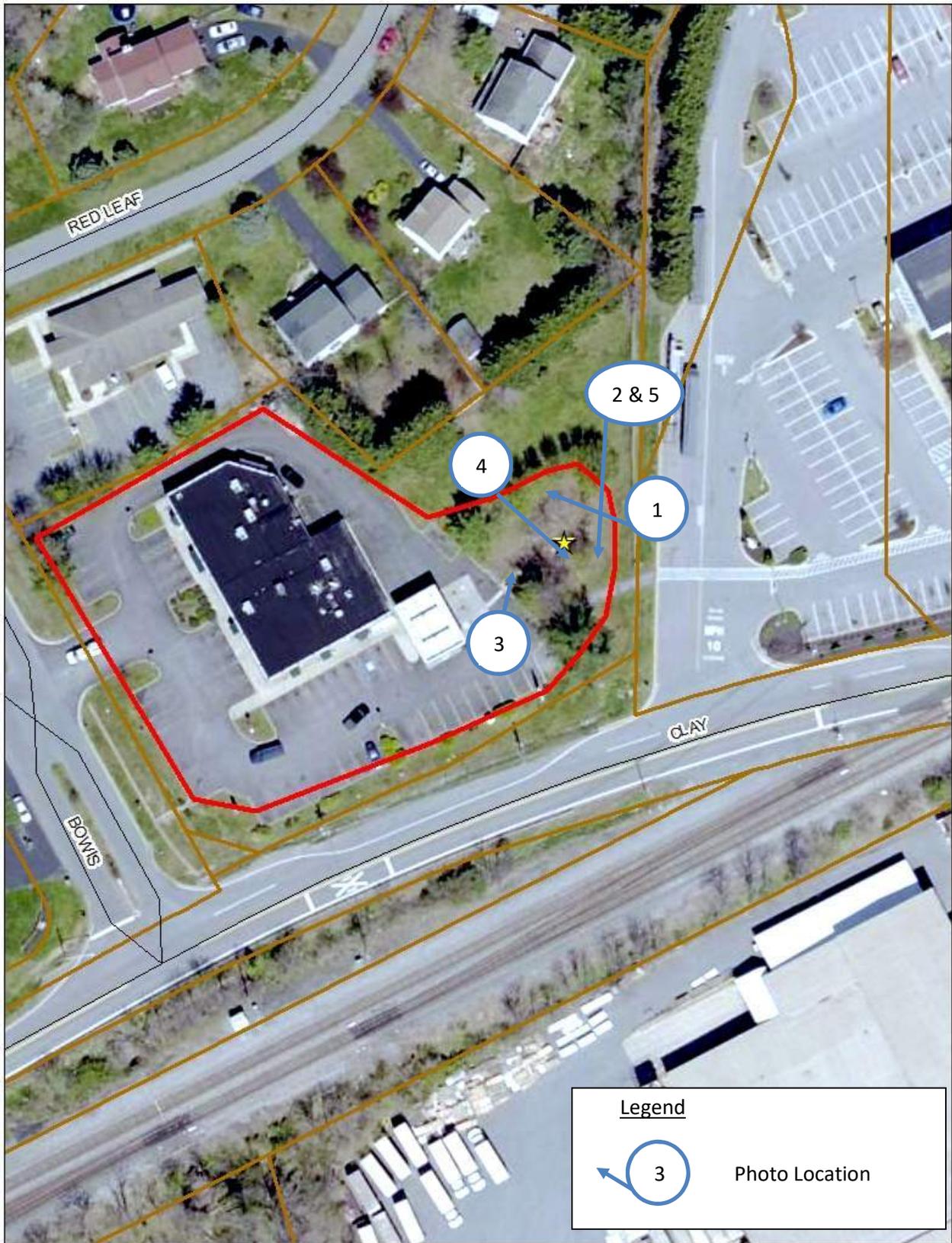


Figure 2: BMP 103 Photo Locations



**Photo 1: Overall view of the facility looking North.**



**Photo 2: View of unknown pipe inflow looking south.**



**Photo 3: View of inflow curb cut looking North.**



**Photo 4: Overall view of facility looking to the east.**



**Photo 5: Overall view of facility looking west.**

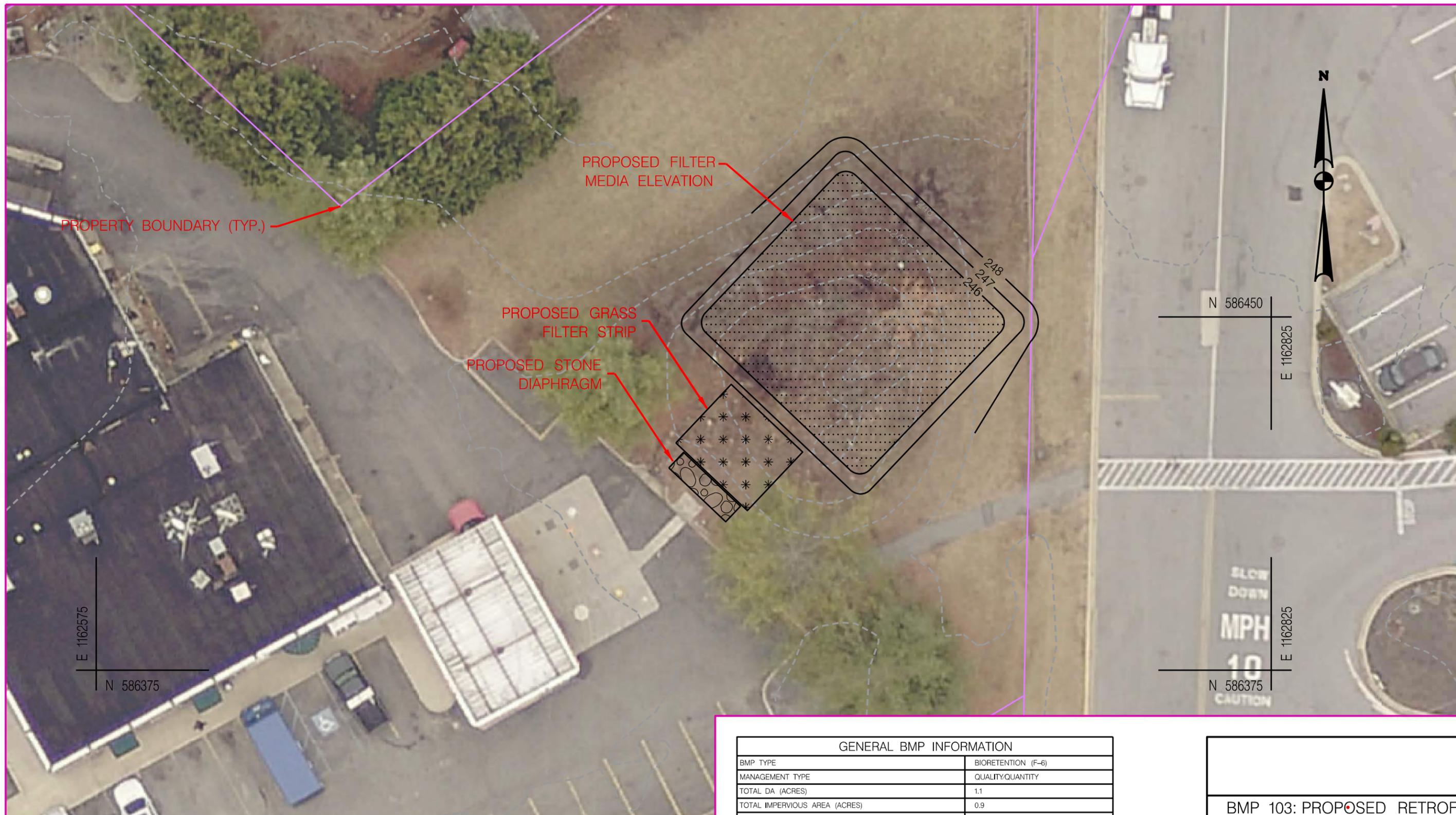


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 103	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Pt of Rocks Convenience Cntr, Infiltration Basin	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Md. Rt. #28 and Bowis Drive	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.28, -77.53	<b>Name/#:</b>	
<b>Northing/Easting:</b>	586,434/1,162,734	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/19/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/11/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	1.1		1.1
Total Impervious Area within Drainage Area (acres):	0.9		0.9
WQv Required:	Unknown		2,969
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	2,969 cu.ft.      0.07 ac-ft
Total Treated Drainage Area (acres):	1.1	0	1.1
Total Treated Impervious Area within Drainage Area (acres):	0.9	0	0.9
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.86
Total Nitrogen	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		5.0
TP (lbs/yr):	0		0.8
TSS (lbs/yr):	0		513.1

<b>Projected Retrofit Cost:</b>	\$122,455
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GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	1.1
TOTAL IMPERVIOUS AREA (ACRES)	0.9
WQv REQUIRED (CU. FT)	2,969
WQv REQUIRED (AC. FT)	0.07
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	2,969
TOTAL TREATED DA (ACRES)	1.1
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.9

BMP 103: PROPOSED RETROFIT	
SCALE: 1" = 20'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000127  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 4.46 ac Stream Use: I  
 Impervious Area: 1.98 ac  
 % Impervious (I): 44%  
 Minimum WQv\*: 0.07 ac-ft \*If %I<15%  
 Existing RCN: N/A Existing tc: N/A  
 Post Development RCN: N/A Pose Development tc: N/A

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 44.39  
 $R_v = 0.450$   
**WQv = 0.15 ac-ft**  
**6550.335 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	2.23	50%
C	0.13	2.23	50%
D	0.06	0.00	0%

S = 0.195

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  **Rev = 0.108 ac/ft**  
**4725.494 cu.ft**

**3. Forebay Sizing:**

Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.04 ac-ft  
 1637.5838 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.075814063  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 435.9308594$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2	Af (sf) =	4366.89
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
378.00	4507.00	0.103				0.000	0.00
379.00	4507.00	0.103	1.00	0.103	0.103	0.103	4,507.00
380.00	4507.00	0.103	1.00	0.103	0.103	0.207	9,014.00
381.00	5355.00	0.123	1.00	0.113	0.113	0.320	13,945.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	2253.5
WQv Check***:	OK	Surface Storage	4931

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #127 – Stanford, Lot 54

**Prioritization Ranking:** 25  
**Planning Level Cost Estimate:** \$249,900  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	4985 Winchester Boulevard
Northing/Easting:	611,206/1,171,528
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	4.5
Total Impervious Area (ac):	2.0
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	6,550
Total Treated Drainage Area (ac):	4.5
Total Treated Impervious Area (ac):	2.0
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	18.7
TP (lbs/yr):	2.3
TSS (lbs/yr):	1377.0



Existing site conditions for BMP #127



Site map for BMP #127

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP #127 is a dry pond, however, the facility is very ill defined. The facility is constructed on the western side of Winchester Boulevard in a field located behind the business center. The facility has a 4.5-acre drainage area, including 2.0 acres of impervious area. The drainage area includes all of the nearby business center and the majority of the surrounding field. It appears that the field is used for livestock grazing.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the nearby business park parking lot. No Maintenance of Traffic (MOT) will be required and staging area will be planned to not interfere with business operations.

## PROPOSED RETROFIT

The proposed retrofit for BMP #127 is a bioretention (F-6) practice. The proposed retrofit will provide quantity and quality management for the original 4.5-acre drainage area, including 2.0 acres impervious area. The retrofit concept proposes excavating three feet below the existing grade and filling with two feet of bioretention mix. The facility will utilize a grass filter strip and stone diaphragm as pre-treatment. The retrofit concept proposes a perforated underdrain and riser structure and outfall to the south in an existing grass swale. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X

# BMP #127 - Stanford, Lot 54

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database) BMP #127 is a dry pond however during the site visit there did not appear to be a clearly defined BMP in place. The facility is located on the western side of Winchester Boulevard behind Rennwelt LLC and the surrounding business center as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 4.5 acres of total drainage area, including 2.0 acres of impervious surface. Figure 1 shows the drainage area for the facility, which encompasses a large portion of the nearby business center and the surrounding field.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding property and a 30" CMP stormdrain pipe.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has no notable control structures that were visible during the site visit or shown on the as-builts.

### Embankment:

The facility does not have an embankment in place.

### Outflow:

The facility outfalls to a grass channel.

### Overall BMP:

Overall, the facility appears to be in poor condition, with ill-defined topography, no distinguishable banks and poor drainage. The facility currently does not meet criteria for water quality and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from the nearby business center parking lot. Construction vehicles will have to mount a curb to reach the facility. Staging and material storage should be placed to avoid interruptions to business operations.

## Proposed Retrofit:

BMP #127 is categorized as a dry pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 4.5-acre drainage area, including 2.0 acres of impervious surface. The retrofit concept includes excavation to three feet below existing grade and filling the bottom two feet with bioretention mix. The retrofit proposes a grass filter strip and stone diaphragm as pretreatment. A proposed concrete riser will be installed on the southern end of the facility with a perforated PVC underdrain tied in. The facility will outfall to the existing grass swale with riprap stabilization. These proposed design elements are displayed on the attached **Concept Plan**.

Although not initially identified BMP #127 has potential to receive full credit as a regenerative stormwater conveyance. Further consideration to this should happen during the final design process.

### Step 1: Watershed Factors

BMP #127 is located in the Eastalco Aluminum subwatershed in the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #127 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The retrofit concept includes excavating three feet below the existing grade and filling the bottom two feet of the facility with bioretention mix. A concrete riser and a perforated PVC underdrain are proposed to outfall to the southern side of the facility into the existing grass swale. The downstream stream use is I-P so thermal impacts are of a limited concern.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #127 is 4.5 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres so bioretention is a suitable practice for this area

## **Step 5: Community and Environmental Factors**

BMP #127 is located on the western side of Winchester Boulevard and has low visibility. Bioretentions tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

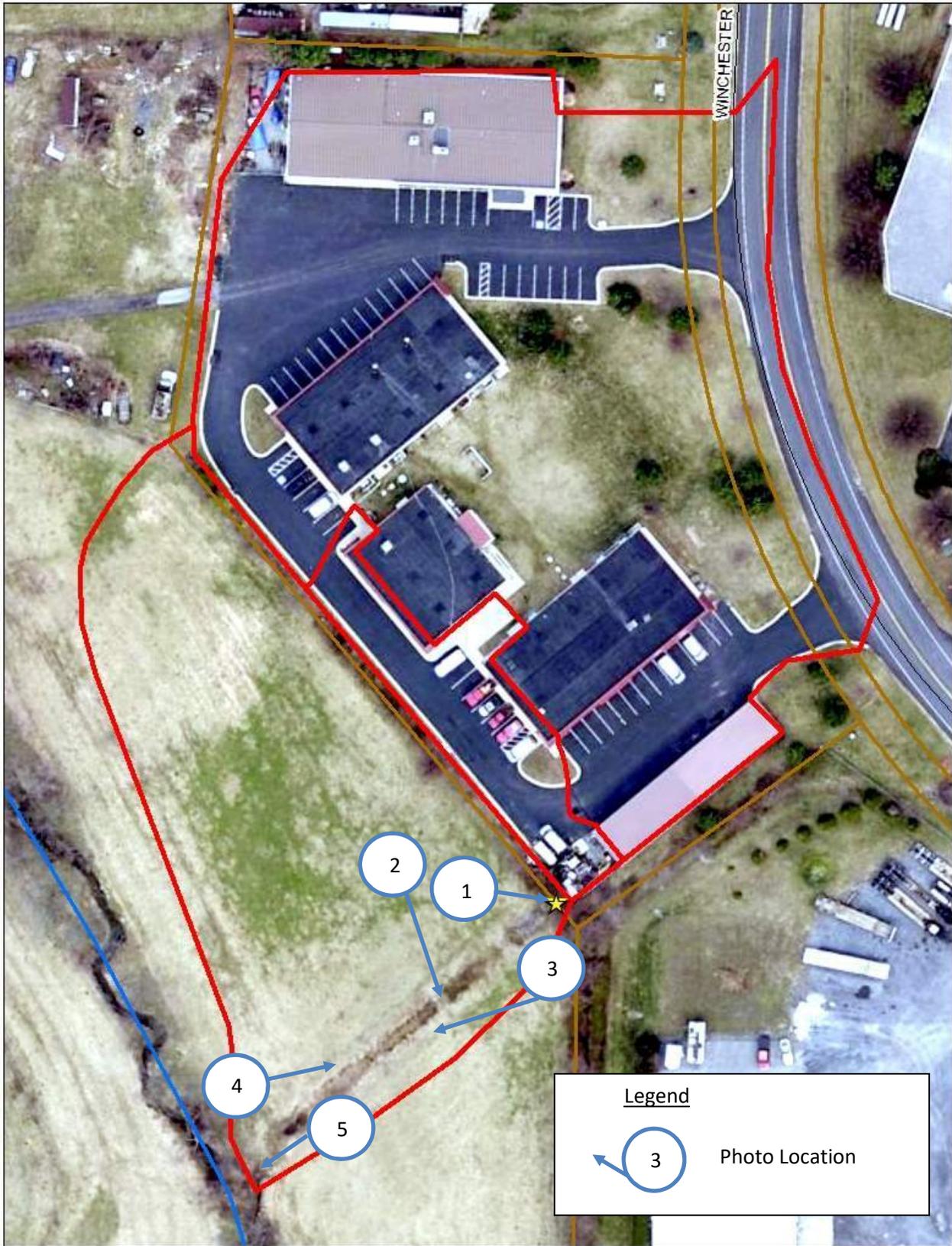
## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #127 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) JPA



Figure 1: BMP 127 Location Map – Existing Condition



**Figure 2: BMP 127 Photo Locations**



**Photo 1: View of inflow looking north.**



**Photo 2: Overall view of facility looking south.**



**Photo 3: Overall view of the facility looking northeast.**



**Photo 4: View of the facility's outfall channel.**



**Photo 5: View of downstream stream channel.**

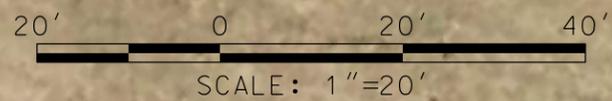
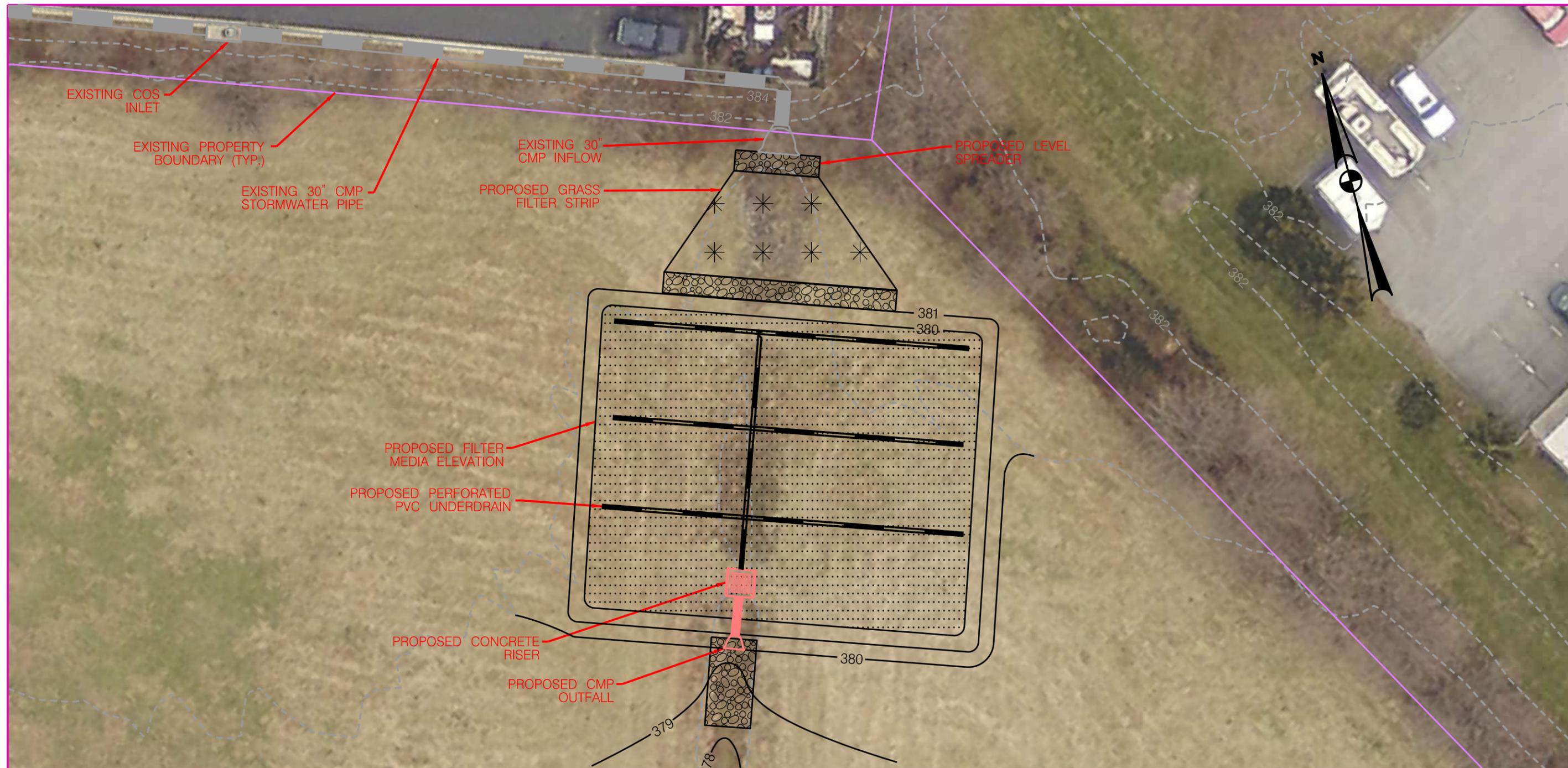


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	OID 54 / BMP 127	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Stanford, Lot 54	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	4985 Winchester Boulevard	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	611,206/1,171,528	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/21/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/20/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	4.5		4.5
Total Impervious Area within Drainage Area (acres):	2.0		2.0
WQv Required:	Unknown		6,550
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	6,550 cu.ft.      0.15 ac-ft
Total Treated Drainage Area (acres):	4.5	0	4.5
Total Treated Impervious Area within Drainage Area (acres):	2.0	0	2.0
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.91
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		18.7
TP (lbs/yr):	0		2.3
TSS (lbs/yr):	0		1377.0

<b>Projected Retrofit Cost:</b>	\$249,900
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GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	4.5
TOTAL IMPERVIOUS AREA (ACRES)	2.0
WQv REQUIRED (CU. FT)	6,550
WQv REQUIRED (AC. FT)	0.15
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	6,550
TOTAL TREATED DA (ACRES)	4.5
TOTAL TREATED IMPERVIOUS AREA (ACRES)	2.0

GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



OID 127: PROPOSED RETROFIT

SCALE: 1" = 20'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	1.96	ac	Stream Use: I
Impervious Area:	0.77	ac	County: Frederick
% Impervious (I):	39%		
Minimum WQv*:	0.03	ac-ft	*If %IA<15%
Existing RCN:	88	Existing tc:	0.1
Post Development RCN:	88	Pose Development tc:	0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**      Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 39.29

$R_v = 0.404$

**WQv = 0.06 ac-ft**  
2584.20 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.27	14%
B	0.26	1.33	68%
C	0.13	0.35	18%
D	0.06	0.00	0%

S = 0.2534

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

**Rev = 0.001 ac/ft**  
42.0 cu ft

**3. Forebay Sizing:**

\*Facility only has forebay for existing pipe inflow capturing a portion of the DA

**A. Compute Forebay Sizing :**

	Forebay 1	Forebay 2
10% WQv Partial DA (ac)	1.16	0.80
IA (ac)	0.40	0.37
%I	34.48	46.25
WQv (cf)	<b>1365.61</b>	<b>1218.59</b>
	0.00 ac-ft	ac-ft
	136.56 cf	cf
		0.00
		121.8591

Design Firm:

Maryland Environmental Site Design Calculations

Project# BMP 000175

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Project: Potomac Direct Watershed Assessment

Designer: NCW

Checked

Practice #

**Forebay 1**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
413.00	565.00	0.013				0.000	0.00
414.00	860.00	0.020	1.00	0.016	0.016	0.016	712.50
			0.00	0.000	0.000	1538.229	
			0.00	0.000	0.000	1538.229	
			0.00	0.000	0.000	1538.229	
			0.00	0.000	0.000	1538.229	

FB1 Check: OK

**Forebay 2**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
413.00	666.00	0.015				0.000	0.00
414.00	983.00	0.023	1.00	0.019	0.019	0.019	824.50
			0.00	0.000	0.000	1538.248	
			0.00	0.000	0.000	1538.248	
			0.00	0.000	0.000	1538.248	
			0.00	0.000	0.000	1538.248	

FB2 Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
412.00	3943.00	0.091				0.000	0.00
413.00	5095.00	0.117	1.00	0.104	0.104	0.104	4,519.00
414.00	6322.00	0.145	1.00	0.131	0.131	0.235	10,227.50 ***
415.00	7648.00	0.176	1.00	0.160	0.160	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50
			0.00	0.000	0.000	0.395	17,212.50

WQv Check\*\*\*: OK  
 10 Yr-Storm Volume (cf): 14356.65  
 10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP # 175 – Appalachian Tree Service

**Prioritization Ranking:** 7  
**Planning Level Cost Estimate:** \$29,322  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Northern side of Winchester Road
Northing/Easting:	612,649/1,171,557
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond
Management Type:	Quality and Quantity
Total Drainage Area (ac):	2.0
Total Impervious Area (ac):	0.7
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	2,349
Total Treated Drainage Area (ac):	2.0
Total Treated Impervious Area (ac):	0.7
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	8.0
TP (lbs/yr):	0.9
TSS (lbs/yr):	518.1



Existing site conditions for BMP # 175



Site map for BMP # 175

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 175 is a wet pond. The facility was constructed north of Winchester Boulevard at the intersection of Winchester Boulevard and Harvard Place. The BMP Database indicates that the original design was intended to provide management for quality and quantity for 2.0 acres of total drainage area including 0.7 acres of impervious. The drainage area for the facility encompasses the Appalachian Tree Service property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material in and out via Appalachian Tree Services Parking Lot. Maintenance of Traffic (MOT) will likely not be required, and the staging area will be planned to not interfere with local business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP # 175 is for the facility to remain a wet pond. The proposed retrofit will provide quality and quantity management for the original 2.0 acre drainage area including 0.7 acres of impervious area. The concept retrofit plan proposes adding a forebay in the northwestern corner of the facility as well as installing a new concrete riser. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. This design was intended to limit thermal impacts using a riser with an inverted low flow pipe, however modification of the existing weir wall to create the permanent pool is also an option.

# BMP #175 – Appalachian Tree Service (Stanford Industrial Park, Lot 4)

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 175 is a wet pond. The facility was constructed north of Winchester Boulevard at the intersection of Winchester Boulevard and Harvard Place, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quality and quantity for 2.0 acres of total drainage, area including 0.7 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses the Appalachian Tree Service property. Inflow comes in via sheet flow and a pipe that discharges directly to the facility on the northwest. There is also a grass swale on the southeastern side of the facility that brings inflow. The facility includes a notched weir outlet control structure.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Runoff is conveyed to the facility via sheet flow, a pipe that discharges into the northwestern side of the facility, and an existing grass swale on the southeastern side of the facility. The pipe inflow is filled with sediment and debris.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the County's BMP Database, the control structure for this facility is a notched weir. At the time of the site visit, the spillway was in good condition.

### Embankment:

A fill embankment is present between the pond and Winchester Boulevard. The embankment was observed to be stable and have sufficient vegetative cover on both the upstream and downstream side of the 6-foot tall embankment.

### Outflow:

Outflow occurs via the weir to a riprap channel that discharges to an existing 18" CMP that runs under Harvard Place and seems to be in good condition. The rip rap channel has evidence of erosion and overgrown vegetation.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet the criteria to treat for water quality and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and via the Appalachian Tree Service entrance. This access is from the west side of the facility. Stakeholder input is recommended to ensure that material storage and staging is placed in a way to not interrupt business operations.

## Proposed Retrofit:

BMP # 175 was originally designed as a wet pond. The proposed retrofit will modify the current wet pond configuration to provide both water quality and quantity treatment for the originally designed 2.0 acre drainage area, including 0.7 acres of impervious. The concept retrofit plan proposes to regrade the facility and create a fill embankment in place of the existing weir wall to create a 2 foot permanent pool as well as an additional 3 foot berm to create the forebay in the northwestern corner of the facility.

The **Concept Plan** proposes a concrete riser that outfalls to the west into an existing roadside swale, replacing the existing weir wall. The facility was designed with the intent of limiting thermal impacts to a downstream III-P stream, however the stream was recently e-designated as I-P. With the new stream designation, modification of the existing weir structure may be a

more appropriate means of creating the permanent pool.

### **Step 1: Watershed Factors**

BMP #175 is in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P. There are special watershed factors and/or constraints that must be considered for retrofit design for BMP #175 due to the stream use designation. To minimize thermal impacts the design will include a permanent pool with an inverted low flow pipe to draw from the bottom. Tree plantings just outside the embankment will provide shading.

### **Step 2: Terrain Factors**

BMP # 175 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes a permanent pool being created two foot above the existing facility bottom. The concept plan also includes a forebay for the existing CMP inflow on the northwestern side. The permanent pool is proposed to be created by removing the existing weir wall, closing the fill embankment, and installing a concrete riser structure. The design foregoes utilizing the existing weir wall, however, given the updated stream designation it could be modified to create the permanent pool.

### **Step 4: Physical Feasibility Factors**

The facility is already a wet pond and the modifications above are suggested for the County to receive impervious area credit. The proposed drainage area to BMP #175 is 2.0 acres and is composed of largely B soils with a portion of C and A soils. The likelihood of BMP # 175 receiving hotspot runoff is low.

### **Step 5: Community and Environmental Factors**

BMP # 175 is located on the north side of Winchester Boulevard but has low visibility. Ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 175 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 175 Location Map – Existing Conditions



Figure 2: BMP 175 Photo Locations



**Photo 1: View of inflow looking north.**



**Photo 2: View of CMP inflow.**



**Photo 3: Overall view of facility looking north.**



**Photo 4: Overall view of facility looking to the south.**



**Photo 5: Overall view of facility looking southeast.**



**Photo 6: View of existing weir wall.**



**Photo 7: View of existing outfall channel.**

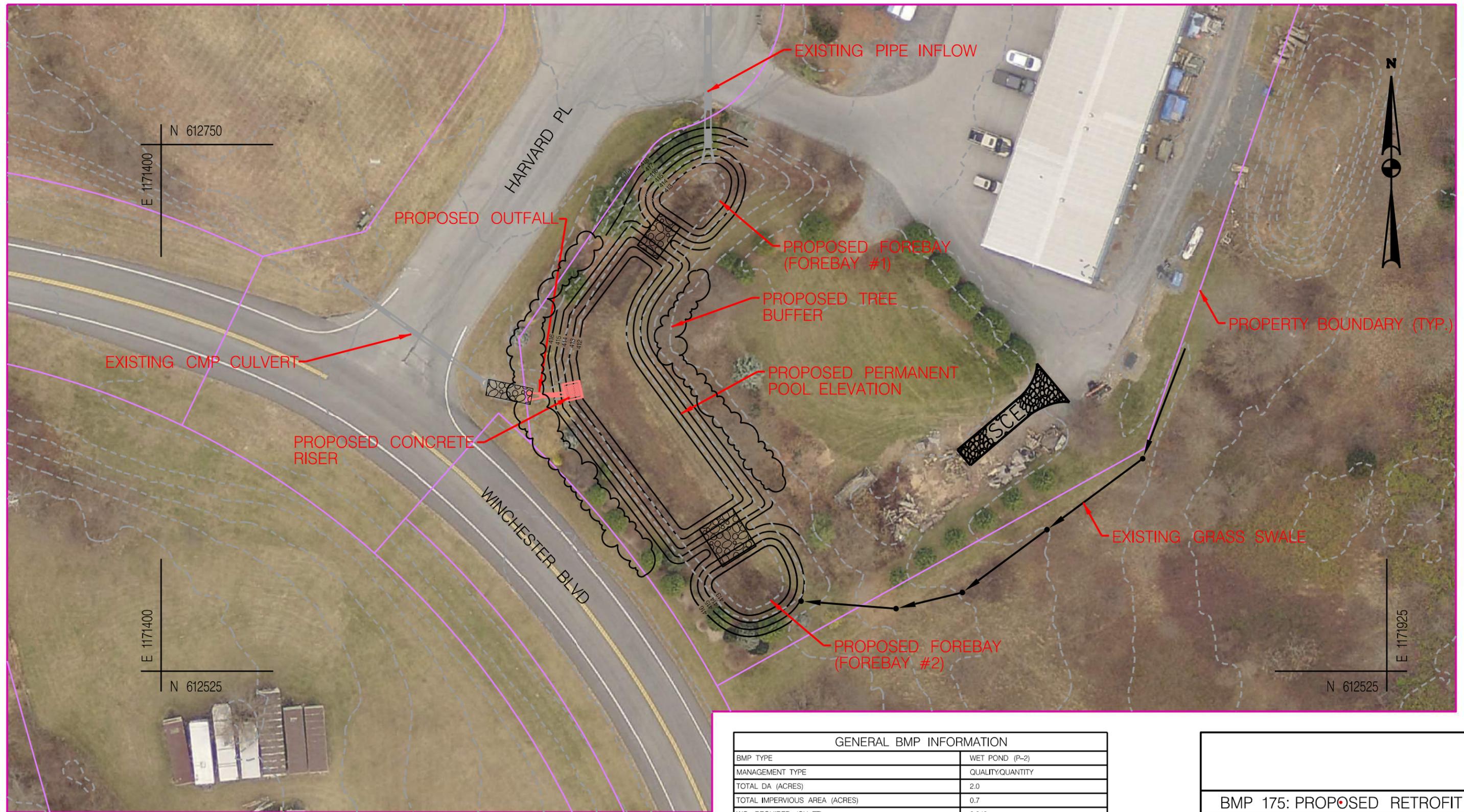


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 175	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Appalachian Tree Service - SWM Pond	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	4101 Harvard Place	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.35, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	612,650/1,171,557	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	2.0		2.0
Total Impervious Area within Drainage Area (acres):	0.7		0.7
WQv Required:	Unknown		2,349
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	2,349 cu.ft.      0.05 ac-ft
Total Treated Drainage Area (acres):	2.0	0	2.0
Total Treated Impervious Area within Drainage Area (acres):	0.7	0	0.7
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.94
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		8.0
TP (lbs/yr):	0		0.9
TSS (lbs/yr):	0		518.1

<b>Projected Retrofit Cost:</b>	\$29,322
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	2.0
TOTAL IMPERVIOUS AREA (ACRES)	0.7
WQv REQUIRED (CU. FT)	2,349
WQv REQUIRED (AC. FT)	0.05
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	2,349
TOTAL TREATED DA (ACRES)	2.0
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.7

**BMP 175: PROPOSED RETROFIT**

SCALE: 1" = 40'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Brown AND Caldwell**

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

Project# BMP 000243  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	5.02	ac	Stream Use:	I
Impervious Area:	3.90	ac	County:	Frederick
% Impervious (I):	78%			
Minimum WQv*:	0.08	ac-ft	*If %IA<15%	

Existing RCN:	92	Existing tc:	0.12
Post Development RCN:	92	Pose Development tc:	0.12

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: **Western** Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = **77.69**

$R_v = 0.749$

**WQv = 0.28 ac-ft**  
**12287.19 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	0.05	1%
C	0.13	4.67	93%
D	0.06	0.30	6%

S = 0.1271

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

**Rev = 0.012 ac/ft**  
**507.6 cu ft**

Design Firm: Maryland Environmental Site Design Calculations

Project# BMP 000243

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv

0.03 **ac-ft**

1228.719 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
401.00	1824.00	0.042				0.000	0.00
402.00	2980.00	0.068	1.00	0.055	0.055	0.055	2,402.00
403.00	4412.00	0.101	1.00	0.085	0.085	0.140	6,098.00
			0.00	0.000	0.000	0.140	6,098.00
			0.00	0.000	0.000	0.140	6,098.00
			0.00	0.000	0.000	0.140	6,098.00

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
400.00	6440.00	0.148				0.000	0.00
401.00	7670.00	0.176	1.00	0.162	0.162	0.162	7,055.00
402.00	8960.00	0.206	1.00	0.191	0.191	0.353	15,370.00
403.00	10323.00	0.237	1.00	0.221	0.221	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50
			0.00	0.000	0.000	0.574	25,011.50

7670  
8960

\*\*\*

WQv Check\*\*\*: OK

10 Yr-Storm Volume (cf): 68262.15

10 Yr-Storm Check: NOT OK

\*\*\*Includes both permanent and forebay storage.

# BMP # 243 – Mullinix Agro, Sec. II, Lot 5

**Prioritization Ranking:** 6  
**Planning Level Cost Estimate:** \$142,943  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Southern side of Manor Woods Road
Northing/Easting:	610,608/1,175,536
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond
Management Type:	Quality and Quantity
Total Drainage Area (ac):	5.0
Total Impervious Area (ac):	3.9
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	12,287
Total Treated Drainage Area (ac):	5.0
Total Treated Impervious Area (ac):	3.9
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	23.7
TP (lbs/yr):	3.7
TSS (lbs/yr):	2,368.6



Existing site conditions for BMP # 243



Site map for BMP # 243

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 243 is a dry pond. The facility is located between Agro Drive and Manor Woods Road. The BMP Database indicates that the original design was intended to provide management for quality and quantity for 5.0 acres of total drainage area including 3.9 acres of impervious. The drainage area for the facility primarily encompasses the Mullinix Agro, Sec II, Lot 5 property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material in and out of the property’s parking lot to the west of the site. No Maintenance of Traffic (MOT) may be required, and the staging area will be planned to not interfere with local business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP # 243 is a wet pond. The proposed retrofit will provide quality management for the original 5.0 acre drainage area, including 3.9 acres of impervious area. The concept retrofit plan proposes grading the western side of the facility and creating a grass swale into to capture run off and discharge into the sediment forebay on the southern side of the facility. The existing CMP riser is to be replaced with a concrete riser. The downstream stream designation was III-P but was re-designated to I-P in January, 2019 and thermal impacts are not a concern.

# BMP #243 – Mullinix Agro, Sec. II, Lot 5

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 243 is a dry pond. The facility is located between Agro Drive and Manor Woods Road, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quality and quantity for 5.0 acres of total drainage area including 3.9 acres of impervious. Figure 1 shows the drainage area for the facility, which primarily encompasses the Mullinix Agro, Sec II, Lot 5 property. As-builts are not available for this facility, but a site visit identified inflow via three riprap channels and a control structure consisting of a CMP riser with a stone jacketed 6" low flow pipe.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility receives inflow from three riprap channels. As-builts are not available for this facility, but the inflow points were identified during the site visit. The property owner has installed super silt fence along the western side of the facility and limited flow to two riprap inflows.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

Based on the site visit notes, the control structure consists of a CMP riser with a stone jacketed 6" low flow pipe.

### Embankment:

A fill embankment is present and was observed to be stable and have sufficient vegetative cover on both the upstream and downstream side of the 6-foot tall embankment. Several rodent borrows were noted.

### Outflow:

The outfall pipe is in good condition. The facility outfalls to a stream located in the northeast corner of the property.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality as it does not meet the current stormwater standards and has a CMP riser. The property owner has made several unapproved modifications to the facility limiting its ability to properly treat the large amount of runoff draining to it. The facility is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out Gabe's Services, Inc. parking lot. Material storage and staging will be placed in a way to not interrupt business operations. Stakeholder input is recommended to ensure material storage and staging be placed in a way to not interrupt business operations.

## Proposed Retrofit:

BMP # 243 was originally designed as a wet pond. The proposed retrofit will modify the current wet pond configuration to provide both water quality and quantity treatment for the originally designed 5.0 acre drainage area, including 3.9 acres of impervious. The concept plan proposes grading small portions of the parking lot to direct flow into a proposed grass swale and into the forebay located on the southern side of the facility. The existing facility embankments are proposed to be regraded at a 3:1 slope, while keeping the top elevation. The existing CMP riser is to be replaced by a concrete riser and designed to create a 2-foot deep permanent pool. The facility is proposed to outfall to the existing outfall channel.

In order to properly grade the retrofit at a stable 3:1 slope there is an estimated 100 square feet of impact to neighboring property. During the final design process attempt to both limit any impacts to neighboring property while maximizing the WQv treated.

### **Step 1: Watershed Factors**

BMP #243 is located in Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P. There are no special watershed factors and/or constraints that must be considered for retrofit design for BMP #243 due to the stream use designation.

### **Step 2: Terrain Factors**

BMP # 243 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes a permanent pool elevation is two feet above the existing pond bottom (based on information available). A fill embankment will need to be constructed to create the necessary sediment forebay. The super silt fence along the western side of the facility will be removed and the proposed grass swale constructed. The riser structure details will need to be developed further in the design process. The new facility will encompass a slightly large foot print.

### **Step 4: Physical Feasibility Factors**

The facility is a dry pond and requires the modifications outlined above for the County to receive impervious area credit. The proposed drainage area to BMP #243 is 5.0 acres and is primarily composed of C soils with a small amount of D and B soils. The likelihood of BMP # 243 receiving hotspot runoff is moderate as it is located near a storage lot that uses heavy equipment every day. Additional assessment is necessary to determine if there is adequate separation from the water table.

### **Step 5: Community and Environmental Factors**

BMP # 243 is located to the south of Manor Woods Road but has low visibility. Ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 243 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit

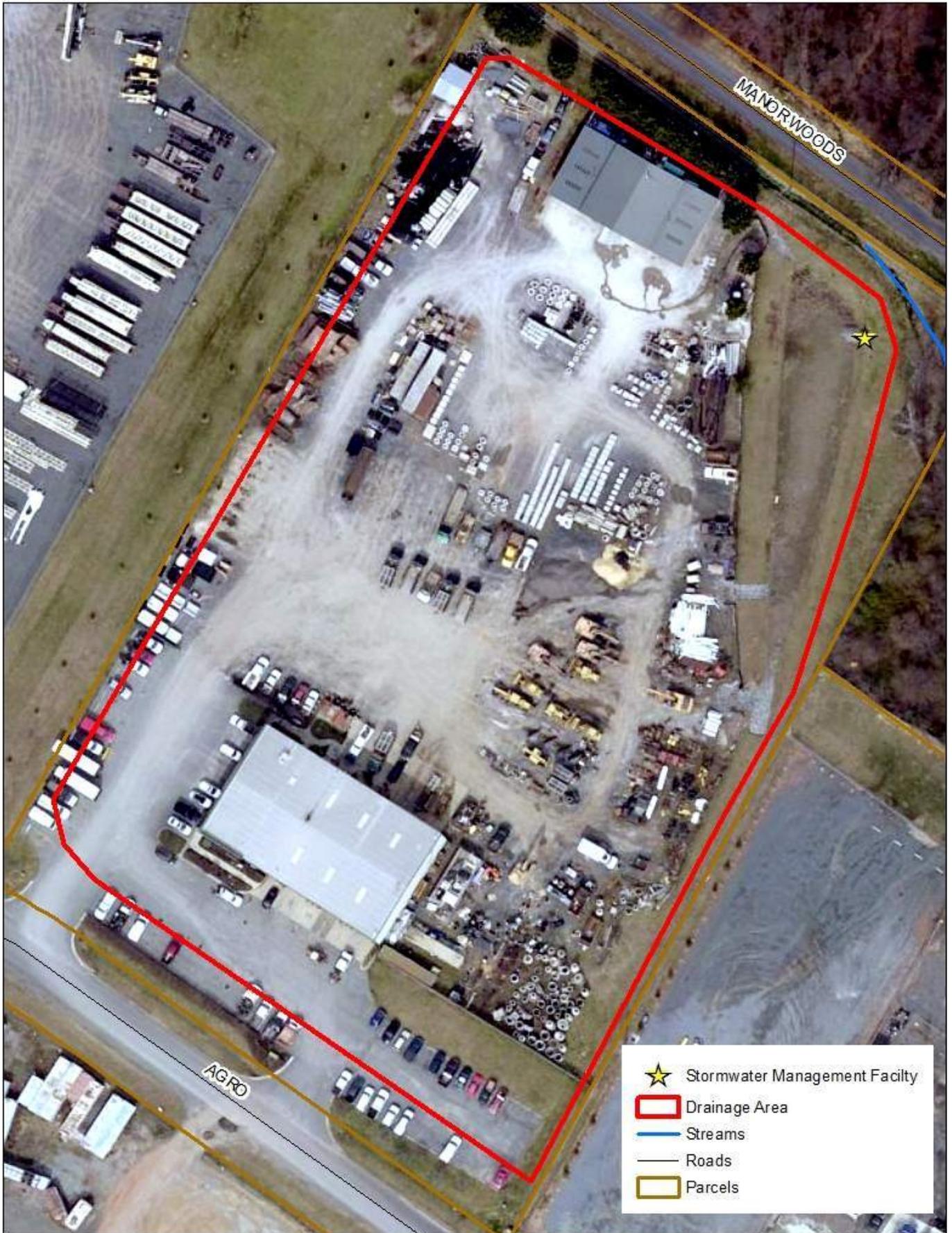


Figure 1: BMP 243 Location Map – Existing Conditions

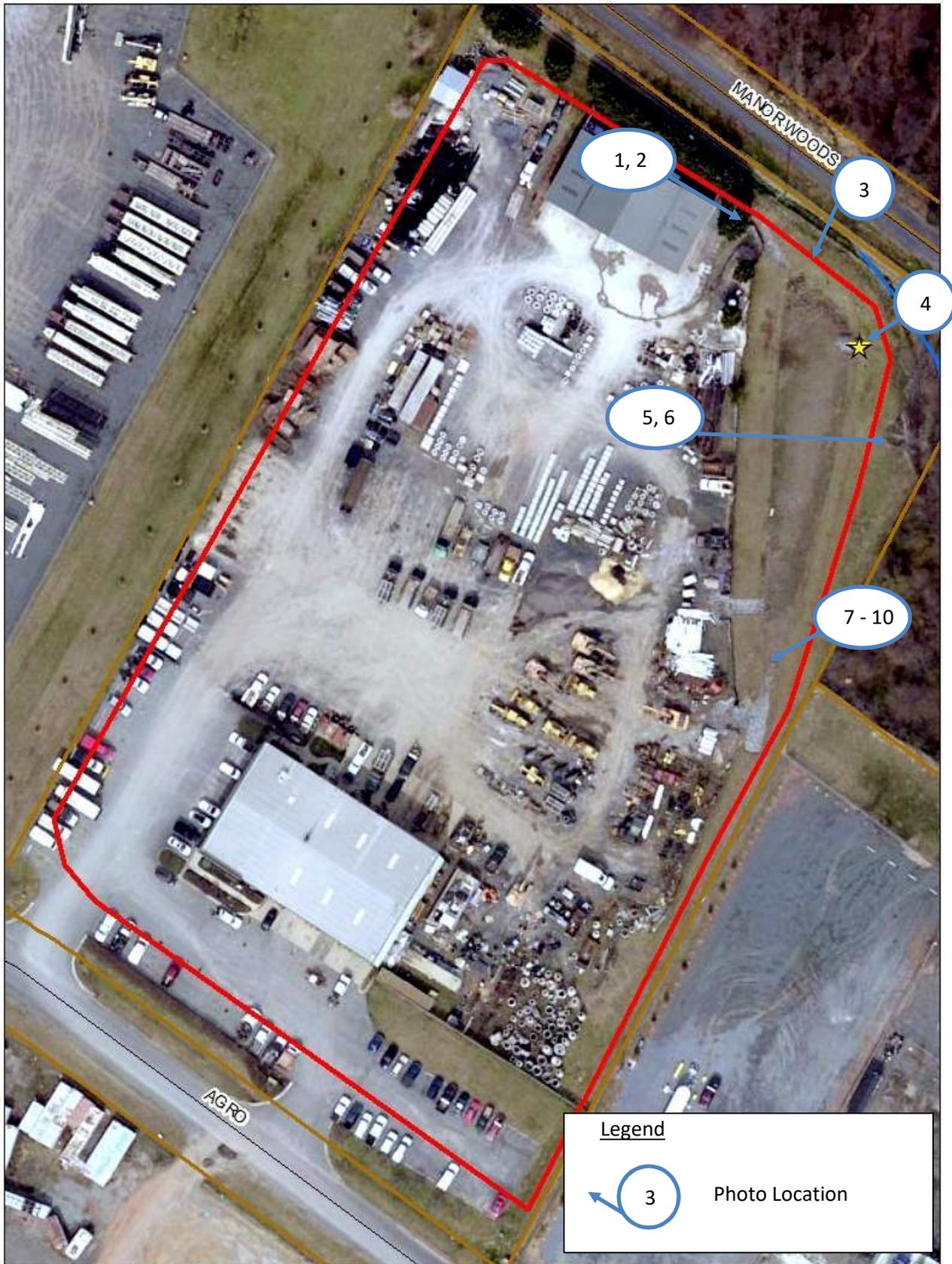


Figure 2: BMP 243 Photo Locations



**Photo 1: View of super silt fence on northwestern side of the facility.**



**Photo 2: View of debris in inflow looking south.**



**Photo 3: Overall view of facility looking south.**



**Photo 4: View of existing CMP riser.**



**Photo 5: View of existing CMP outfall.**



**Photo 6: View of existing outfall channel.**



**Photo 7: View of property owner-created riprap inflow looking west.**



**Photo 8: View of property owner-created inflow looking south.**



**Photo 9: Overall view of facility looking to the north.**



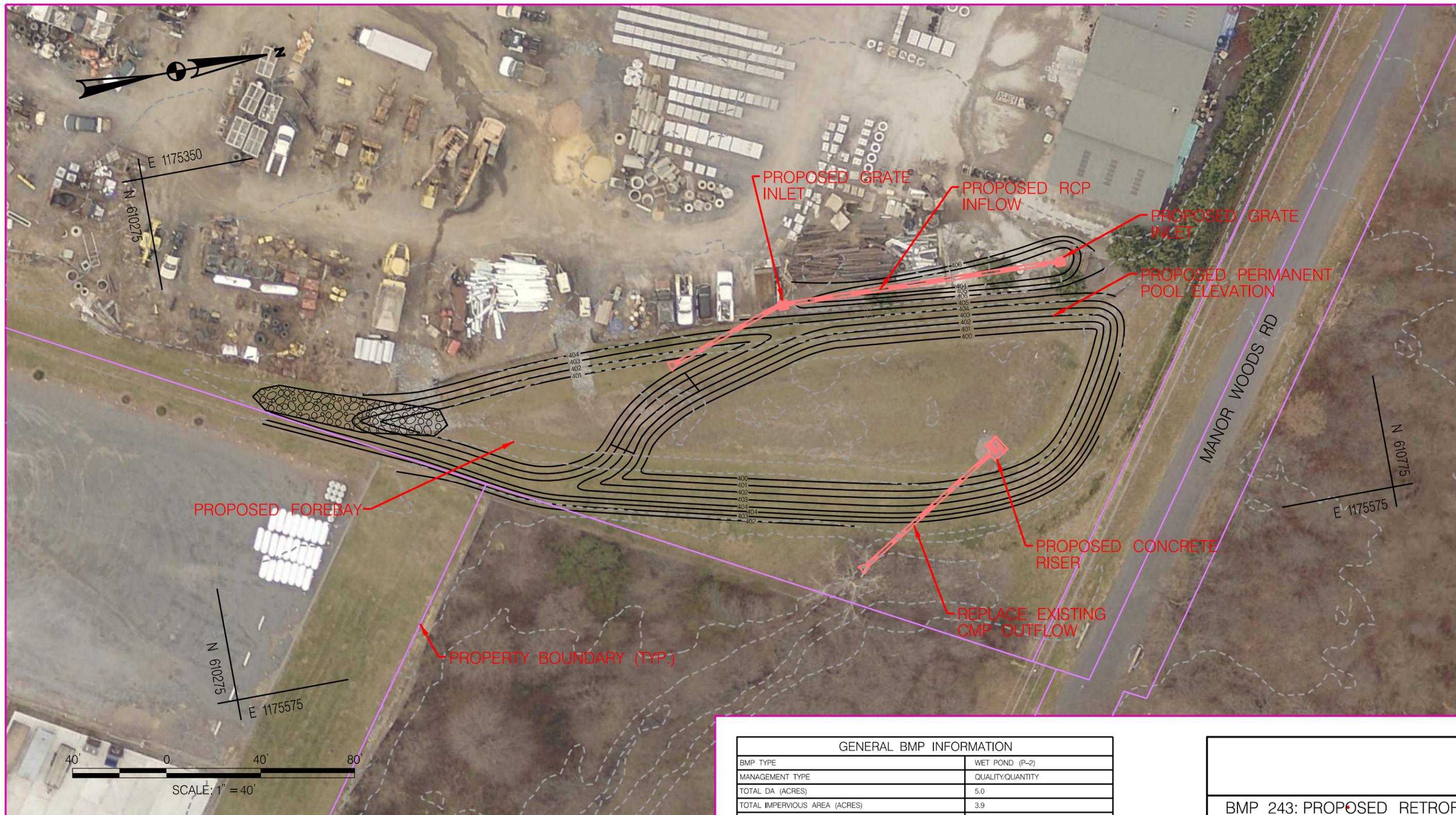
**Photo 10: Potential oil sheen found in facility.**

Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 243	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Mullinix Agro, Sec. II, Lot 5 - Wet ED Pond	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	5294 Argo Drive	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.48	<b>Name/#:</b>	
<b>Northing/Easting:</b>	610,609/1,131,054	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/21/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/20/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	5.0		5.0
Total Impervious Area within Drainage Area (acres):	3.9		3.9
WQv Required:	Unknown		12,287
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	12,287 cu.ft.
Total Treated Drainage Area (acres):	5.0	0	5.0
Total Treated Impervious Area within Drainage Area (acres):	3.9	0	3.9
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.87
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		23.7
TP (lbs/yr):	0		3.7
TSS (lbs/yr):	0		2368.6

<b>Projected Retrofit Cost:</b>	\$142,942
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PROPOSED FOREBAY

PROPOSED GRATE INLET

PROPOSED RCP INFLOW

PROPOSED GRATE INLET

PROPOSED PERMANENT POOL ELEVATION

PROPOSED CONCRETE RISER

REPLACE EXISTING CMP OUTFLOW

PROPERTY BOUNDARY (TYP.)

MANOR WOODS RD

E 1175350

N 610275

N 610775

E 1175575

N 610275

E 1175575

40' 0 40' 80'

SCALE: 1" = 40'

GENERAL BMP INFORMATION

BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	5.0
TOTAL IMPERVIOUS AREA (ACRES)	3.9
WQv REQUIRED (CU. FT)	12,287
WQv REQUIRED (AC. FT)	0.28
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	12,287
TOTAL TREATED DA (ACRES)	5.0
TOTAL TREATED IMPERVIOUS AREA (ACRES)	3.9

BMP 243: PROPOSED RETROFIT

SCALE: 1" = 40'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_



GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000316  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 1.81 ac Stream Use: I  
 Impervious Area: 0.56 ac  
 % Impervious (I): 31%  
 Minimum WQv\*: 0.03 ac-ft \*If %I < 15%  
 Existing RCN: 83 Existing tc: 0.4  
 Post Development RCN: 83 Pose Development tc: 0.4

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 30.94  
 $R_v = 0.328$   
 WQv = 0.04 ac-ft  
 1942.2315 cf

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	0.87	48%
C	0.13	0.58	32%
D	0.06	0.36	20%

S = 0.1784

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  Rev = 0.021 ac/ft  
 893.355 cu.ft

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**  
 25% WQv:  
 0.01 ac-ft  
 485.55788 cf

**B. Sedimentation Surface Area**  
 $As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.022479531  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 129.2573047$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
502.00	462.00	0.011				0.000	0.00
503.00	718.00	0.016	1.00	0.014	0.014	0.014	590.00
			0.00	0.000	0.000	0.014	590.00
			0.00	0.000	0.000	0.014	590.00
			0.00	0.000	0.000	0.014	590.00
			0.00	0.000	0.000	0.014	590.00

WQv: OK As: OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2.5	Af (sf) =	1387.3082
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
500.50	2627.00	0.060				0.000	0.00
501.00	2627.00	0.060	0.50	0.060	0.030	0.030	1,313.50
502.00	2627.00	0.060	1.00	0.060	0.060	0.090	3,940.50
503.00	2627.00	0.060	1.00	0.060	0.060	0.151	6,567.50
504.00	3367.00	0.077	1.00	0.069	0.069	0.220	9,564.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1641.875
WQv Check***:	OK	Surface Storage	2997

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #316 – Brunswick McDonald's, Infiltration Basin Site 1

**Prioritization Ranking:** 22  
**Planning Level Cost Estimate:** \$74,970  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Behind McDonald's located off Jefferson Street
Northing/Easting:	609,346/1,131,054
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention
Management Type:	Quality and Quantity
Total Drainage Area (ac):	1.8
Total Impervious Area (ac):	0.6
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	1,942
Total Treated Drainage Area (ac):	1.8
Total Treated Impervious Area (ac):	0.6
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	7.3
TP (lbs/yr):	0.8
TSS (lbs/yr):	435.9



Existing site conditions for BMP # 316



Site map for BMP # 316

## EXISTING SITE CONDITIONS

According to Frederick County's Urban BMP Database (BMP Database), BMP # 316 is an infiltration basin. The facility was constructed behind the McDonald's parking lot off Jefferson Street. The BMP Database indicates that the original design was intended to provide management for quantity and quality for 1.8 acres of total drainage area, including 0.6 acres of impervious. The drainage area for the facility encompasses the majority of the McDonald's parking lot and building.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material in and out from the McDonald's parking lot. A Maintenance of Traffic (MOT) may not be required to identify traffic controls. The staging area will be planned to not interfere with local business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit includes filling the bottom two feet of the facility with bioretention mix and adding a sedimentation forebay to the northeastern end of the facility. The existing weir wall is to be removed and the fill embankment extended across the existing weir wall location, while a proposed concrete inlet and a perforated PVC underdrain are to be added.

# BMP #316 – Brunswick McDonald’s, Infiltration Basin, Site 1

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 316 is an infiltration basin. The facility is located behind the McDonald’s off Jefferson Street, as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity and quality management for 1.8 acres of total drainage area including 0.6 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses much of the McDonald’s building and parking lot. Inflow comes in via sheet flow and two riprapped channels. The facility includes a notched weir control structure.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow and two riprapped channels. The riprapped channels have minor sedimentation and vegetation and are in good condition.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the site visit notes, the spillway is in good condition.

### Embankment:

The facility has a seven-foot vegetated embankment in good condition.

### Outflow:

The notched weir control structure discharges to a riprapped channel in good condition.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality and is a candidate for retrofit or creating updated as-builts.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out via the McDonald’s parking lot off Jefferson Street. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations.

## Proposed Retrofit:

BMP #316 was originally designed as an infiltration basin. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 1.8 acres, including 0.6 acres of impervious. The concept retrofit plan proposes filling the facility with two feet of bioretention mix and adding a forebay to the northeastern side of the facility. A perforated PVC underdrain is to be added at the base of the filter media and connected to a proposed inlet. The existing weir wall is to be removed and the fill embankment extended across the existing weir wall location as shown in the **Concept Plan**.

Alternatively, because the facility is an infiltration basin and can receive treatment credit updated as-builts could be created. T

### Step 1: Watershed Factors

BMP #316 is located in the Little Catocin Creek South – Upper Mainstem subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

## **Step 2: Terrain Factors**

BMP # 316 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes filling the facility with two feet of bioretention mix for the filter media. The existing weir wall is to be removed and the fill embankment extended to create a continuous embankment. A proposed perforated PVC underdrain is to be added and tied into a proposed concrete inlet. A sediment forebay is to be constructed on the northeastern end of the facility; receiving flow directly from the adjacent parking lot.

## **Step 4: Physical Feasibility Factors**

According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres, so a bioretention is an appropriate BMP selection that reduces maintenance for the property owner and improves aesthetics. The proposed drainage area to BMP #316 is 1.4 acres and is composed of largely B soils with a portion of C soils.

## **Step 5: Community and Environmental Factors**

BMP # 316 is located behind the McDonald's parking lot, so it has high visibility. Bioretention tends to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit

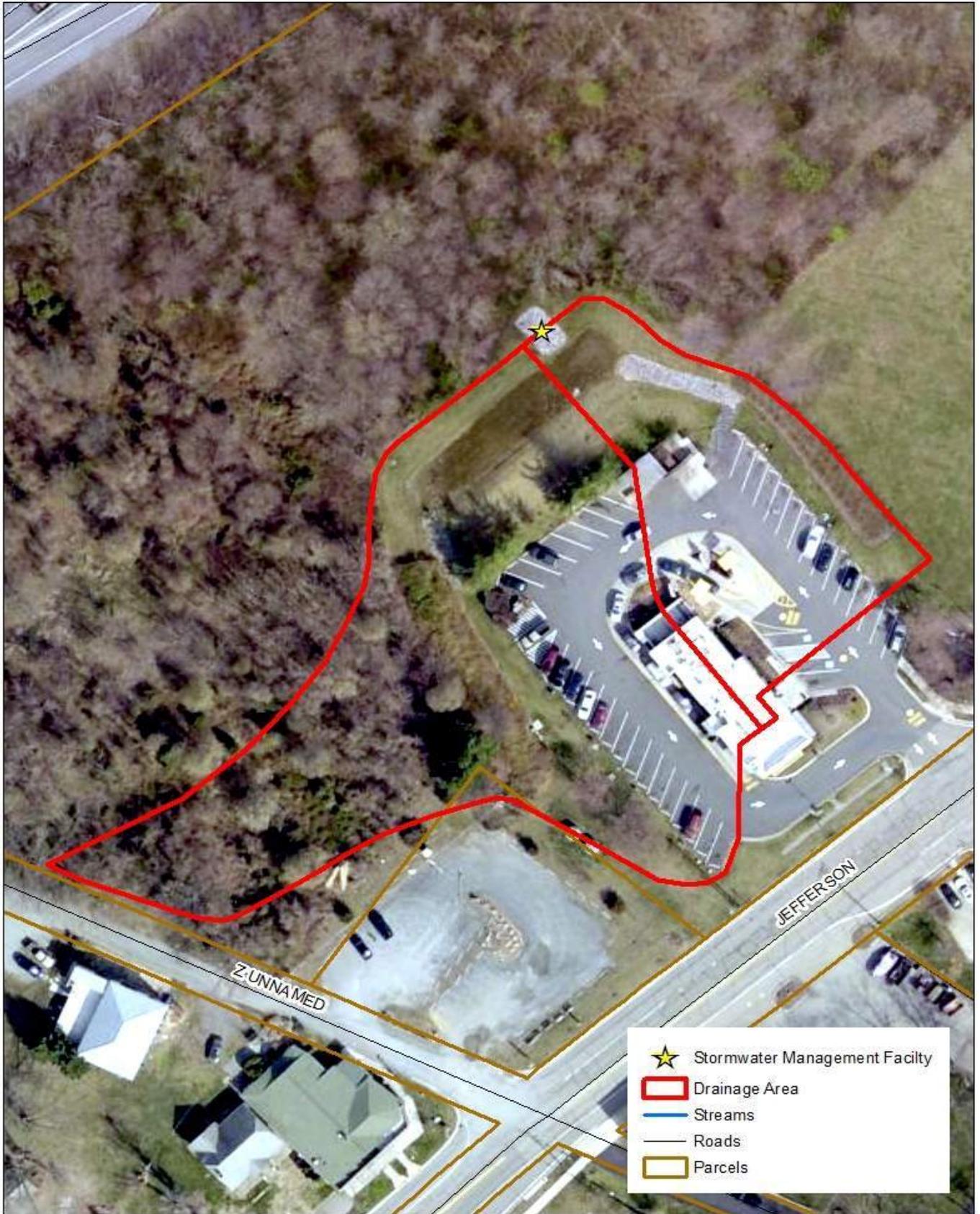
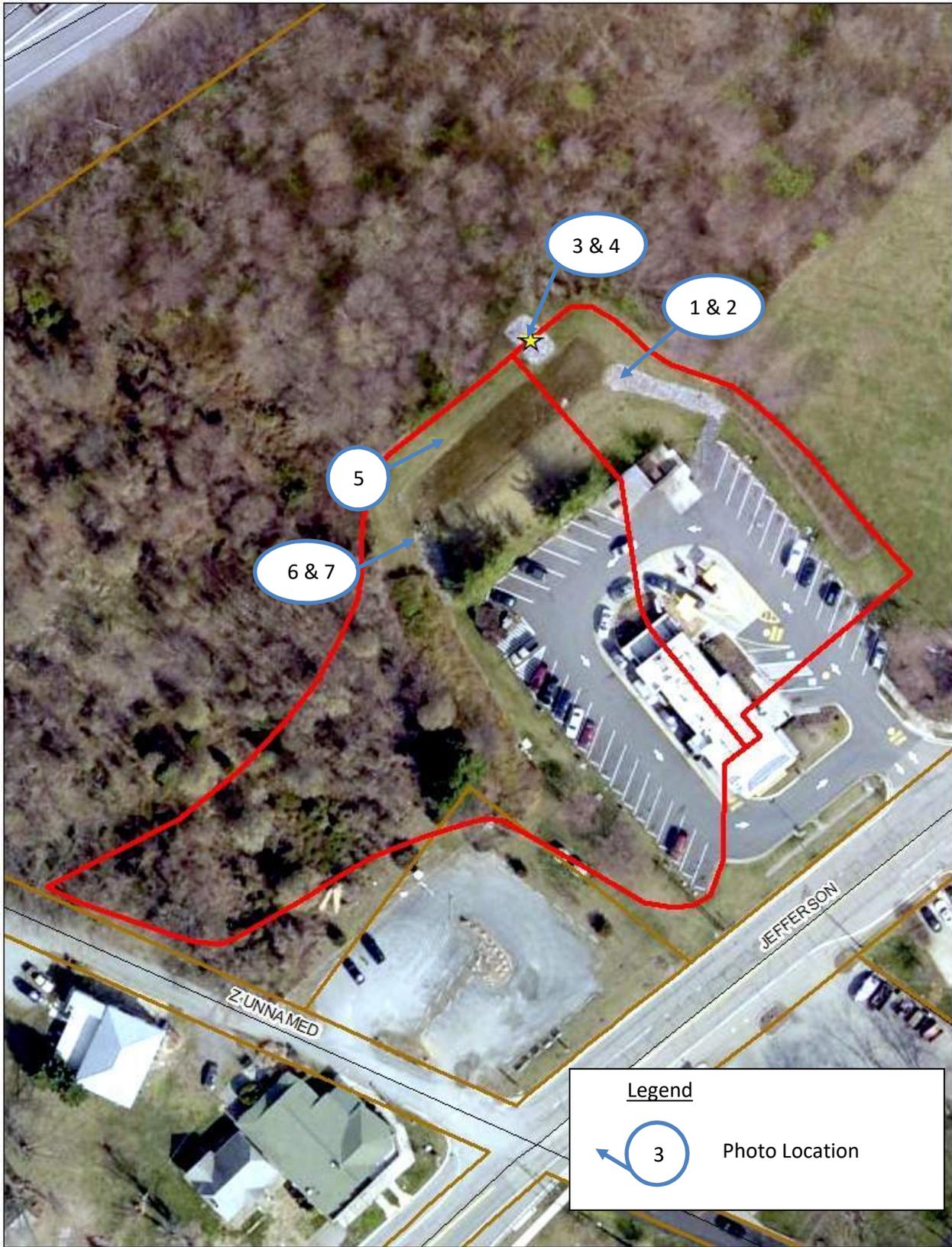


Figure 1: BMP 316 Location Map – Existing Conditions



**Figure 2: BMP 316 Photo Locations**



**Photo 1: View of inflow looking east.**



**Photo 2: Overall view of facility looking west.**



**Photo 3: View of existing weir wall looking south.**



**Photo 4: View of existing weir wall looking north.**



**Photo 5: View of embankment, looking north.**



**Photo 6: View of grass swale inflow looking east.**



**Photo 7: Overall view of facility looking north.**

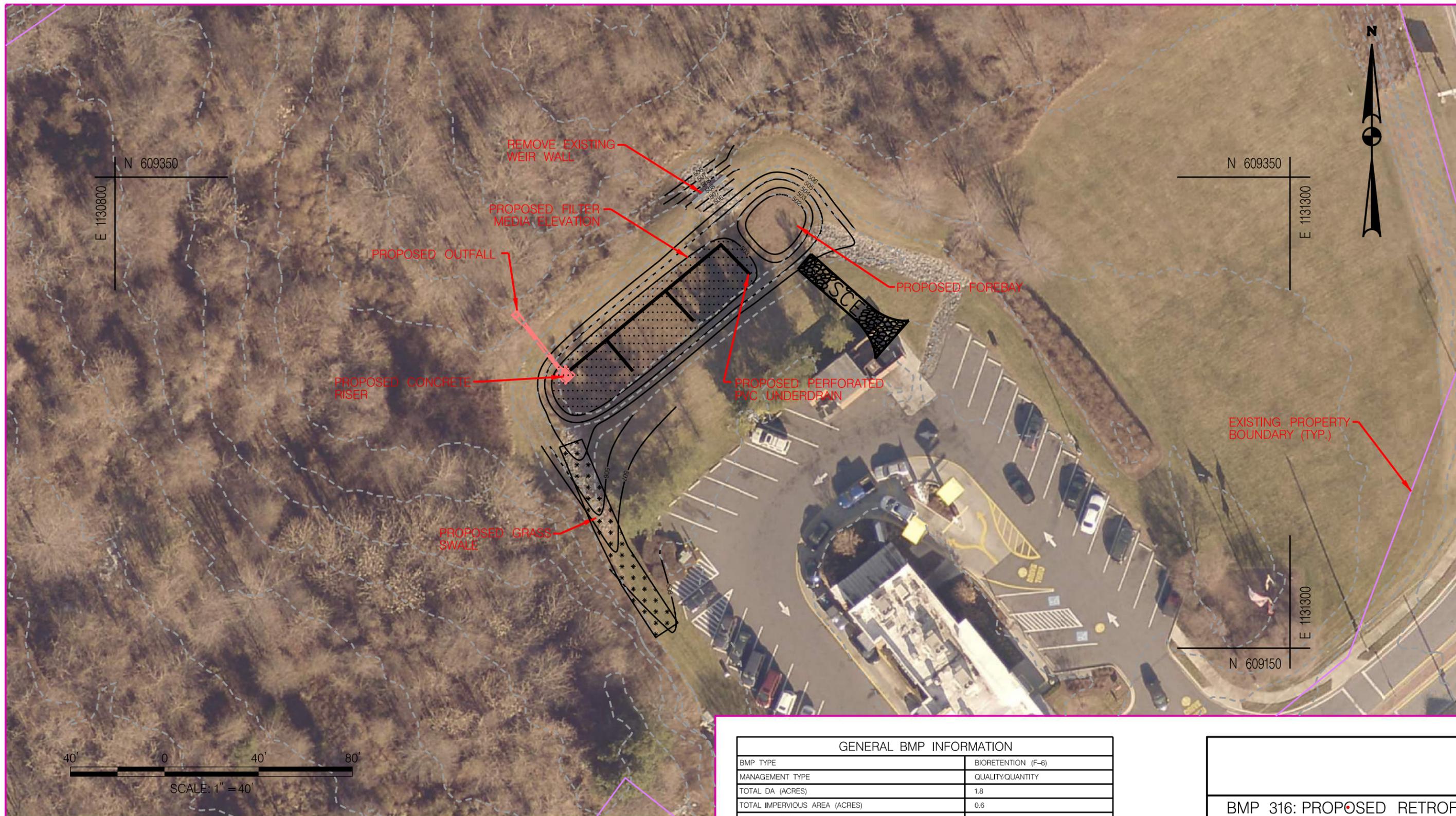


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 316	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Brunswick McDonalds, Infiltration Basin, Site 1	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Rt 17 and Jefferson Pike	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.64	<b>Name/#:</b>	
<b>Northing/Easting:</b>	609,346/1,131,054	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/21/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/20/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	1.8		1.8
Total Impervious Area within Drainage Area (acres):	0.6		0.6
WQv Required:	Unknown		1,942
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	1,942 cu.ft.      0.04 ac-ft
Total Treated Drainage Area (acres):	1.8	0	1.8
Total Treated Impervious Area within Drainage Area (acres):	0.6	0	0.6
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.95
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		7.3
TP (lbs/yr):	0		0.8
TSS (lbs/yr):	0		435.9

<b>Projected Retrofit Cost:</b>	\$74,970
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**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	1.8
TOTAL IMPERVIOUS AREA (ACRES)	0.6
WQv REQUIRED (CU. FT)	1,942
WQv REQUIRED (AC. FT)	0.04
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	1,942
TOTAL TREATED DA (ACRES)	1.8
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.6

BMP 316: PROPOSED RETROFIT	
SCALE: 1" = 40'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

**Brown AND Caldwell**

Design Firm:	Maryland Environmental Site Design Calculations	Project#	BMP 000317
		Date	10/10/2018
Brown and Caldwell	<b>M-8 Bioswale</b>	Designer:	NCW
	Project: Potomac Driect Watershed Assessment	Checked	
		Practice #	

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	0.12	ac	Stream Use:	I
Impervious Area:	0.05	ac		
% Impervious (I):	42%			
Minimum WQv*:	0.00	ac-ft	*If %I<15%	
Existing RCN:	90	Existing tc:		0.1
Post Development RCN:	90	Pose Development tc:		0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** BMP Type: Bioswale

ESDv = Environmental Site Design Volume  
 $ESDv = (Pe \times Rv \times A) / 12$

Pe (in): 1 inches  
 $Rv = 0.05 + (0.009)(I)$ ; where I = 41.67  
 $Rv = 0.425$

ESDv = 0.0043 ac-ft  
 185.13 cf

**2. Swale Sizing:**

**A.Storage Volume :**  
 $Af = WQv(df) / [(k)(hf+df)(tf)]$

Media Depth df (ft) =	2	Af (sf) =	360
Swale Width w (ft) =	4	ESDv Capacity (cf)=	288
Swale Length l (ft) =	90	Minimum Af =	348.48
Number of cells =	1	Af Check:	OK
Check Dam Height (ft) =	0	ESDv Check:	OK
Check Dam Width (ft) =	0		
Soil Porosity n =	0.4		

**3. Swale Slope**

**A. Average Slope**

Change in elevation (ft):	1.25	Slope Check:	OK
Average Slope (%):	1.3888889		



# BMP #317 – Brunswick McDonald's, Infiltration Trench Site 2

**Prioritization Ranking:** 23  
**Planning Level Cost Estimate:** \$12,495  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Off Jefferson Street in front of the McDonalds
Northing/Easting:	609,075/1,131,222
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention
Management Type:	Quality
Total Drainage Area (ac):	0.1
Total Impervious Area (ac):	0.1
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	185
Total Treated Drainage Area (ac):	0.1
Total Treated Impervious Area (ac):	0.1
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	0.8
TP (lbs/yr):	0.1
TSS (lbs/yr):	37.7



Existing site conditions for BMP # 317



Site map for BMP # 317

## EXISTING SITE CONDITIONS

According to Frederick County's Urban BMP Database (BMP Database), BMP # 317 is an infiltration trench. The facility was constructed in front of the McDonald's restaurant, adjacent to Jefferson Street. The BMP Database indicates that the original design was intended to provide quality management for 0.1 acres of total drainage area, including 0.1 acres of impervious. The drainage area for the facility encompasses the front of the McDonald's parking lot and building.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material in and out from the McDonald's parking lot. A Maintenance of Traffic (MOT) may not be required to identify traffic controls. The staging area will be planned to not interfere with local business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP #317 is a bioswale. The proposed retrofit will provide quality and quantity management for the original 0.1 acres, including 0.1 acres of impervious area. The concept design proposes replacing the infiltration trench with two feet of bioretention mix and a perforated PVC underdrain to be tied into the existing inlet at the downstream end of the facility. There is an underground water pipe crossing beneath the trench that may cause conflict during construction.

# BMP #317 – Brunswick McDonald’s, Infiltration Trench, Site 2

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 317 is an infiltration trench. The facility is located adjacent to Jefferson Street, in front of the McDonald’s restaurant, as shown on the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quality and quantity for 0.1 acres of total drainage area, including 0.1 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses the front portion of the McDonald’s parking lot and building. Inflow consists of two curb cuts and no control structure exists for the facility.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has two inflow points consisting of curb cuts with riprap in good condition.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

This facility does not have a control structure or spillway.

### Embankment:

No embankment exists for this facility.

### Outflow:

Outflow is collected by an inlet located at the northeastern end of the facility. The inlet primarily serves as overflow as this is an infiltration device.

### Overall BMP:

Overall, the facility appears to be in good condition, but the overflow inlet needs maintenance. This facility does not meet criteria to treat for water quality. The facility is a candidate for retrofit or creating updated as-builts.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out of the McDonald’s restaurant parking lot off Jefferson Street. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations.

## Proposed Retrofit:

BMP # 317 was originally designed as an infiltration trench. This facility was identified to have potential to be retrofit to a bioswale. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 0.1 acres, including 0.1 acres of impervious. The concept plan includes removing the current infiltration trench and replacing it with two feet of bioretention mix. The existing downstream inlet, as seen on the **Concept Plan**, will be left in place in case of overflow events. An additional curb cut is proposed on the southwestern (upstream) end of the facility. There is an existing underground water pipe that may cause conflict during construction. Alternatively because the facility can receive treatment credit updated as-builts can be created.

### Step 1: Watershed Factors

BMP #317 is located in the Little Catocin Creek South – Upper Mainstem subwatershed which is located within the Potomac Direct Potomac Driect 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

## **Step 2: Terrain Factors**

BMP # 317 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes replacing the existing infiltration trench with two feet of bioretention mix. A perforated PVC underdrain is to be added and tied into the existing downstream inlet, however no major modification of the inlet is necessary. A curb cut is proposed on the western side of the facility for additional inflow.

## **Step 4: Physical Feasibility Factors**

The facility receives just over 0.1 acres of sheet flow from a parking lot which is a typical configuration for a bioswale facility. According to the MDE Stormwater Design Manual bioswales can treat a maximum drainage area of 1 acre. The proposed drainage area to BMP #317 is 0.1 acres and is composed of largely B soils with a portion of C soils. Additional investigation is necessary to determine if the existing underground water pipe that crosses under the facility will cause conflicts during construction.

## **Step 5: Community and Environmental Factors**

BMP # 317 is located at the front of the McDonald's restaurant parking lot, so it has high visibility. Bioswales tend to have moderate maintenance requirements, medium community acceptance, moderate construction costs, and low habitat value. Plantings can be implemented to improve aesthetics.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 317 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 317 Location Map – Existing Conditions



Figure 2: BMP 317 Photo Locations



**Photo 1: Overall view of facility looking southwest.**



**Photo 2: View of downstream inlet and curb cut.**



**Photo 3: View of downstream inlet.**



**Photo 4: View of existing curb cut near center of facility.**



**Photo 5: Potential underground utility conflict.**



**Photo 6: Overall view of facility looking northeast.**

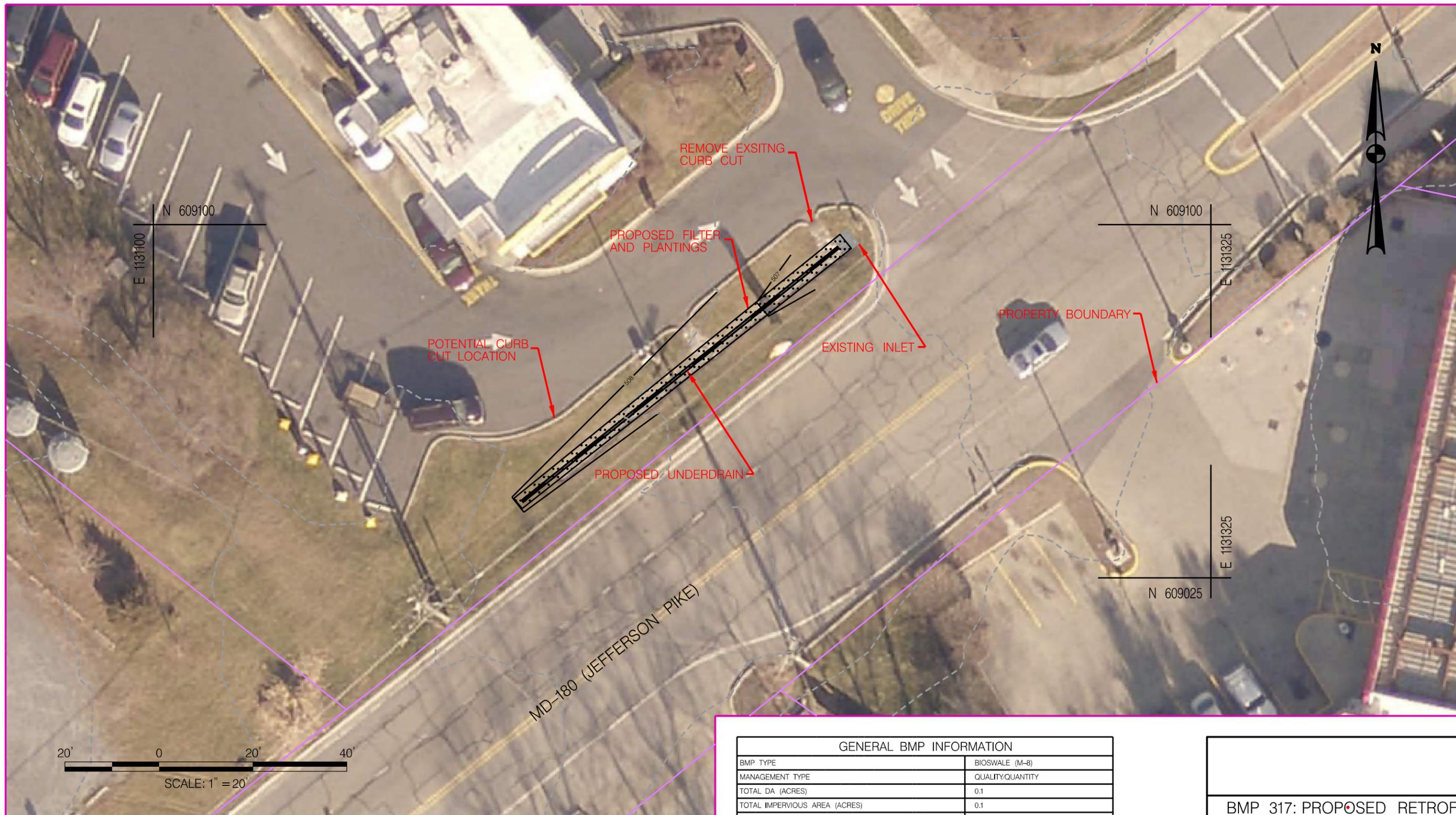


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 317	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Brunswick McDonalds, Infiltration Trench, Site 2	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Rt 17 and Jefferson Pike - Trench out Front	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.64	<b>Name/#:</b>	
<b>Northing/Easting:</b>	609,075/1,131,222	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/21/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/20/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Infiltration Trench		Bioswale (M-8)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quality/Quantity		Quality/Quantity
Total Drainage Area (acres):	0.1		0.1
Total Impervious Area within Drainage Area (acres):	0.1		0.1
WQv Required:	Unknown		185
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	185 cu.ft. 0.004
Total Treated Drainage Area (acres):	0.1	0	0.1
Total Treated Impervious Area within Drainage Area (acres):	0.1	0	0.1
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.02
Total Nitrogen:	N/A		57%
Total Phosphorus:			66%
Sediment:			70%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		0.9
TP (lbs/yr):	0		0.1
TSS (lbs/yr):	0		37.7

<b>Projected Retrofit Cost:</b>	\$12,495
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

**Brown AND Caldwell**

GENERAL BMP INFORMATION	
BMP TYPE	BIOSWALE (M-8)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	0.1
TOTAL IMPERVIOUS AREA (ACRES)	0.1
ESDv REQUIRED (CU. FT)	185
ESDv REQUIRED (AC-FT)	0.004
WATER QUALITY PROVIDED	
ESDv PROVIDED (CU. FT)	185
TOTAL TREATED DA (ACRES)	0.1
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.1

BMP 317: PROPOSED RETROFIT

SCALE: 1" = 20'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	11.40	ac	Stream Use:	I
Impervious Area:	3.39	ac	County:	Frederick
% Impervious (I):	30%			
Minimum WQv*:	0.19	ac-ft		*If %IA<15%
Existing RCN:	88	Existing tc:		0.2
Post Development RCN:	88	Pose Development tc:		0.2

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**      Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 29.74

$R_v = 0.318$

**WQv = 0.27 ac-ft**  
**11829.81 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	1.60	14%
B	0.26	7.75	68%
C	0.13	2.05	18%
D	0.06	0.00	0%

S = 0.2534

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

**Rev = 0.019 ac/ft**  
**846.8 cu ft**

Design Firm:

Maryland Environmental Site Design Calculations

Project# BMP 000318

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv

0.03 **ac-ft**

1182.981 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
392.00	1010.00	0.023				0.000	0.00
393.00	1890.00	0.043	1.00	0.033	0.033	0.033	1,450.00
394.00	2904.00	0.067	1.00	0.055	0.055	0.088	3,847.00
			0.00	0.000	0.000	0.088	3,847.00
			0.00	0.000	0.000	0.088	3,847.00
			0.00	0.000	0.000	0.088	3,847.00

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
392.00	8045.00	0.185				0.000	0.00
393.00	9525.00	0.219	1.00	0.202	0.202	0.202	8,785.00
394.00	11380.00	0.261	1.00	0.240	0.240	0.442	19,237.50
395.00	13410.00	0.308	1.00	0.285	0.285	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50
			0.00	0.000	0.000	0.726	31,632.50

\*\*\*

WQv Check\*\*\*: OK  
 10 Yr-Storm Volume (cf): 65721.15  
 10 Yr-Storm Check: NOT OK

\*\*\*Includes both permanent and forebay storage.

# BMP #318 – The Steel Yard

**Prioritization Ranking:** 2  
**Planning Level Cost Estimate:** \$124,617  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	4990 Winchester Blvd
Northing/Easting:	611,259/1,171,836
NPDES Watershed:	Frederick County Potomac Direct
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond (P-2)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	11.4
Total Impervious Area (ac):	3.4
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	11830
Total Treated Drainage Area (ac):	11.4
Total Treated Impervious Area (ac):	3.3
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	45.6
TP (lbs/yr):	4.8
TSS (lbs/yr):	2708.0



Existing site conditions for BMP# 318



Site map for BMP #318

## EXISTING SITE CONDITIONS

According to Frederick County's Urban BMP Database (BMP Database), BMP #318 is a dry extended detention pond. The facility was constructed on the northern side of Winchester Boulevard. The BMP Database indicates that the original design for BMP #318 was intended to provide water quantity management for 11.4 acres of total drainage area, including 3.4 acres of impervious. The drainage area encompasses the adjacent business park as well as a portion of Winchester Boulevard.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the shoulder of Winchester Boulevard. Shoulder closure and flagging operations are recommended for safe construction.

## PROPOSED RETROFIT

The proposed retrofit for BMP #318 is a wet pond (P-2). The proposed retrofit will provide quantity and quality management for the original 11.4 acres, including 3.4 acres of impervious area. The concept retrofit plan proposes adding a forebay in the northwestern corner of the facility. The retrofit proposes utilizing the existing concrete riser, however further design is necessary to finalize sizing. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

# BMP #318 – The Steel Yard

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 318 is a dry extended detention pond. The facility is located on the northern side of Winchester Boulevard as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 11.4 acres of total drainage area, including 3.4 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses most of the adjacent parking lot and building. Inflow comes in via sheet flow, two corrugated metal pipes, and a grass swale on the eastern side of the facility. The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. Much of the stone jacket has been displaced.

## General Observations:

A site visit was conducted on June 11, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow and two 21" corrugated metal pipes entering the facility in the northwest corner. There is also a grass swale inflow on the eastern side of the facility. The CMP inflows appeared to be in good condition.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in stone jacket. The riser appeared to be in good condition during the site visit.

### Embankment:

The facility has a seven-foot vegetated embankment in good condition.

### Outflow:

The concrete riser outfalls south of Winchester Boulevard into a grass swale via reinforced concrete pipe. The condition of the RCP outfall could not be assessed due to overgrown vegetation.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria for water quality treatment as it does not meet current MDE requirements and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out via Winchester Boulevard. Shoulder closure and basic flagging operations are recommended to safely perform construction operations. Staging is to be conducted in way that traffic and operations at the nearby business park are not interrupted.

## Proposed Retrofit:

BMP #318 was originally designed as a dry extended detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 11.4 acres, including 3.4 acres of impervious. The concept retrofit proposes constructing a forebay in the northwest corner. A 3' fill embankment is proposed to be installed to create the forebay. The existing concrete riser is to be modified as necessary to allow for proper WQv storage and to maintain downstream flows. See attached **Concept Plan** for layout.

### Step 1: Watershed Factors

BMP #318 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP # 316 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes construction of a 3-foot fill embankment to create a sediment forebay. The existing concrete riser is to be modified to allow for proper drainage and WQv retention. Thermal impacts are not a concern as the downstream stream designation is I-P. Safety fencing should be added around the perimeter of the facility due to the close proximity to the roadway and nearby business park.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #318 is 11.4 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the minimum drainage area for a wet pond is 25 acres, unless adequate water balance and anti-clogging measures are put in place. Further investigation is necessary before final design to confirm this BMP meets the requirements.

## **Step 5: Community and Environmental Factors**

BMP # 318 is located on the northern side of Winchester Boulevard and has high visibility. Wet ponds tend to have low maintenance requirements, high community acceptance, low construction costs, and high habitat value.

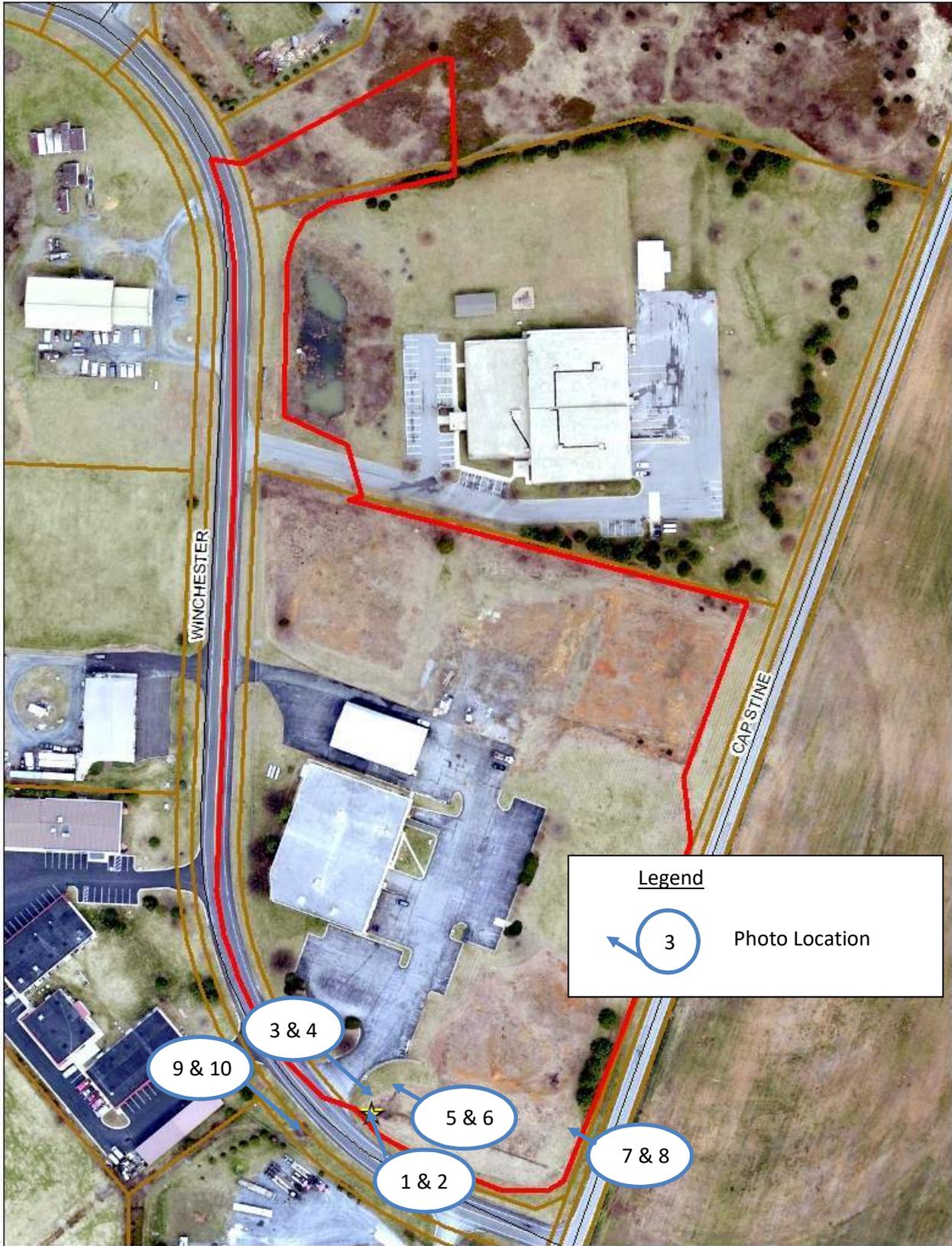
## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 318 Location Map – Existing Conditions



**Figure 2: BMP 318 Photo Locations**



**Photo 1: View of existing concrete riser.**



**Photo 2: View of facility's existing outflow CMP.**



**Photo 3: Overall view of facility looking east**



**Photo 4: Overall view of facility looking northeast.**



**Photo 5: View of existing CMP inflow.**



**Photo 6: View of second existing CMP inflow.**



**Photo 7: View of grass swale inflow looking North.**



**Photo 8: Overall view of facility looking west.**



**Photo 9: View of existing RCP outfall.**



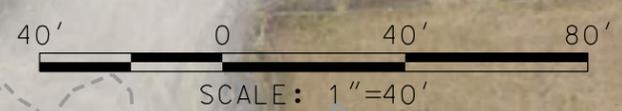
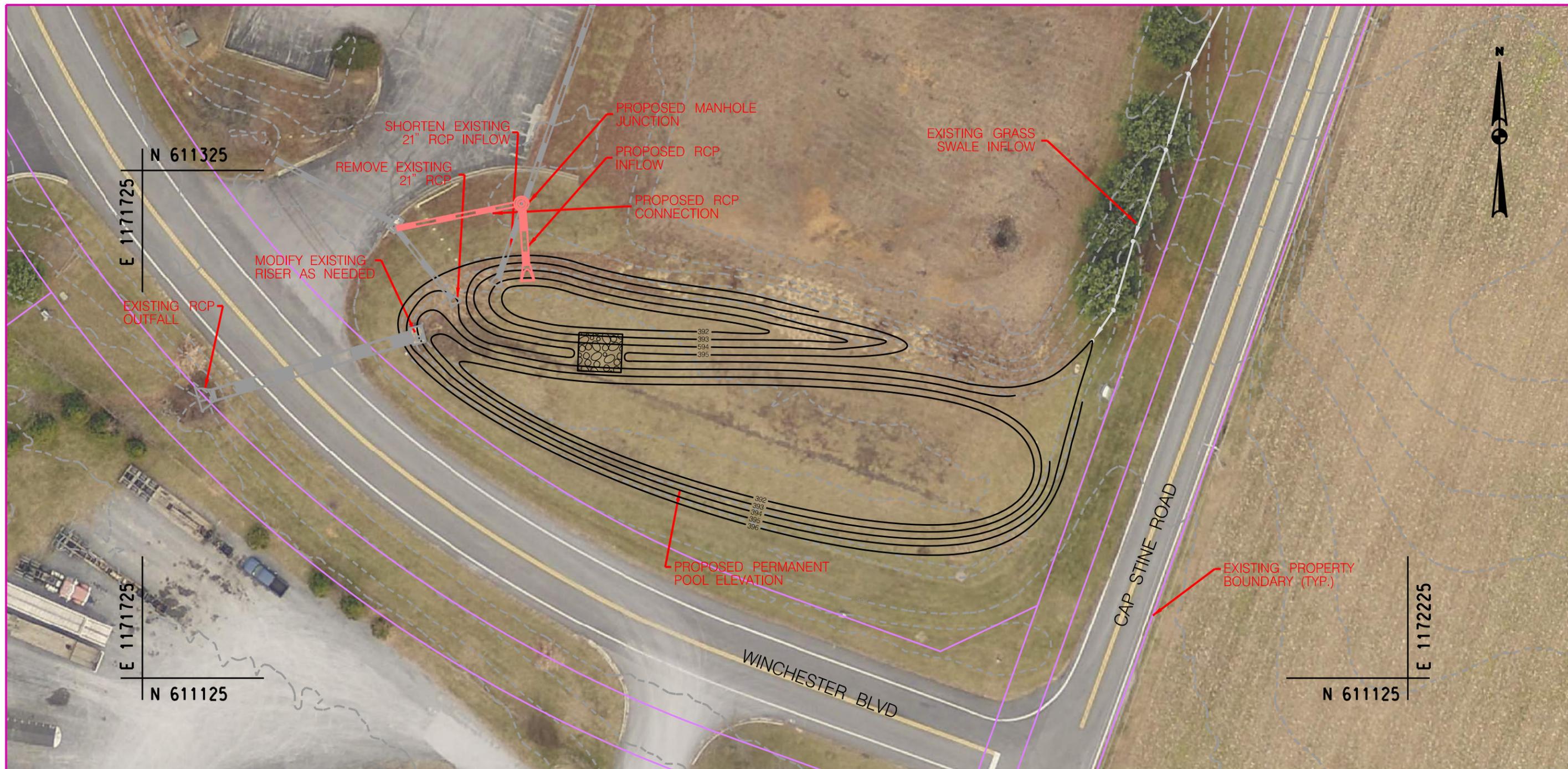
**Photo 10: View of existing outfall channel.**

Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 318	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	The Steel Yard - SWM Pond	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	4990 Winchester Blvd	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	611,259/1,171,836	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	11.4		11.4
Total Impervious Area within Drainage Area (acres):	3.4		3.4
WQv Required:	Unknown		11,830
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
<b>Estimated Treatment Provided</b>	<b>Per Design</b>	<b>Per MDE 2000 Standards</b>	
WQv Provided:	Unknown	0	11830 cu.ft. 0.27
Total Treated Drainage Area (acres):	11.4	0	11.4
Total Treated Impervious Area within Drainage Area (acres):	3.4	0	3.4
<b>Estimated Pollutant Removal Rates</b>			
Runoff Volume Treated per Impervious Acre (in.)			0.96
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
<b>Estimated Pollutant Load Reduction</b>			
TN (lbs/yr):	0		45.6
TP (lbs/yr):	0		4.8
TSS (lbs/yr):	0		2708.0

<b>Projected Retrofit Cost:</b>	\$124,616
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	11.4
TOTAL IMPERVIOUS AREA (ACRES)	3.4
WQv REQUIRED (CU. FT)	11,830
WQv REQUIRED (AC. FT)	0.27
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	11,830
TOTAL TREATED DA (ACRES)	11.4
TOTAL TREATED IMPERVIOUS AREA (ACRES)	3.4

BMP 318: PROPOSED RETROFIT	
SCALE: 1" = 40'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____



**Drainage Area Data**

Contributing Drainage Area to Practice (A): 5.45 ac Stream Use: I  
 Impervious Area: 3.49 ac  
 % Impervious (I): 64%  
 Minimum WQv\*: 0.09 ac-ft \*If %IA<15%  
 Existing RCN: 76 Existing tc: 0.3  
 Post Development RCN: 76 Pose Development tc: 0.3

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 64.04  
 $R_v = 0.626$   
**WQv = 0.26 ac-ft**  
**11151.905 cf**

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	1.09	20%
C	0.13	3.27	60%
D	0.06	1.09	20%

S = 0.142

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  **Rev = 0.194 ac/ft**  
**8450.552 cu.ft**

**3. Forebay Sizing:** Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**  
 25% WQv:  
 0.06 ac-ft  
 2787.9761 cf

**B. Sedimentation Surface Area**  
 $As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.129072969  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 742.1695703$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) = 2 Af (sf) = 7434.603  
k (ft/day) = 0.5  
hf (ft) = 1  
tf (days) = 2 Af Check: OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
394.00	7812.00	0.179				0.000	0.00
395.00	7812.00	0.179	1.00	0.179	0.179	0.179	7,812.00
396.00	7812.00	0.179	1.00	0.179	0.179	0.359	15,624.00
397.00	8835.00	0.203	1.00	0.191	0.191	0.550	23,947.50
			0.00	0.000	0.000	0.550	23,947.50
			0.00	0.000	0.000	0.550	23,947.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check: NOT OK Subsurface Storage 3906  
WQv Check\*\*\*: OK Surface Storage 8323.5

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #362 – Mullinix Agro Industrial Park, Lot 12

**Prioritization Ranking:** 21  
**Planning Level Cost Estimate:** \$437,325  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Agro Drive Cul-de-sac
Northing/Easting:	601,211/1,174,156
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Sand Filter (F-1)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	5.5
Total Impervious Area (ac):	3.5
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	11,152
Total Treated Drainage Area (ac):	5.5
Total Treated Impervious Area (ac):	3.5
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	24.3
TP (lbs/yr):	3.5
TSS (lbs/yr):	2,282.5



Existing site conditions for BMP #362



Site map for BMP #362

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP #362 is a dry detention pond. The facility was constructed on the western side of Agro Drive. The BMP Database indicates that the original design for BMP# 362 provides water quantity management and the total drainage area for the BMP is 5.5 acres, with 3.5 acres of impervious. The drainage area encompasses a portion of the Builders Supply & Lumber property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the adjacent parking lot on Agro Drive Lot #12. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with nearby business operations on Agro Drive, Lot #12.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP #362 is sand filter (F-1). The proposed retrofit will provide quantity and quality management for the original 5.5 acres, including 3.5 acres of impervious area. The concept retrofit plan includes re-grading the facility embankments and excavating two feet below the existing bottom of the facility and filling it with filter media. The existing notched weir wall is to be removed and the embankment filled in. A yard inlet and perforated PVC underdrain system are to be installed. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #362 – Mullinux Agro Industrial Park, Lot 12

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 362 is a dry detention pond. The facility is located on the western end side of Agro Drive as shown on the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 5.5 acres of total drainage area, including 3.5 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses all of the adjacent parking lot and building as well as portions of neighboring properties and Agro Drive. Inflow comes into the facility via sheet flow from the adjacent properties. The facility has an existing notched weir wall on the southern side.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from the adjacent properties.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. The riser appeared to be in good condition during the site visit.

### Embankment:

The facility has a five-foot vegetated embankment with eroded patches and multiple animal burrows.

### Outflow:

The facility has a notched weir wall on the southern side of the facility. The weir wall was in good condition during the assessment.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality treatment and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out by using the adjacent parking lot. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations

## Proposed Retrofit:

BMP #362 was originally designed as a dry detention pond. The proposed retrofit is a sand filter (F-1) and will provide both water quality and quantity treatment for the originally designed 5.5 acres, including 3.5 acres of impervious. The concept retrofit plan includes re-grading the existing embankments excavating two feet below the existing facility bottom and filling this excavation with filter media. The proposed facility includes a 20-foot grass filter strip and a stone diaphragm as pretreatment to reduce sediment clogging the filter media and energy dispersion. The existing notched weir wall is to be removed and filled in to make a continuous embankment. The attached **Concept Plan** also shows the proposed yard inlet with a perforated underdrain. The underdrain system cannot outfall across property lines and may need additional modification during final design.

### Step 1: Watershed Factors

BMP #362 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #362 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes excavating the facility an additional two feet below the existing bottom and filling it with filter media. The existing notched weir wall is to be removed and the embankment filled in to make a continuous embankment. A yard inlet and a perforated PVC underdrain are proposed to be installed. The downstream stream use is I-P, so there is limited concern for thermal impacts.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #362 is 5.5 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention facility is 5 acres; but can adequately treat some larger drainage areas if properly designed. Further investigation will be necessary before final design to ensure adequate treatment in the facility

## **Step 5: Community and Environmental Factors**

BMP #362 is located on the western side of Agro Drive and has low visibility. Bioretention facilities tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit

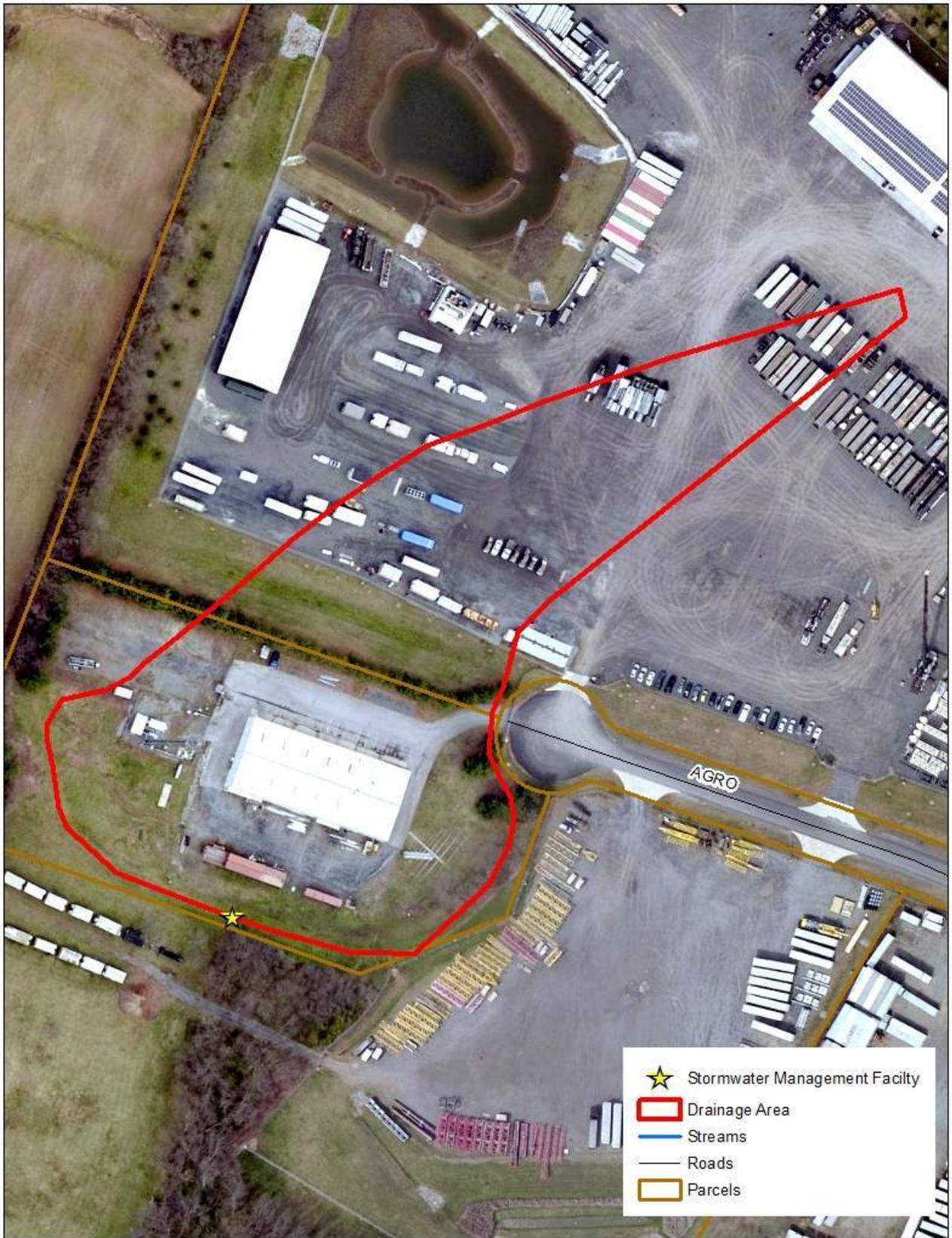


Figure 1: BMP 362 Location Map – Existing Conditions

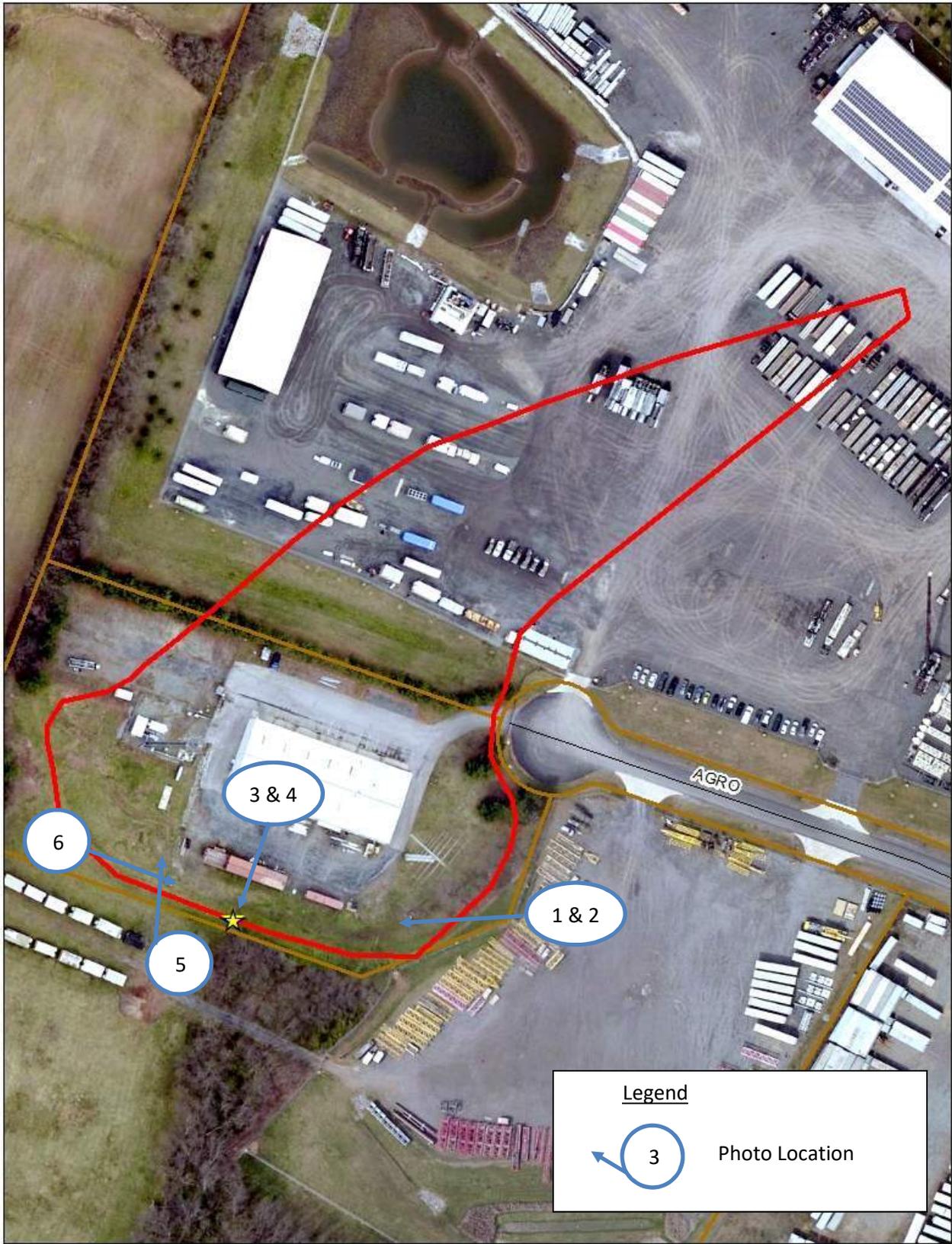


Figure 2: BMP 362 Photo Locations



**Photo 1: Overall view of facility looking west.**



**Photo 2: Overall view of facility looking west.**



**Photo 3: View of existing notched weir wall.**



**Photo 4: View of downstream channel.**



**Photo 5: View of surrounding land use looking west.**



**Photo 8: Overall view of facility looking east.**

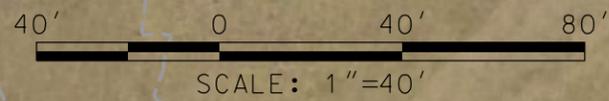
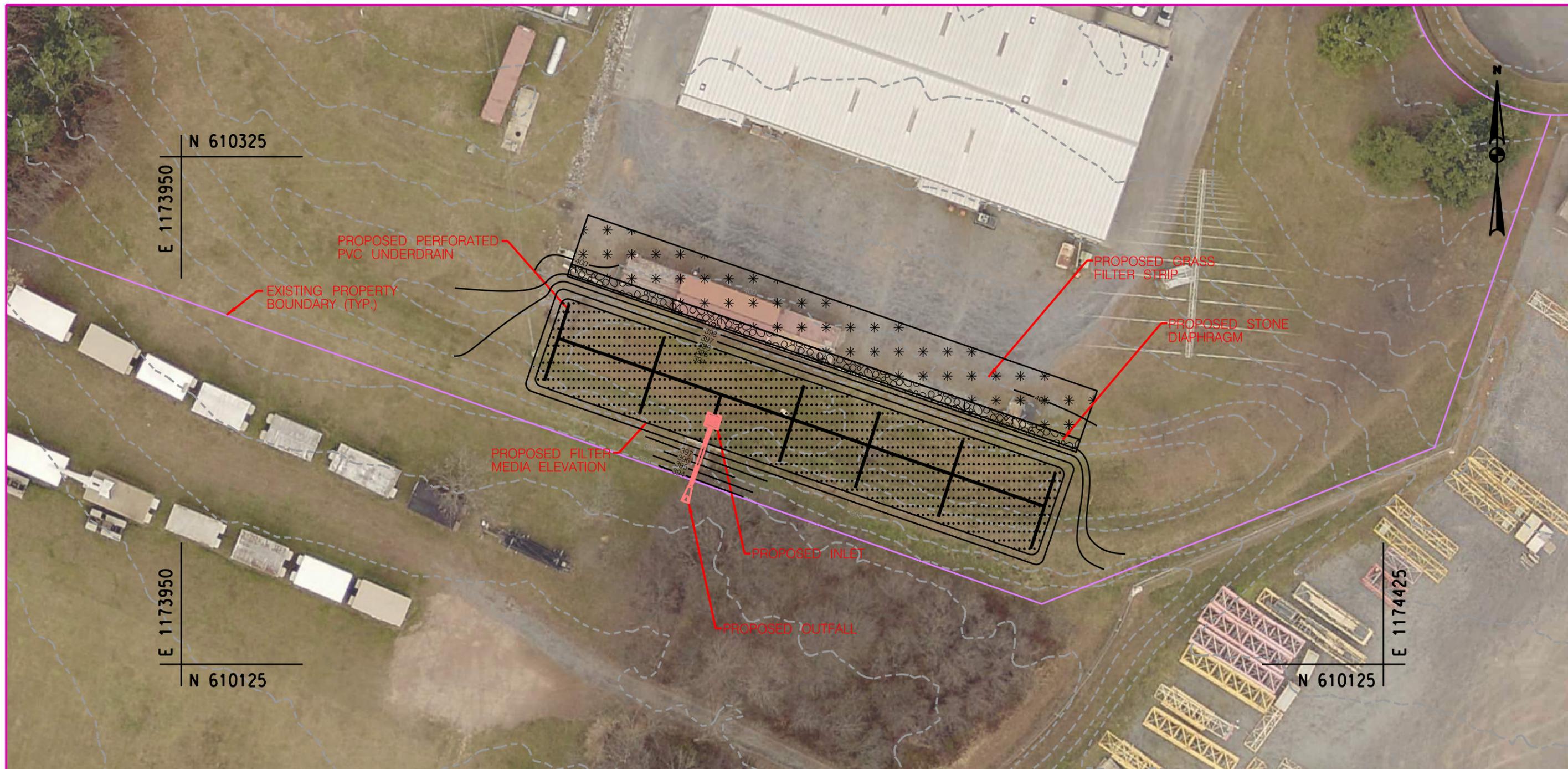


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 362	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Mullinix Agro Industrial Park, Lot 12	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Argo Drive Cul-de-sac	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	610,211/1,174,156	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/19/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Sand Filter (F-1)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	5.5		5.5
Total Impervious Area within Drainage Area (acres):	3.5		3.5
WQv Required:	Unknown		11,151
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	11,151 cu.ft. 0.26
Total Treated Drainage Area (acres):	5.5	0	5.5
Total Treated Impervious Area within Drainage Area (acres):	3.5	0	3.5
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.88
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		24.3
TP (lbs/yr):	0		3.5
TSS (lbs/yr):	0		2282.5

<b>Projected Retrofit Cost:</b>	\$437,325
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GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	5.5
TOTAL IMPERVIOUS AREA (ACRES)	3.5
WQv REQUIRED (CU. FT)	11,152
WQv REQUIRED (AC. FT)	0.26
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	11,152
TOTAL TREATED DA (ACRES)	5.5
TOTAL TREATED IMPERVIOUS AREA (ACRES)	3.5

BMP 362: PROPOSED RETROFIT	
SCALE: 1" = 40'	
DESIGNED BY:	NCW COUNTY: FREDERICK
DRAWN BY:	NCW
CHECKED BY:	
DRAWING NO.	OF

GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



Design Firm: Maryland Environmental Site Design Calculations

Project# BMP 000423

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 2.13 ac  
 Impervious Area: 0.81 ac  
 % Impervious (I): 38%  
 Minimum WQv\*: 0.04 ac-ft

Stream Use: I  
 County: Frederick

\*If %IA<15%

Existing RCN: 81 Existing tc: 0.3  
 Post Development RCN: 81 Pose Development tc: 0.3

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**

Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

R<sub>v</sub> = 0.05 + (0.009)(I); where

I = 38.03

R<sub>v</sub> = 0.392

WQv = 0.06 ac-ft  
 2729.58 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	0.96	45%
C	0.13	0.87	41%
D	0.06	0.30	14%

S = 0.1787

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

Rev = 0.001 ac/ft  
 32.9 cu ft

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations  
**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000423  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**3. Forebay Sizing:** No forebay in this design

**A. Compute Forebay Sizing :**  
10% WQv  
0.01 **ac-ft**  
272.9579 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

FB Check: NOT OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
353.00	7068.00	0.162				0.000	0.00
354.00	8115.00	0.186	1.00	0.174	0.174	0.174	7,591.50
355.00	9226.00	0.212	1.00	0.199	0.199	0.373	16,262.00
356.00	10401.00	0.239	1.00	0.225	0.225	0.599	26,075.50
357.00	11641.00	0.267	1.00	0.253	0.253	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50
			0.00	0.000	0.000	0.852	37,096.50

\*\*\*

WQv Check\*\*\*: OK  
10 Yr-Storm Volume (cf): 15164.325  
10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP# 423 – Mark’s Equipment Services ED Pond

**Prioritization Ranking:** 2  
**Planning Level Cost Estimate:** \$29,322  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Mountville Road West of Ballenger Creek Pike
Northing/Easting:	604,422/1,172,871
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond (P-2)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	2.1
Total Impervious Area (ac):	0.8
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	2,730
Total Treated Drainage Area (ac):	2.1
Total Treated Impervious Area (ac):	0.8
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	8.8
TP (lbs/yr):	1.0
TSS (lbs/yr):	592.4



Existing site conditions for BMP# 423



Site map for BMP# 423

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 423 is an extended detention dry pond but appeared to be a wet pond with a permanent pool during the site visit. The facility was constructed on the northern side of Mountville Road in the northwestern corner of the Valley Excavating campus. The BMP Database indicates that the original design for BMP# 423 provides water quantity and quality management for the total drainage area of 2.1 acres, with 0.8 acres of impervious. The drainage area encompasses the majority of the Valley Excavating property.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the Valley Excavating lot. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with Valley Excavating business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 423 is a wet pond (P-2). The proposed concept is to regrade the facility’s embankment and maintain its originally treated 2.1-acre drainage area including the 0.8 acres of impervious. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. The existing structures and inflows are to remain and be maintained in functioning order.

# BMP #423– Mark’s Equipment Services ED Pond ED Pond

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP #423 is a dry extended detention pond but appeared to be wet pond with a permanent pool during the site visit. The facility is located at the western side of Valley Excavating campus, north of Mountville Road, as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates the original design was intended to provide quantity and quality management for 2.1 acres of total drainage area, including 0.8 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses the majority of the adjacent parking lot and buildings. Inflow comes in via sheet flow and a grass swale on the northern side of the facility. The facility has an existing concrete riser and low flow pipe covered in a stone jacket.

## General Observations:

A site visit was conducted on June 21, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow and a grass swale on the northern side of the facility.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. The riser appeared to be in good condition during the site visit.

### Embankment:

The facility has a four-foot vegetated embankment in good condition.

### Outflow:

The facility has a concrete riser with a PVC low flow pipe covered in a stone jacket.

### Overall BMP:

Overall, the facility appears to be in good condition with the exception of an eroded area found on the upstream embankment. The facility is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out by using the Mark’s Equipment Services’ parking lot. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations

## Proposed Retrofit:

BMP #423 was originally designed as a dry extended detention pond but during the site investigation appeared to be a wet pond. The facility currently is not receiving credit for the facility though because it lacks current as-builts. The concept retrofit plan includes regrading the facility’s embankments and grass swale inflow. The proposed retrofit uses the facility’s existing structures and outfalls; however, they should be fully inspected to address potential maintenance concerns. The drainage area will not be altered, and the facility will continue to treat the 2.1-acre drainage area, including 0.8 acres of impervious. The proposed grading is shown on the attached **Concept Plan**. Alternatively, it will be more cost effective to have updated as-builts created for the facility instead of performing a retrofit.

### Step 1: Watershed Factors

BMP #423 is located in the Doubs Branch subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #423 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes re-grading the facility while maintaining the existing structures. The downstream stream use is I-P limiting concerns for thermal impacts.

## **Step 4: Physical Feasibility Factors**

The BMP facility type will not change and will continue to be a wet extended detention pond, per the site investigation. The proposed drainage area to BMP #423 is 2.1 acres and is composed of largely B and C soils, with some D soils.

## **Step 5: Community and Environmental Factors**

BMP #423 is located on the western side of the Mark's Equipment Services campus, north of Mountville Road, and has low visibility. Wet Ponds tend to have low maintenance requirements, high community acceptance, low construction costs, and high habitat value.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #423 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 423 Location Map – Existing Conditions



Figure 2: BMP 423 Photo Locations



**Photo 1: View of grass swale inflow looking east.**



**Photo 2: View of eroded and unvegetated area on upstream embankment.**



**Photo 3: Overall view of facility looking northeast.**



**Photo 4: Overall view of facility looking southeast.**



**Photo 5: View of existing concrete riser.**



**Photo 6: View of inside existing concrete riser.**



**Photo 7: View of facility embankment looking north.**



**Photo 8: View of outfall channel looking to the northwest**

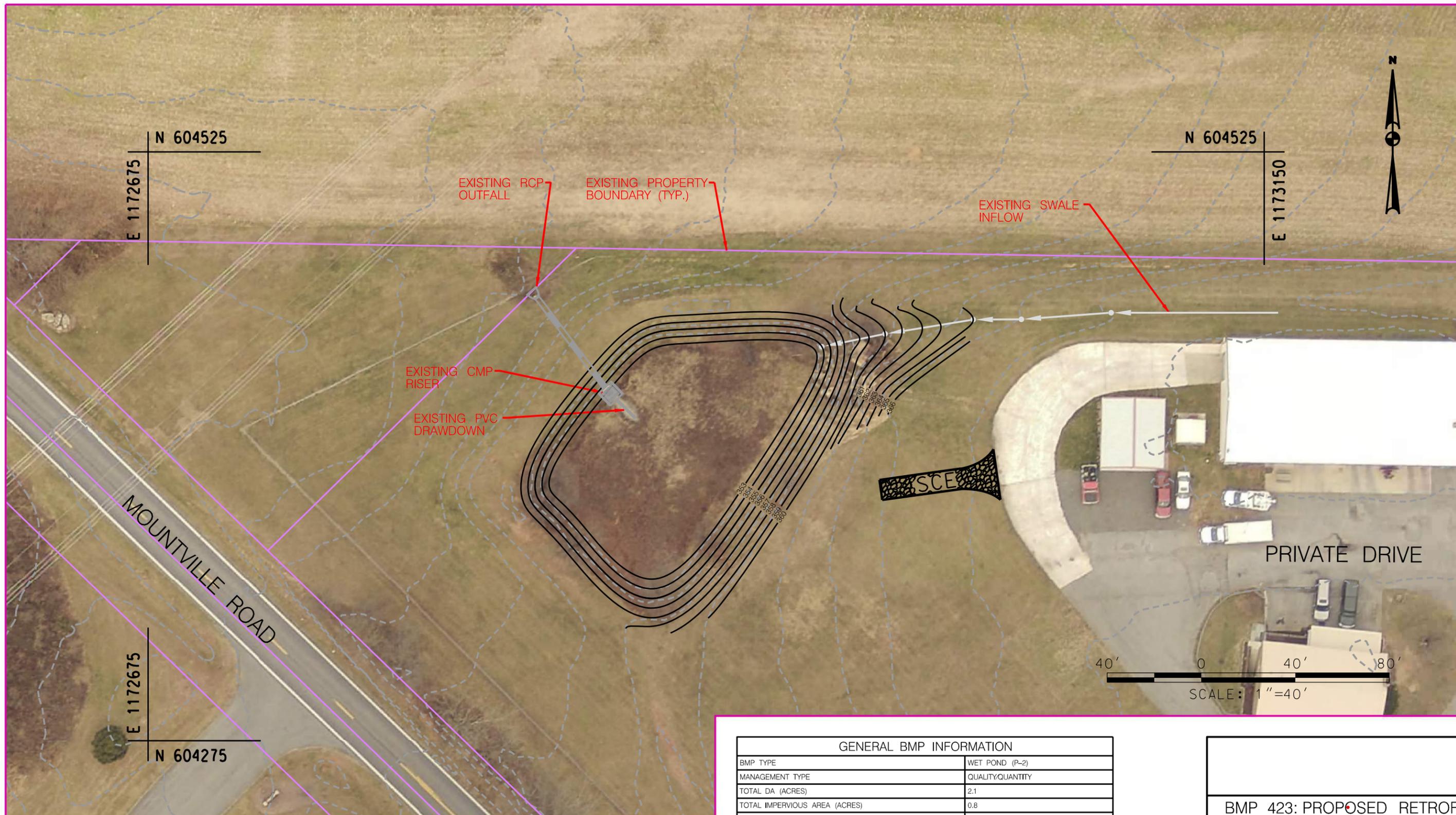


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 423	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Valley Excavating ED Pond	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Mountville Road West of Ballenger Creek Pike	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.33, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	604,422/1,172,871	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/21/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/20/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Wet Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	2.1		2.1
Total Impervious Area within Drainage Area (acres):	0.8		0.8
WQv Required:	Unknown		2,730
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	2,730 cu.ft.      .06 ac-ft
Total Treated Drainage Area (acres):	2.1	0	2.1
Total Treated Impervious Area within Drainage Area (acres):	0.8	0	0.8
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.93
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		8.8
TP (lbs/yr):	0		1.0
TSS (lbs/yr):	0		592.4

<b>Projected Retrofit Cost:</b>	\$29,322
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	2.1
TOTAL IMPERVIOUS AREA (ACRES)	0.8
WQv REQUIRED (CU. FT)	2,730
WQv REQUIRED (AC. FT)	0.06
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	2,730
TOTAL TREATED DA (ACRES)	2.1
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.8

BMP 423: PROPOSED RETROFIT

SCALE: 1" = 40'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Brown AND Caldwell**

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

Project# BMP 000494  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	3.34	ac	Stream Use:	I
Impervious Area:	0.84	ac	County:	Frederick
% Impervious (I):	25%			
Minimum WQv*:	0.06	ac-ft	*If %IA<15%	
Existing RCN:	90	Existing tc:		0.1
Post Development RCN:	90	Pose Development tc:		0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: **Western** Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

$$P = 0.90 \text{ inches}$$

$$R_v = 0.05 + (0.009)(I); \text{ where}$$

$$I = 25.15$$

$$R_v = 0.276$$

$$WQv = \begin{matrix} 0.07 & \text{ac-ft} \\ 3015.44 & \text{cf} \end{matrix}$$

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	1.50	45%
C	0.13	1.37	41%
D	0.06	0.47	14%

$$S = 0.1787$$

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

$$Rev = \begin{matrix} 0.001 & \text{ac/ft} \\ 37.7 & \text{cu ft} \end{matrix}$$

Design Firm: Maryland Environmental Site Design Calculations

Project# BMP 000494

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv

0.01 **ac-ft**

301.5441 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
358.00	1020.00	0.023				0.000	0.00
359.00	3323.00	0.076	1.00	0.050	0.050	0.050	2,171.50
			0.00	0.000	0.000	0.050	2,171.50
			0.00	0.000	0.000	0.050	2,171.50
			0.00	0.000	0.000	0.050	2,171.50
			0.00	0.000	0.000	0.050	2,171.50

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
354.00	2782.00	0.064				0.000	0.00
355.00	3605.00	0.083	1.00	0.073	0.073	0.073	3,193.50
356.00	4478.00	0.103	1.00	0.093	0.093	0.166	7,235.00
357.00	5407.00	0.124	1.00	0.113	0.113	0.280	12,177.50
358.00	6392.00	0.147	1.00	0.135	0.135	0.415	18,077.00
359.00	13316.00	0.306	1.00	0.226	0.226	0.641	27,931.00
			0.00	0.000	0.000	0.641	27,931.00
			0.00	0.000	0.000	0.641	27,931.00
			0.00	0.000	0.000	0.641	27,931.00
			0.00	0.000	0.000	0.641	27,931.00
			0.00	0.000	0.000	0.641	27,931.00

\*\*\*

WQv Check\*\*\*: OK  
 10 Yr-Storm Volume (cf): 16752.45  
 10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP# 494 – Thomas Industrial Park, Section 1, Lot 3 (ANTEK)

**Prioritization Ranking:** 1  
**Planning Level Cost Estimate:** \$29,322  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	5151 Mountville Road
Northing/Easting:	603,707/1,173,247
NPDES Watershed:	Potomac Direct
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond (P-2)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	3.3
Total Impervious Area (ac):	0.8
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	3,015
Total Treated Drainage Area (ac):	3.3
Total Treated Impervious Area (ac):	0.8
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	13.2
TP (lbs/yr):	1.3
TSS (lbs/yr):	718.9



Existing site conditions for BMP# 494



Site map for BMP# 494

## EXISTING SITE CONDITIONS

According to Frederick County's Urban BMP Database (BMP Database), BMP# 494 is a dry extended detention pond. The facility was constructed on the southern side of Mountville Road. The BMP Database indicates that the original design for BMP# 494 provides water quantity management for the total drainage area of 3.3 acres, with 0.8 acres of impervious. The drainage area encompasses the nearby business building and parking lot.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from Mountville Road. Shoulder closure and basic flagging operations should be used to safely perform construction operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 494 is a wet pond (P-2). The proposed retrofit will provide quantity and quality management for the original 3.3-acre drainage area, including 0.8 acres of impervious area. The concept retrofit plan includes excavating 2 feet below the existing pond bottom to create the 2 foot deep permanent pool and adding a forebay along the southern side of the facility. The existing concrete riser is to remain in place and modified as needed to maintain permanent pool. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #494– Thomas Industrial Park, Section 1, Lot 3 (ANTEK)

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP #494 is a dry extended detention pond. The facility is located on the southern side of Mountville Road as shown on the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 3.3 acres of total drainage area, including 0.8 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses most of the adjacent parking lot and building. Inflow comes in via sheet flow, two existing grass swales, and a 15” HDP pipe on the southern side of the facility. The facility has an existing concrete riser with a low flow pipe covered in a stone jacket.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow, two grass swales entering the facility from the southwestern and southeastern corners of the facility, and a 15” HDP pipe inflow on the southern side of the facility.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. The riser appeared to be in good condition during the site visit.

### Embankment:

The facility has a four-foot vegetated embankment in good condition.

### Outflow:

The concrete riser outfalls to a roadside swale along the southern side of Mountville Road.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality and is a candidate for retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out by Mountville Road. Shoulder closure and basic flagging operations are recommended to safely perform construction operations. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations.

## Proposed Retrofit:

BMP #494 was originally designed as a dry extended detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 3.3 acres, including 0.8 acres of impervious. The retrofit concept includes excavating 2 feet below the existing pond bottom to create the 2-foot permanent pool. A 2-foot fill embankment is proposed to create the forebay. The existing concrete riser is to remain in place; however, it may need to be modified to maintain the permanent pool. See attached **Concept Plan** for details.

Additionally; it may be possible for the facility to be retrofitted to a surface sand filter. The facility would still require a forebay as pretreatment, but the facility would be backfilled with filter media. Additional consideration would be necessary during final design.

### Step 1: Watershed Factors

BMP #494 is located in the Doubs Branch subwatershed which is located within the Potomac Direct 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #494 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes construction of a 2-foot fill embankment to create a sediment forebay. The existing concrete riser will remain in place and be modified as needed during final design. Because the stream use downstream of the facility is I-P there is limited concern for thermal impacts. Safety fencing should be added around the perimeter of the facility due to the close proximity to the roadway and nearby business park.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #494 is 3.3 acres and is composed of largely B soils, with a portion located in C soils. According to the Maryland Stormwater Design Manual, the minimum drainage area for a wet pond is 25 acres, unless adequate water balance and anti-clogging measures are put in place. Further investigation will be necessary before final design to confirm the requirements of a wet pond can be met.

## **Step 5: Community and Environmental Factors**

BMP # 494 is located on the southern side of Mountville Rd and has moderate visibility. Wet ponds tend to have low maintenance requirements, high community acceptance, low construction costs, and high habitat value.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP Location Map – Existing Conditions



**Figure 2: BMP 316 Photo Locations**



**Photo 1: Overall view of facility looking northwest.**



**Photo 2: View of inflow looking to southeast.**



**Photo 3: View of 15" HDP pipe inflow.**



**Photo 4: Overall view of facility looking north.**



**Photo 5: View of inflow looking southwest.**



**Photo 6: View of outfall.**

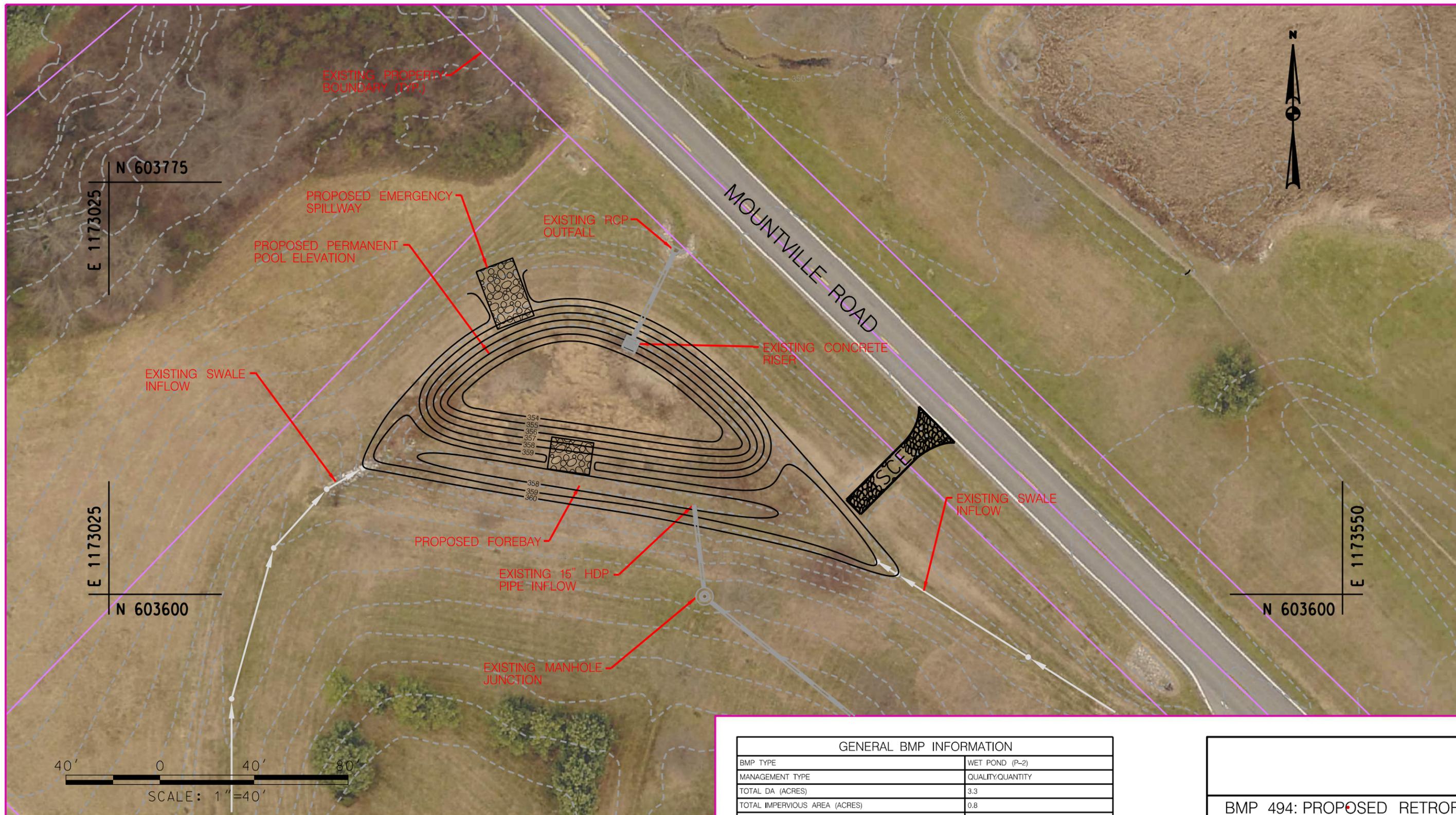


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 494	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Thomas Industrial Park, Section 1, Lot 3 - (ANTEK)	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	5151 Mountville Road	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.32, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	603,707/1,173,247	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/19/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/11/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	3.3		3.3
Total Impervious Area within Drainage Area (acres):	0.8		0.8
WQv Required:	Unknown		3,015
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	3,015 cu.ft.      .07 ac-ft
Total Treated Drainage Area (acres):	3.3	0	3.3
Total Treated Impervious Area within Drainage Area (acres):	0.8	0	0.8
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.99
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		13.2
TP (lbs/yr):	0		1.3
TSS (lbs/yr):	0		718.9

<b>Projected Retrofit Cost:</b>	\$29,322
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**GENERAL NOTES:**

1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	3.3
TOTAL IMPERVIOUS AREA (ACRES)	0.8
WQV REQUIRED (CU. FT)	3,015
WQV REQUIRED (AC. FT)	0.99
WATER QUALITY PROVIDED	
WQV PROVIDED (CU. FT)	3,015
TOTAL TREATED DA (ACRES)	3.3
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.8

<b>BMP 494: PROPOSED RETROFIT</b>	
SCALE: 1" = 40'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

**Brown AND Caldwell**

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	<b>4.41</b>	ac	Stream Use:	<b>I</b>
Impervious Area:	<b>1.35</b>	ac	County:	<b>Frederick</b>
% Impervious (I):	<b>31%</b>			
Minimum WQv*:	<b>0.07</b>	ac-ft		*If %IA<15%
Existing RCN:	90	Existing tc:		0.1
Post Development RCN:	90	Pose Development tc:		0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**      Rainfall Zone: **Western** Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

$$P = 0.90 \text{ inches}$$

$$R_v = 0.05 + (0.009)(I); \text{ where}$$

$$I = \boxed{30.61}$$

$$R_v = 0.326$$

$$WQv = \boxed{0.11} \text{ ac-ft}$$

$$\boxed{4689.78} \text{ cf}$$

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	1.98	45%
C	0.13	1.81	41%
D	0.06	0.62	14%

$$S = 0.1787$$

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

$$Rev = \mathbf{0.002} \text{ ac/ft}$$

$$94.3 \text{ cu ft}$$

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

**P-1 Micropool Extended Detention**

Project: Potomac Direct Watershed Assessment

Project# BMP 000558

Date 5/22/2019

Designer: NCW

Checked

Practice #

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

10% WQv  
0.01 ac-ft  
468.9779 cf

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
327.00	1574.00	0.036				0.000	0.00
328.00	2093.00	0.048	1.00	0.042	0.042	0.042	1,833.50
			0.00	0.000	0.000	0.042	1,833.50
			0.00	0.000	0.000	0.042	1,833.50
			0.00	0.000	0.000	0.042	1,833.50
			0.00	0.000	0.000	0.042	1,833.50

FB Check: OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
326.00	1035.00	0.024				0.000	0.00
327.00	1482.00	0.034	1.00	0.029	0.029	0.029	1,258.50
328.00	1976.00	0.045	1.00	0.040	0.040	0.069	2,987.50
329.00	6116.00	0.140	1.00	0.093	0.093	0.161	7,033.50
330.00	21000.00	0.482	1.00	0.311	0.311	0.473	20,591.50
331.00	22750.00	0.522	1.00	0.502	0.502	0.975	42,466.50
			0.00	0.000	0.000	0.975	42,466.50
			0.00	0.000	0.000	0.975	42,466.50
			0.00	0.000	0.000	0.975	42,466.50
			0.00	0.000	0.000	0.975	42,466.50
			0.00	0.000	0.000	0.975	42,466.50

\*\*\*

WQv Check\*\*\*: OK  
10 Yr-Storm Volume (cf): 26054.325  
10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP# 558 – Moehrle Masonry Wetland Pond

**Prioritization Ranking:** 9  
**Planning Level Cost Estimate:** \$51,313  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	5101 Mountville Road
Northing/Easting:	604,134/1,172,396
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Micropool Extended Detention (P-1)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	4.4
Total Impervious Area (ac):	1.4
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	4,690
Total Treated Drainage Area (ac):	4.4
Total Treated Impervious Area (ac):	1.4
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	17.7
TP (lbs/yr):	1.8
TSS (lbs/yr):	1,066.8



Existing site conditions for BMP# 558



Site map for BMP# 558

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 558 is a wet pond. The facility was constructed on the southern side of Mountville Road just west of the Moehrle Masonry parking lot. The BMP Database indicates that the original design for BMP# 558 includes water quantity and partial quality management for the total drainage area of 4.4 acres, including 1.4 acres of impervious. The drainage area encompasses the majority of the Moehrle Masonry parking lot and building, as well as a small portion of Mountville Road.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the Moehrle Masonry driveway. No maintenance of traffic operations is necessary. There is ample space for stock piling and material storage.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 558 is a micropool extended detention (P-1). The proposed retrofit includes regrading the facility’s forebay and micropool to provide storage for the water quality volume. The proposed retrofit will provide quantity and quality management for the original 4.4 acres, which includes 1.4 acres of impervious area. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. This retrofit design was intended to limit thermal impacts using a riser with an inverted low flow pipe, however modification of the existing weir wall to create a permanent pool is also an option.

# BMP #558– Moehrle Masonry Wetland Pond

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP #558 is a wet pond. The facility is located on the southern side of Mountville Road as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide quantity, and partial quality, management for 4.4 acres of total drainage area, including 1.4 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses most of the adjacent parking lot and building, and a small portion of Mountville Road. Inflow comes in via sheet flow and a 24” RCP inflow pipe. The facility has an existing notched weir wall.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow and a 24” RCP in the northeastern corner of the facility; however, the pipe was not visible during the site visit.

### Pretreatment:

According to the county provided as-builts, the facility has a forebay, though it was not visible during the inspection due to ponding in the facility.

### Control Structure and Spillways:

The facility has a notched weir wall.

### Embankment:

The facility has a four-foot vegetated embankment in good condition.

### Outflow:

The facility outfalls to a riprap channel and a grass swale.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality and is a candidate for retrofit or creating updated as-builts.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out of the Moehrle Masonry driveway. No maintenance of traffic operations will be necessary and there is ample space for staging and stockpile.

## Proposed Retrofit:

BMP #558 was originally designed as a micropool extended detention. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 4.4 acres, including 1.4 acres of impervious. The retrofit concept includes regrading both the forebay and micropool to create enough space to store the entire WQv. The facility was designed with the intent of limiting thermal impacts to a downstream III-P stream, however the stream was recently re-designated as I-P. With the new stream designation, modification of the existing weir structure may be a more appropriate means of creating a permanent pool.

Alternatively, the facility is a wet pond and could potentially receive water quality treatment credit as is and may only require current as-builts.

### **Step 1: Watershed Factors**

BMP #558 is located in the Doubs Branch subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019, but was previously designated as III-P.

### **Step 2: Terrain Factors**

BMP #558 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retro fit includes regrading the forebay and micropool for proper WQv storage. The existing weir wall is to be removed, filled in, and a concrete riser installed. The stream use downstream of the facility is I-P so thermal impacts are of a limited concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP 558 is 4.4 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the minimum drainage area for a micropool extended detention is 10 acres, unless adequate water balance and anti-clogging measures are put in place. Further investigation will be necessary before to confirm this concept is appropriate for this site.

### **Step 5: Community and Environmental Factors**

BMP # 558 is located on the southern side of Mountville Rd and has low visibility. Micropool extended detention ponds tend to have moderate maintenance requirements, moderate community acceptance, low construction costs, and moderate habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 558 Location Map – Existing Conditions



Figure 2: BMP 558 Photo Locations



**Photo 1: Overall view of facility looking west.**



**Photo 2: View of existing notched weir wall.**



**Photo 3: View of facility outfall channel.**



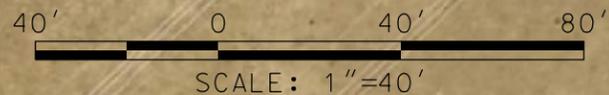
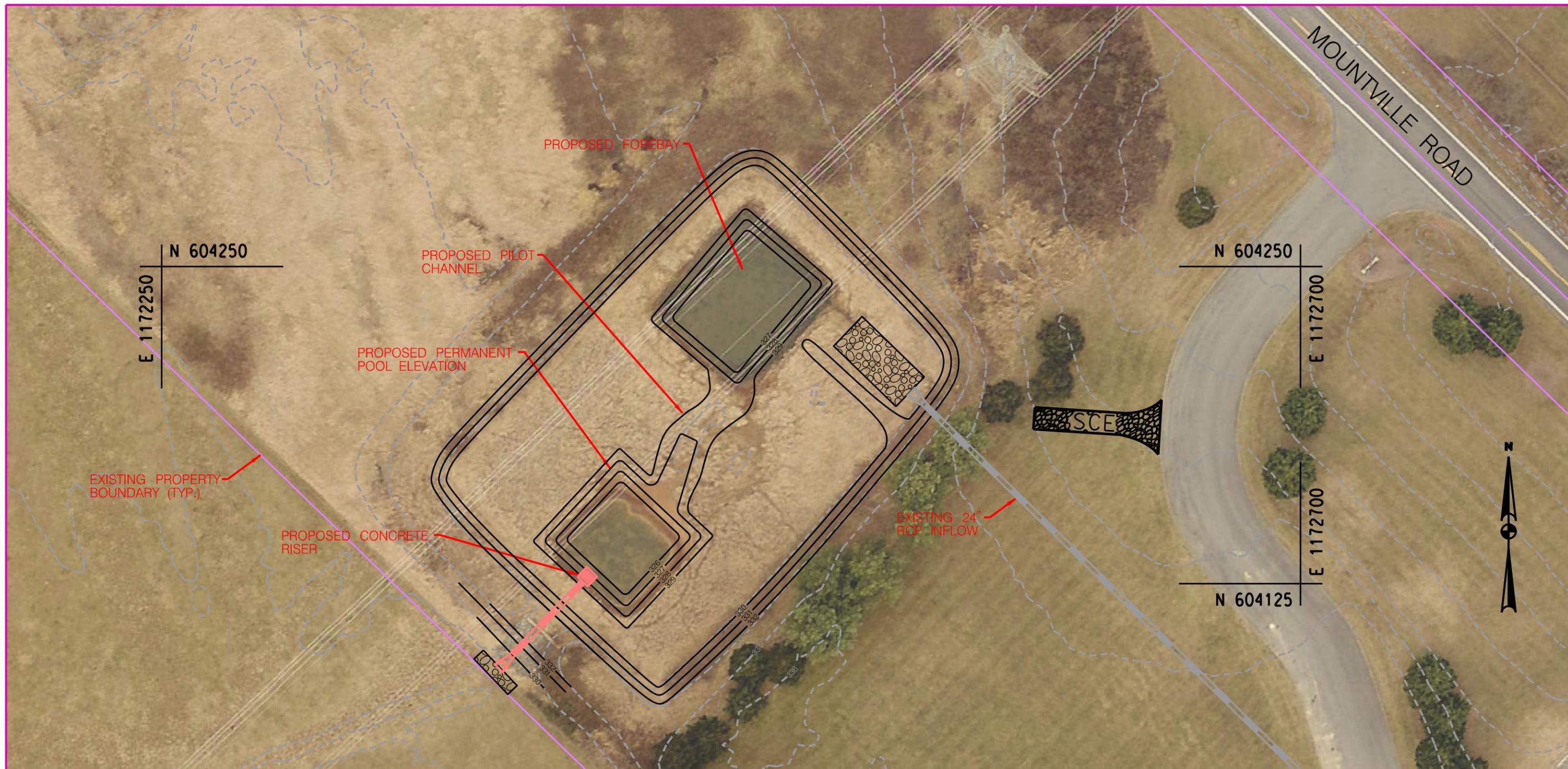
**Photo 4: View of facility forebay looking northwest.**

Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 558	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Moehrlle Masonry Wetland Pond	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	5101 Mountville Road	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.32, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	604,134/1,172,396	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/19/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Wet Pond		Micropool Extended Detention (P-1)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quality/Quantity		Quality/Quantity
Total Drainage Area (acres):	4.4		4.4
Total Impervious Area within Drainage Area (acres):	1.4		1.4
WQv Required:	Unknown		4,690
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	4,690 cu.ft.      0.11 ac-ft
Total Treated Drainage Area (acres):	4.4	0	4.4
Total Treated Impervious Area within Drainage Area (acres):	1.4	0	1.4
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.96
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		17.7
TP (lbs/yr):	0		1.9
TSS (lbs/yr):	0		1066.8

<b>Projected Retrofit Cost:</b>	\$55,313
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**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	MIRCOPOOL EXT. DETENTION (P-1)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	4.4
TOTAL IMPERVIOUS AREA (ACRES)	1.4
WQv REQUIRED (CU. FT)	4,690
WQv REQUIRED (AC. FT)	0.96
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	4,690
TOTAL TREATED DA (ACRES)	4.4
TOTAL TREATED IMPERVIOUS AREA (ACRES)	1.4

**BMP 558: PROPOSED RETROFIT**

SCALE: 1" = 40'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Brown AND Caldwell**

Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000588  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 6.87 ac Stream Use: I  
 Impervious Area: 0.93 ac  
 % Impervious (I): 14%  
 Minimum WQv\*: 0.11 ac-ft \*If %I<15%  
 Existing RCN: N/A Existing tc: N/A  
 Post Development RCN: N/A Pose Development tc: N/A

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 13.54  
 $R_v = 0.172$   
**WQv = 0.09 ac-ft**  
**3856.6935 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	6.87	100%
C	0.13	0.00	0%
D	0.06	0.00	0%

S = 0.26

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  **Rev = 0.026 ac/ft**  
**1131.184 cu.ft**

**3. Forebay Sizing:**

Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.02 ac-ft  
 964.17338 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.044637656  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 256.6665234$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2	Af (sf) =	2571.129
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
272.00	2575.00	0.059				0.000	0.00
273.00	2575.00	0.059	1.00	0.059	0.059	0.059	2,575.00
274.00	2575.00	0.059	1.00	0.059	0.059	0.118	5,150.00
275.00	3244.00	0.074	1.00	0.067	0.067	0.185	8,059.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1287.5
WQv Check***:	OK	Surface Storage	2909.5

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #588 – Hadley Woods

**Prioritization Ranking:** 26  
**Planning Level Cost Estimate:** \$112,455  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Basford Road – 5000 ft South of Mountville RD.
Northing/Easting:	604,232/1,166,810
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	6.9
Total Impervious Area (ac):	0.9
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	3,857
Total Treated Drainage Area (ac):	6.9
Total Treated Impervious Area (ac):	0.9
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	25.9
TP (lbs/yr):	2.2
TSS (lbs/yr):	1,089.0



Existing site conditions for BMP# 588



Site map for BMP# 588

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP #588 is a bioretention area, however, there is no defined BMP in place based on the site investigation. The facility is located on western side of Basford Road at an intersection with an unnamed road. The BMP Database indicates that the original design for BMP #588 provides water quantity and quality management and the total drainage area for the BMP is 6.9 acres with 0.9 acres of impervious surface. The drainage area encompasses a large forested area, several residential homes and about half of the unnamed road.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from Basford Road. Maintenance of Traffic (MOT) will be required along with flagging operations. There area is also constricted by tree impacts.

## PROPOSED RETROFIT

The proposed retrofit for BMP #588 is a bioretention (F-6). The proposed retrofit will provide quantity and quality management for the original 6.9-acre drainage area, including the 0.9 acres of impervious area. The retrofit includes regrading existing slopes to create the filter area which is to be filled with 2 feet of bioretention mix. Riprap protection is to be placed at the edges of the facility for energy dispersion. A concrete riser with a tied in perforated PVC underdrain will be constructed and outfall to the northeast corner of the facility into an existing grass swale. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

# BMP #588 - Hadley Woods

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP #558 is a bioretention area. The facility is located on the western side of Basford Road as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide quality and quantity management for 6.9 acres of total drainage area, including 0.9 acres of impervious area. Figure 1 shows the drainage area for the facility, which encompasses a large forested area, several residential rooftops, and the majority of an unnamed road.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding forested area as well as grass swale with several riprap check dams.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has no notable control structures that were visible during the site visit and there were no as-built plans to reference.

### Embankment:

The facility did not have a definable embankment.

### Outflow:

An outfall structure was not visible during the site visit.

### Overall BMP:

Overall, the facility appears to be in poor condition and does not meet criteria for water quality management.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material from Basford Road. Maintenance of Traffic (MOT) and flagging operations will be necessary to safely perform the work. Material storage and staging should be placed to minimize disruption to nearby residents.

## Proposed Retrofit:

BMP #588 was categorized as bioretention area but the BMP is ill defined and no as-builts are available. The proposed retrofit is a bioretention (F-6) will provide both water quality and quantity treatment for the originally designed 6.9 acre drainage area, including 0.9 acres of impervious. The retrofit includes regrading the existing slopes creating a two foot deep filter area filled with bioretention mix. Slopes are to be regraded at a 3:1 slope until tying back in with existing grade. Riprap level spreaders will be constructed on the southwestern corner and northern side of the facility where the majority of drainage is anticipated to enter the facility. The facility has a proposed perforated PVC underdrain tied into a concrete riser structure proposed to outfall to an existing roadside swale along Basford Road. This is displayed on the attached **Concept Plan**.

### Step 1: Watershed Factors

BMP #588 is located in the Doubs Branch subwatershed within the Potomac Direct 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #588 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. Tree impacts will likely be a concern in constructing this retrofit.

## **Step 3: Stormwater Treatment Suitability**

The retrofit includes regrading the existing slopes to create the bioretention practice. The facility's banks are to be regraded and the bottom two feet of the facility will be filled with bioretention mix. A concrete riser connected to a perforated PVC underdrain at the base of the filter media will be constructed with the outfall to the east. The downstream stream use is I-P so thermal impacts are of a limited concern.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #588 is 6.9 acres and is composed of largely B soils with a portion of C soils. according to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres but a larger drainage area is acceptable if properly designed. Given the land cover of the drainage area, bioretention is a suitable practice for this area.

## **Step 5: Community and Environmental Factors**

BMP #588 is located on the western side of Basford Road and has low visibility. Bioretention practices tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

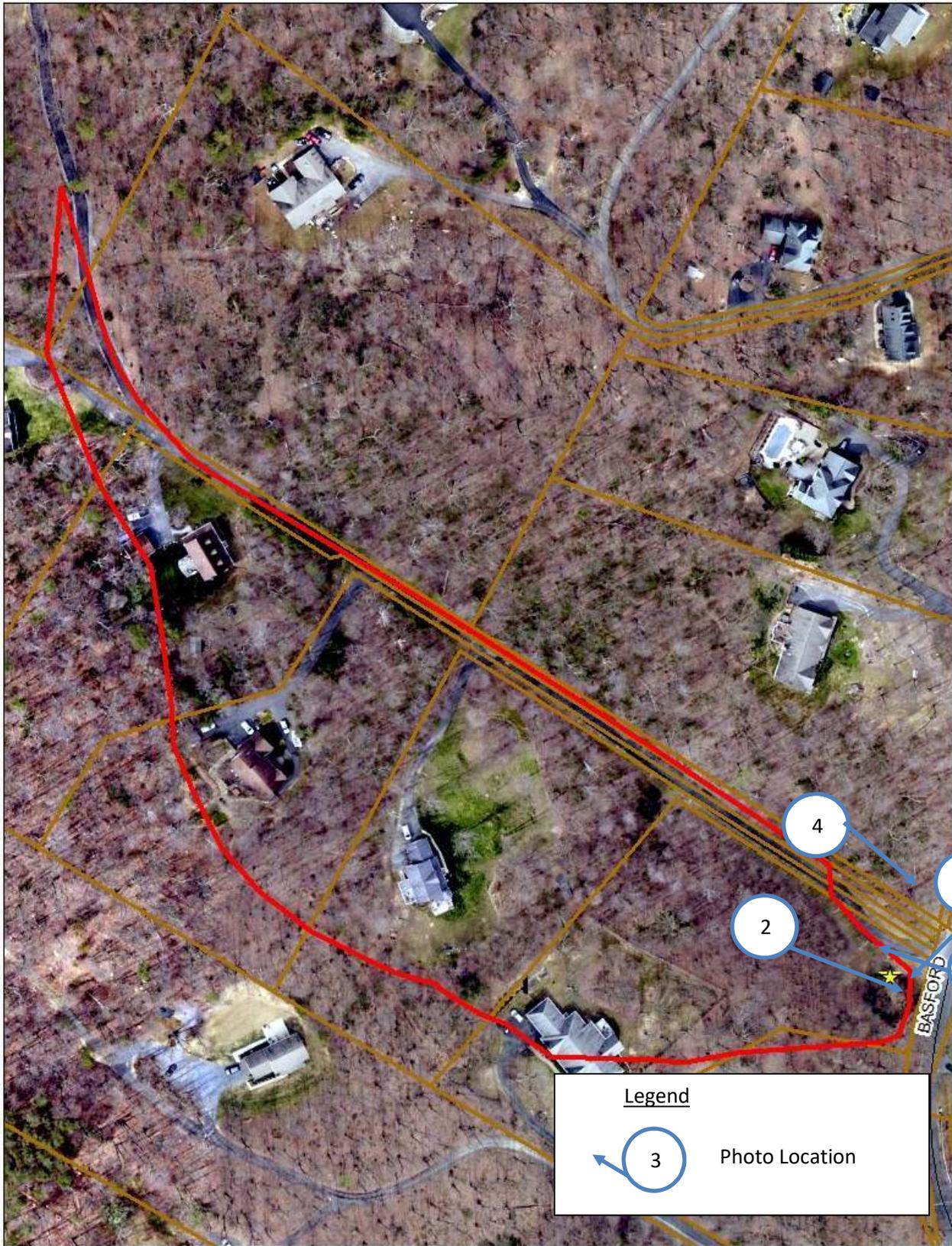
## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #588 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



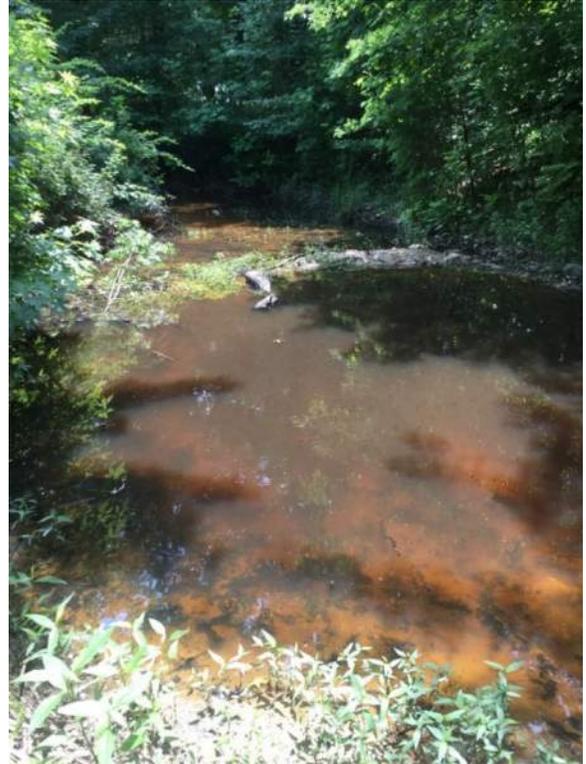
Figure 1: BMP 588 Location Map – Existing Conditions



**Figure 2: BP 588 Photo Locations**



**Photo 1: View of grass swale inflow looking west.**



**Photo 2: Overall view of BMP looking south.**



**Photo 3: View of potential outfall area along Basford Road**



**Photo 4: View of downstream stream channel.**

Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 588	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Hadley Woods, Section 1 - Bioretention Filter "A"	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Basford Road - 5,000 ft. South of Mountville Rd.	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.32, -77.51	<b>Name/#:</b>	
<b>Northing/Easting:</b>	604,232/1,166,810	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition	Proposed Condition	
BMP Type:	Bioretention	Bioretention (F-6)	
BMP Classification:	N/A	Stormwater Treatment (ST) Practice	
Management Type:	Quality/Quantity	Quality/Quantity	
Total Drainage Area (acres):	6.9	6.9	
Total Impervious Area within Drainage Area (acres):	0.9	0.9	
WQv Required:	Unknown	3,857	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No	Yes	
Adequate ROW (Y/N):	Yes	Yes	
Adequate Access (Y/N):	Yes	Yes	
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	3,857 cu.ft.
Total Treated Drainage Area (acres):	6.9	0	6.9
Total Treated Impervious Area within Drainage Area (acres):	0.9	0	0.9
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.14
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		25.9
TP (lbs/yr):	0		2.2
TSS (lbs/yr):	0		1089.0

<b>Projected Retrofit Cost:</b>	\$112,455
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GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	6.9
TOTAL IMPERVIOUS AREA (ACRES)	0.9
WQv REQUIRED (CU. FT)	3.857
WQv REQUIRED (AC. FT)	0.09
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	3.857
TOTAL TREATED DA (ACRES)	6.9
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.9

<b>BMP 588: PROPOSED RETROFIT</b>	
SCALE: 1" = 40'	
DESIGNED BY:	NCW COUNTY: FREDERICK
DRAWN BY:	NCW
CHECKED BY:	
DRAWING NO.	OF

**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



**Drainage Area Data**

Contributing Drainage Area to Practice (A): 1.96 ac Stream Use: I  
 Impervious Area: 0.46 ac  
 % Impervious (I): 23%  
 Minimum WQv\*: 0.03 ac-ft \*If %IA<15%  
 Existing RCN: 81 Existing tc: 0.2  
 Post Development RCN: 81 Pose Development tc: 0.2

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A)/12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 23.47  
 $R_v = 0.261$   
 WQv = 0.04 ac-ft  
 1672.704 cf

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	0.88	45%
C	0.13	0.80	41%
D	0.06	0.27	14%

S = 0.1787

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  Rev = 0.013 ac/ft  
 584.607 cu.ft

**3. Forebay Sizing:** Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.01 ac-ft  
 418.176 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.01936  
 $W \text{ (ft/sec)} =$  0.0004  
 $E' =$  2.3  
 $As \text{ (sf)} =$  111.32

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) = 2                      Af (sf) = 1115.136  
k (ft/day) = 0.5  
hf (ft) = 1  
tf (days) = 2                      Af Check: OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
360.00	4616.00	0.106				0.000	0.00
361.00	4616.00	0.106	1.00	0.106	0.106	0.106	4,616.00
362.00	4616.00	0.106	1.00	0.106	0.106	0.212	9,232.00
363.00	5636.00	0.129	1.00	0.118	0.118	0.330	14,358.00
			0.00	0.000	0.000	0.330	14,358.00
			0.00	0.000	0.000	0.330	14,358.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check: OK                      Subsurface Storage                      2308  
WQv Check\*\*\*: OK                              Surface Storage                              5126

\*\*\*Includes forebay, subsurface, and surface storage

# BMP# 606 – Thomas Industrial Park – Section 1, Lot 2

**Prioritization Ranking:** 14  
**Planning Level Cost Estimate:** \$62,475  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	South Side of Mountville Rd
Northing/Easting:	603,353/1,173,650
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	1.9
Total Impervious Area (ac):	0.5
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	1,672
Total Treated Drainage Area (ac):	1.9
Total Treated Impervious Area (ac):	0.5
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	7.7
TP (lbs/yr):	0.7
TSS (lbs/yr):	405.8



Existing site conditions for BMP# 606



Site map for BMP# 606

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 606 is a dry extended detention pond. The facility was constructed on the southern side of Mountville Road. The BMP Database indicates that the original design for BMP# 606 provides water quantity management for the 1.9-acre drainage area, including 0.5 acres of impervious. The drainage area encompasses a gravel parking lot and driveway to the southwest of the facility.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from Mountville Road. Shoulder closure and basic flagging operations should be used to safely perform construction operations. Stockpile and staging can be placed to the southeast of the facility.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Maintenance of Traffic:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 606 is a bioretention area (F-6). The proposed retrofit will provide quantity and quality management for the original 1.9 acres, including 0.5 acres of impervious area. The concept retrofit plan includes excavating one foot below the existing facility bottom and filling the facility with 3’ of bioretention mix. The existing concrete riser is to remain in place and a perforated PVC underdrain is to be tied into the riser. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #606 – Thomas Industrial Park – Section 1, Lot 2

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 606 is a dry extended detention pond. The facility is located on the southern side of Mountville Rd as shown on the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 1.9 acres of total drainage area, including 0.5 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses a gravel parking lot and driveway. Inflow comes in via sheet flow. The facility has a concrete riser.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding areas.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser which appeared to be in good condition at the time of the site visit.

### Embankment:

The facility has a 6-foot vegetated embankment with some mild erosion and spots lacking ground cover.

### Outflow:

The facility outfalls downstream to a roadside swale that appeared to be in good condition.

### Overall BMP:

Overall, the facility appears to be in moderate condition. The embankments were lacking vegetation and erosion was visible in several places. The facility does not meet criteria for water quality.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out via Mountville road. Shoulder closure and flagging operations should be implemented to safely perform construction operations. Staging and stockpiling could be adequately placed to the east of the facility.

## Proposed Retrofit:

BMP #606 was originally designed as a dry extended detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 1.9 acres, including 0.5 acres of impervious. The concept retrofit plan includes excavating one foot below the existing facility bottom and filling with 3 feet of bioretention mix. The proposed facility implements a 20-foot grass filter strip and a stone diaphragm for pre-treatment and energy dispersion to limit eroding the filter bed. The existing concrete riser is to remain in place and have a PVC perforated underdrain pipe tied into it. This is displayed on the attached **Concept Plan**. Turf grass and other plantings can be added to the top of the filter media.

### Step 1: Watershed Factors

BMP #606 is located in the Doubs Branch subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

### Step 2: Terrain Factors

BMP #606 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No

special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes excavating an additional one foot below the existing bottom of the facility and filling it with 3' of bioretention mix. The existing concrete riser is to remain in place and have a perforated PVC underdrain tied in. A grass filter strip and stone diaphragm are to be constructed on the southern side of the facility. The downstream stream use is III-P; however because this is a filtering practice thermal impacts are less of a concern, though tree plantings could be considered for further protection.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #606 is 1.9 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention facility is 5 acres and the facility is located alongside the roadway, therefore bioretention is the most appropriate practice considering safety and drainage area.

### **Step 5: Community and Environmental Factors**

BMP #606 is located on the southern side of Mountville Road and has moderate visibility. Bioretention areas tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 316 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) Maintenance of Traffic



Figure 1: BMP Location Map – Existing Conditions

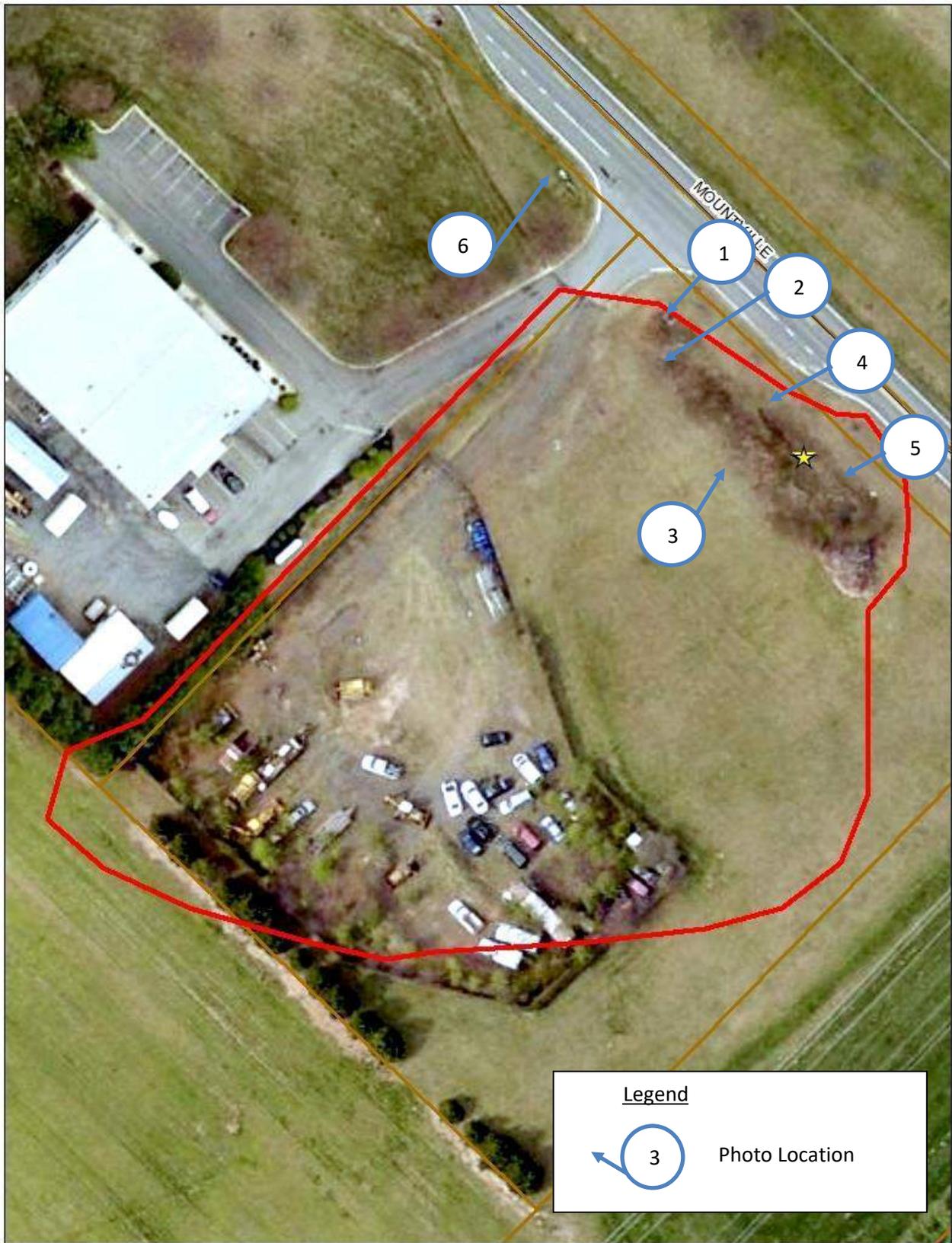


Figure 2: BMP 606 Photo Locations



**Photo 1: View of existing concrete riser.**



**Photo 2: View of inflow into the facility.**



**Photo 3: Overall view of the facility looking north.**



**Photo 4: Overall view of facility looking south.**



**Photo 5: Overall view of facility looking south.**



**Photo 6: View of facility outfall swale.**

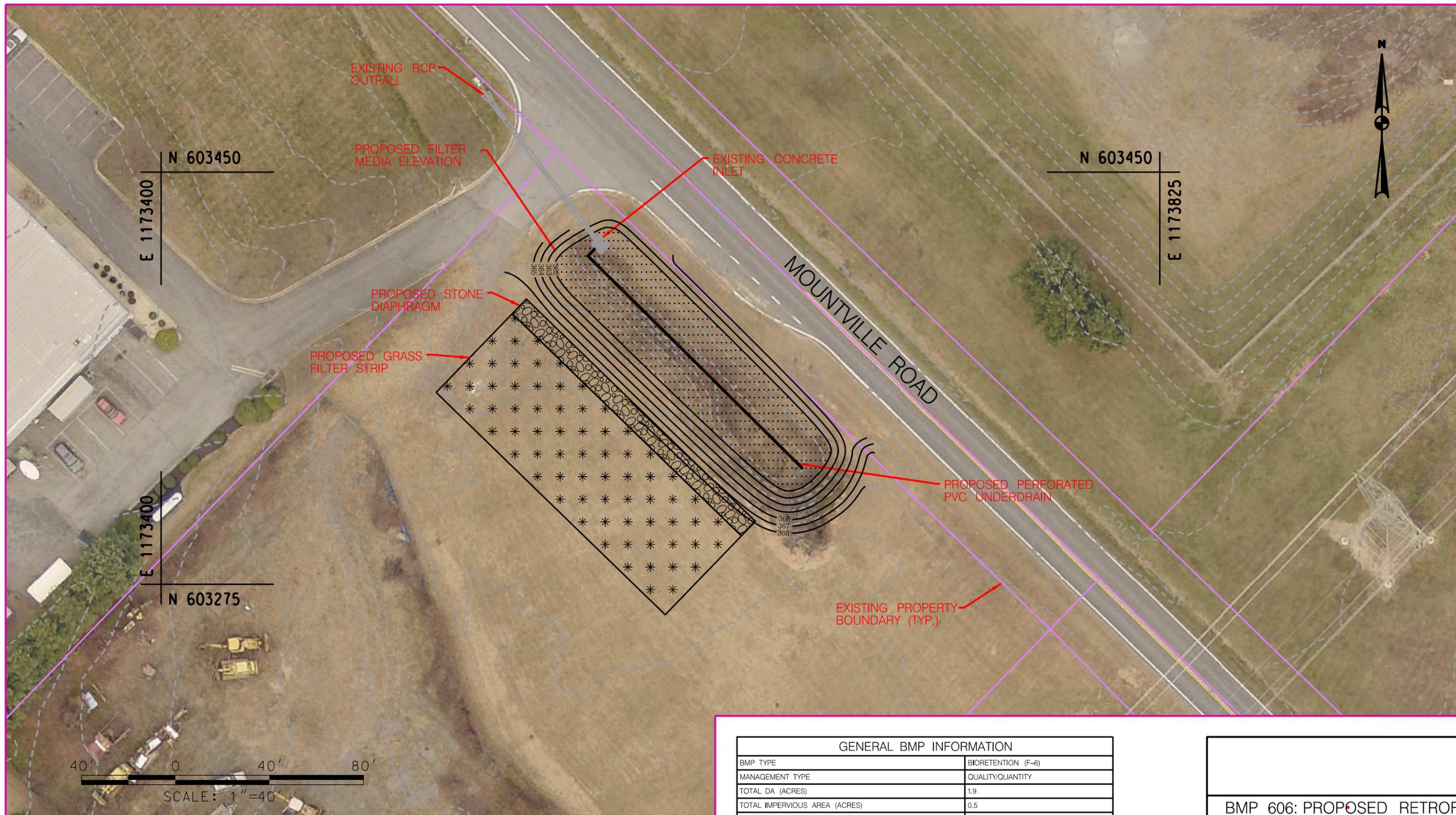


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 606	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Thomas Industrial Park - Section 1, Lot 2	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	South Side of Mountville Rd. ~1,000 ft. off Rt. 351	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.32, -77.49	<b>Name/#:</b>	
<b>Northing/Easting:</b>	603,353/1,173,650	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/19/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	1.9		1.9
Total Impervious Area within Drainage Area (acres):	0.5		0.5
WQv Required:	Unknown		1,672
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	1,672 cu.ft. 0.04
Total Treated Drainage Area (acres):	1.9	0	1.9
Total Treated Impervious Area within Drainage Area (acres):	0.5	0	0.5
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.0
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		7.7
TP (lbs/yr):	0		0.7
TSS (lbs/yr):	0		405.8

<b>Projected Retrofit Cost:</b>	\$62,475
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	1.9
TOTAL IMPERVIOUS AREA (ACRES)	0.5
WQv REQUIRED (CU. FT)	1,672
WQv REQUIRED (AC. FT)	0.04
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	1,672
TOTAL TREATED DA (ACRES)	1.9
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.5

BMP 606: PROPOSED RETROFIT	
SCALE: 1" = 40'	
DESIGNED BY:	NCW COUNTY: FREDERICK
DRAWN BY:	NCW
CHECKED BY:	
DRAWING NO.	OF



Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000630  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 2.17 ac Stream Use: I  
 Impervious Area: 0.96 ac  
 % Impervious (I): 44%  
 Minimum WQv\*: 0.04 ac-ft \*If %IA<15%  
 Existing RCN: 87 Existing tc: 0.29  
 Post Development RCN: 87 Pose Development tc: 0.29

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A)/12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 44.24  
 $R_v = 0.448$   
 WQv = 0.07 ac-ft  
 3177.1575 cf

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.11	5%
B	0.26	1.35	62%
C	0.13	0.63	29%
D	0.06	0.09	4%

S = 0.2203

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  Rev = 0.059 ac/ft  
 2580.379 cu.ft

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**  
 25% WQv:  
 0.02 ac-ft  
 794.28938 cf

**B. Sedimentation Surface Area**  
 $As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.036772656  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 211.4427734$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
418.00	966.00	0.022				0.000	0.00
419.00	1972.00	0.045	1.00	0.034	0.034	0.034	1,469.00
			0.00	0.000	0.000	0.034	1,469.00
			0.00	0.000	0.000	0.034	1,469.00
			0.00	0.000	0.000	0.034	1,469.00
			0.00	0.000	0.000	0.034	1,469.00

WQv: OK As: OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	3	Af (sf) =	2382.8681
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
415.00	2418.00	0.056				0.000	0.00
416.00	2418.00	0.056	1.00	0.056	0.056	0.056	2,418.00
417.00	2418.00	0.056	1.00	0.056	0.056	0.111	4,836.00
418.00	2418.00	0.056	1.00	0.056	0.056	0.167	7,254.00
419.00	3390.00	0.078	1.00	0.067	0.067	0.233	10,158.00
			0.00	0.000	0.000	0.233	10,158.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1813.5
WQv Check***:	OK	Surface Storage	2904

\*\*\*Includes forebay, subsurface, and surface storage

# BMP# 630 – M & O Exterior Applications, INC.

**Prioritization Ranking:** 13  
**Planning Level Cost Estimate:** \$124,950  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	4107 Harvard Place
Northing/Easting:	613,155/1,171,996
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	2.2
Total Impervious Area (ac):	1.0
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	3,177
Total Treated Drainage Area (ac):	2.2
Total Treated Impervious Area (ac):	1.0
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	9.2
TP (lbs/yr):	1.1
TSS (lbs/yr):	699.4



Existing site conditions for BMP# 630



Site map for BMP# 630

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 630 is a dry extended detention pond. The facility was constructed north of Harvard Place, on the western side of M & O Exterior Applications, Inc. The BMP Database indicates that the original design for BMP# 630 provides water quantity management for a 2.2-acre drainage area, including 1.0 acres of impervious. The drainage area encompasses the M & O Exterior Applications, Inc. parking lot and building.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling from the M & O Exterior Applications, Inc. parking lot. No Maintenance of Traffic (MOT) will be required and the staging area will be planned to not interfere with M & O Exterior Applications, Inc. business.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 630 is a bioretention (F-6). The proposed retrofit will provide quantity and quality management for the original 2.2-acre drainage area, including 1.0 acres of impervious area. The concept retrofit plan includes adding a forebay to the western side of the facility and removing the notched weir wall and replacing it with a concrete riser and a perforated PVC underdrain. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #630 – M & O Exterior Applications, INC.

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 630 is a dry extended detention pond. The facility is located just north of the end of Harvard Place as shown on the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for the 2.2-acre drainage area, including 1.0 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses the M & O Exterior Applications, Inc. parking lot and building. The facility has an existing notched weir wall.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding property, a grass swale on the northern side of the facility, and several roof downspouts from the nearby buildings.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing notched weir wall which appeared to be in good condition at the time of the site visit.

### Embankment:

The facility has a 2-foot vegetated embankment in moderate condition due to a few animal burrows were observed in the embankment.

### Outflow:

The facility has outfalls through a notched weir wall to a riprap lined channel and a grass swale further downstream.

### Overall BMP:

Overall, the facility appears to be in moderate condition, the embankment has good vegetative cover, though a few animal burrows are present that need repair. The facility does not meet criteria for water quality due to stormwater era making it a good candidate for a retrofit.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out by the M & O Exterior Applications, Inc. parking lot. No maintenance of traffic or flagging operations are required. Stakeholder input for material storage and staging is recommended so material is placed in a way to not interrupt business operations

## Proposed Retrofit:

BMP #630 was originally designed as a dry extended detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 2.2-acre drainage area, including 1.0 acres of impervious. The concept retrofit plan includes excavating 3 feet below the existing facility bottom and filling with 3 feet of bioretention mix. A 2-foot fill embankment is to be constructed along the western side of the facility to create a sediment forebay. The existing notched weir wall is to be removed and replaced with a concrete riser and a perforated PVC underdrain. This is displayed on the attached **Concept Plan**. The proposed forebay could potentially be replaced with a grass filter strip and gravel diaphragm during final design if space constraints allow for it.

### **Step 1: Watershed Factors**

BMP #630 is located in the Tuscarora Creek- Upper Mainstem subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

### **Step 2: Terrain Factors**

BMP #630 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit includes excavating three feet below the existing facility bottom and backfilling with bioretention mix. A 2-foot fill embankment will be constructed to make a sediment forebay and the existing notched weir wall will be removed and replaced with a concrete riser with a perforated PVC underdrain. The downstream stream use is I-P so thermal impacts are a limited concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #630 is 2.2 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres so a bioretention is the most appropriate practice.

### **Step 5: Community and Environmental Factors**

BMP #630 is located just north of Harvard Place and has moderate visibility. Bioretention tends to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 630 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit

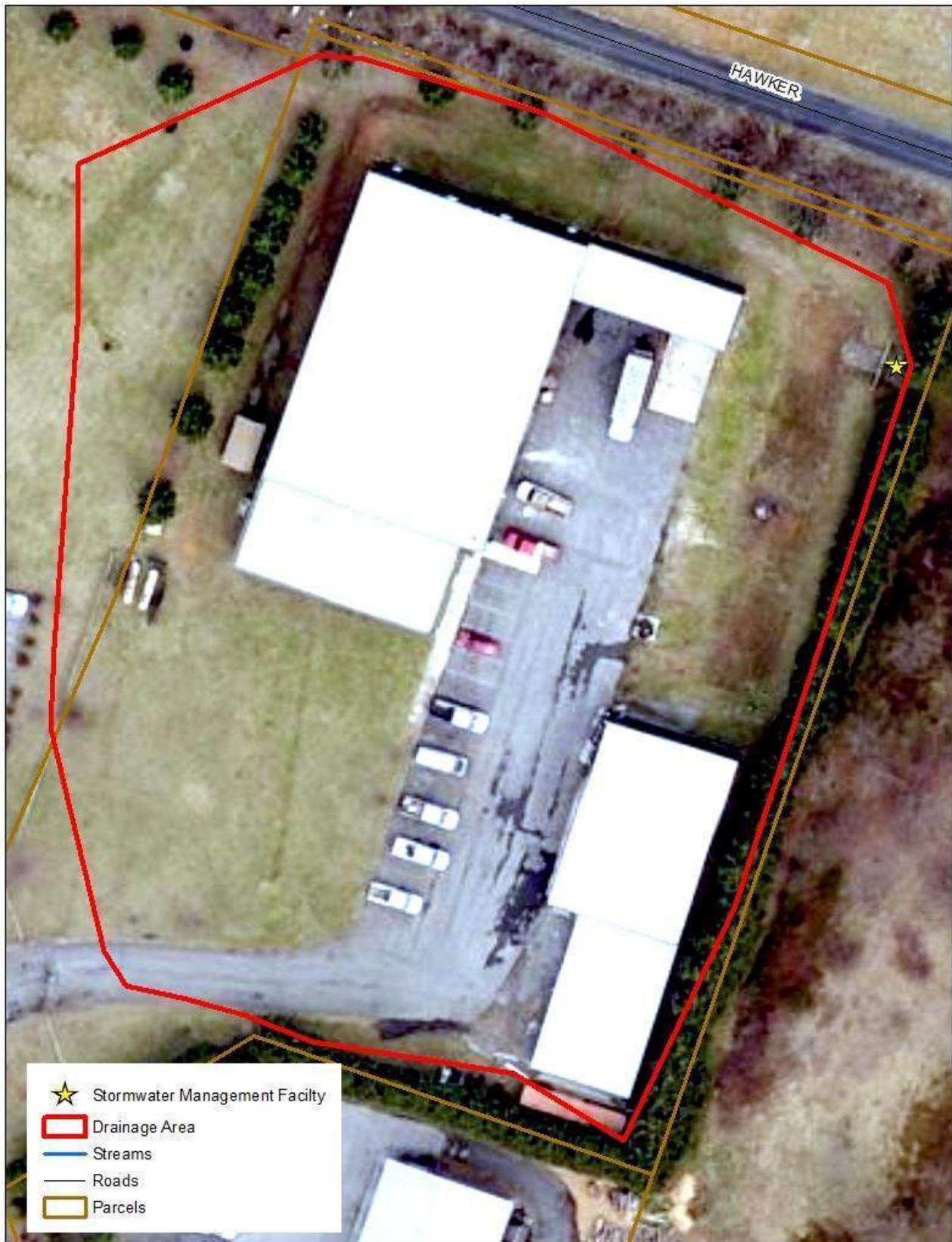


Figure 1: BMP 630 Location Map – Existing Conditions

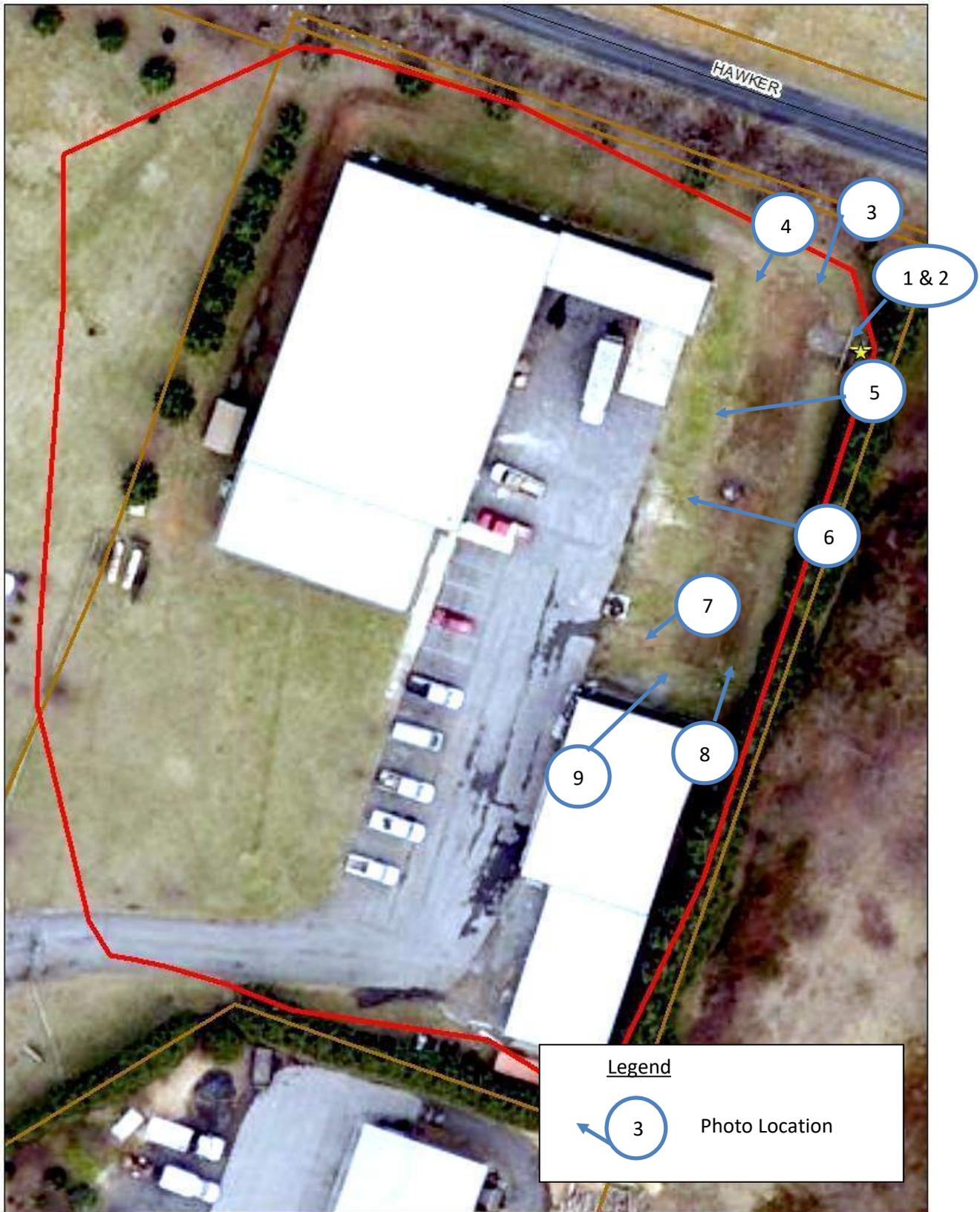


Figure 2: BMP 630 Photo Locations



**Photo 1: View of existing weir wall.**



**Photo 2: View of riprap outfall channel.**



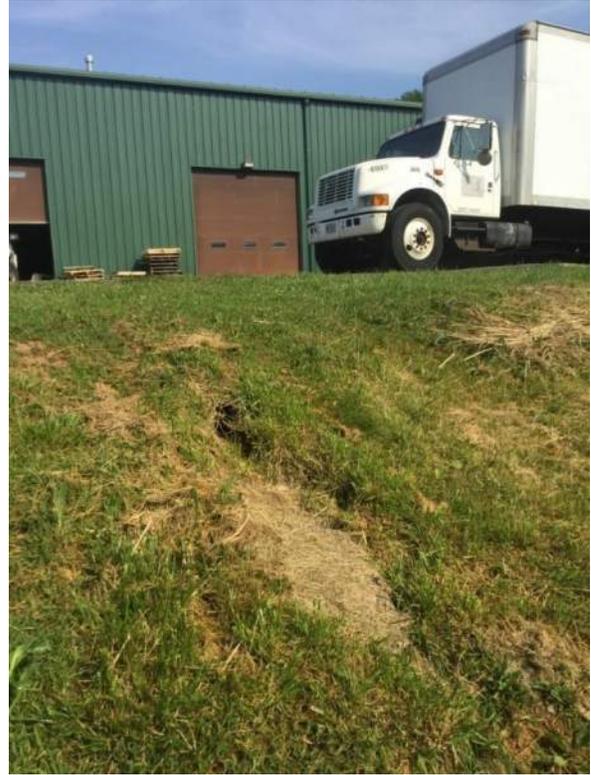
**Photo 3: Overall view of facility looking south.**



**Photo 4: View of grass swale inflow looking west.**



**Photo 5: View of rooftop downspout outflow.**



**Photo 6: View of rooftop downspout outflow.**



**Photo 7: View of rooftop downspout outflow.**



**Photo 8: View of facility embankment, looking north.**



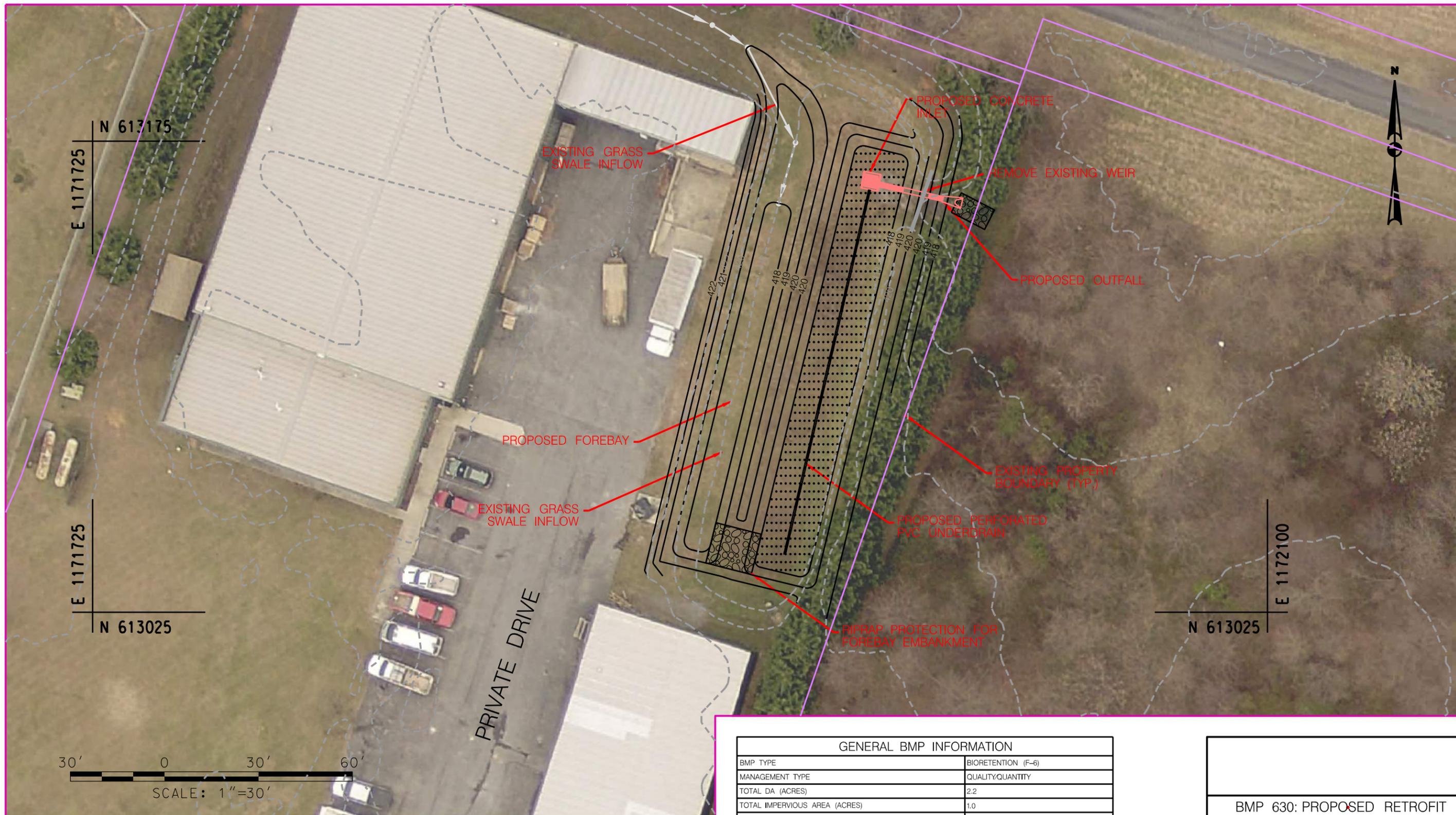
**Photo 9: Overall view of facility looking north.**

Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 630	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	M & O Exterior Applications, Inc. (WKYA Enterprises)	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	4107 Harvard Place	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.35, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	613,155/1,171,996	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	2.2		2.2
Total Impervious Area within Drainage Area (acres):	1.0		1.0
WQv Required:	Unknown		3,177
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	3,177 cu.ft.      0.08 ac-ft
Total Treated Drainage Area (acres):	2.2	0	2.2
Total Treated Impervious Area within Drainage Area (acres):	1.0	0	1.0
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.91
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		9.2
TP (lbs/yr):	0		1.1
TSS (lbs/yr):	0		669.4

<b>Projected Retrofit Cost:</b>	\$124,950
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	2.2
TOTAL IMPERVIOUS AREA (ACRES)	1.0
WQv REQUIRED (CU. FT)	3,177
WQv REQUIRED (AC. FT)	0.91
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	3,177
TOTAL TREATED DA (ACRES)	2.2
TOTAL TREATED IMPERVIOUS AREA (ACRES)	1.0

BMP 630: PROPOSED RETROFIT	
SCALE: 1" = 30'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

**Brown AND Caldwell**

Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000632  
 Brown and Caldwell M-6 MicroBioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 0.76 ac Stream Use: I  
 Impervious Area: 0.18 ac  
 % Impervious (I): 24%  
 Minimum WQv\*: 0.01 ac-ft \*If %I<15%  
 Existing RCN: 89 Existing tc: 0.1  
 Post Development RCN: 89 Pose Development tc: 0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** BMP Type: Bioretention  
 ESDv = Environmental Site Design Volume  
 $ESDv = (Pe \times Rv \times A) / 12$   
 Pe (in): 1 inches  
 $Rv = 0.05 + (0.009)(I)$ ; where I = 23.68  
 $Rv = 0.263$   
 $ESDv = 0.02$  ac-ft  
 726 cf

**2. Swale Sizing:**

**A.Storage Volume :**  
 $Af = WQv(df) / [(k)(hf+df)(tf)]$   
 Media Depth df (ft) = 2 Af (sf) = 2250  
 Swale Width w (ft) = 50 ESDv Capacity (cf)= 1800  
 Swale Length l (ft) = 45  
 Number of cells = 1 Minimum Af = 2207.04  
 Check Dam Height (ft) = 0 Af Check: OK  
 Check Dam Width (ft) = 0 ESDv Check: OK  
 Soil Porosity n = 0.4

**3. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
483.00	2167.00	0.050				0.000	0.00
484.00	2167.00	0.050	1.00	0.050	0.050	0.050	2,167.00
485.00	2167.00	0.050	1.00	0.050	0.050	0.099	4,334.00
486.00	2800.00	0.064	1.00	0.057	0.057	0.157	6,817.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check: OK Subsurface Storage 1083.5  
 WQv Check: OK Surface Storage 2483.5

**F-1 Sand Filter**

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2	Af (sf) =	7434.603
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
394.00	7812.00	0.179				0.000	0.00
395.00	7812.00	0.179	1.00	0.179	0.179	0.179	7,812.00
396.00	7812.00	0.179	1.00	0.179	0.179	0.359	15,624.00
397.00	8835.00	0.203	1.00	0.191	0.191	0.550	23,947.50
			0.00	0.000	0.000	0.550	23,947.50
			0.00	0.000	0.000	0.550	23,947.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	NOT OK	Subsurface Storage	3906
WQv Check***:	OK	Surface Storage	8323.5

\*\*\*Includes forebay, subsurface, and surface storage

# BMP# 632 – AT&T Repeater Station

**Prioritization Ranking:** 20  
**Planning Level Cost Estimate:** \$24,990  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	On left off Winchester Blvd. Just beyond Sunny Side
Northing/Easting:	611,097/1,169,349
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Microbioretention (M-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	0.8
Total Impervious Area (ac):	0.2
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	653
Total Treated Drainage Area (ac):	0.8
Total Treated Impervious Area (ac):	0.2
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	4.4
TP (lbs/yr):	0.3
TSS (lbs/yr):	158.2



Existing site conditions for BMP# 632



Site map for BMP# 632

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 632 is a dry extended detention pond. The facility was constructed on the western side of Winchester Boulevard just behind the AT&T repeater station. The BMP Database indicates that the original design for BMP# 632 provides water quantity management for the 0.8-acre drainage area, including 0.2 acres of impervious. The drainage area encompasses the majority of the rooftop of the repeater station.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the AT&T Repeater Station parking lot. No maintenance of traffic will be required and there should be minimal impact to business operations at the site.

Required Permitting	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 632 is a micro bioretention (M-6). The proposed retrofit will provide quantity and quality management for the original 0.8 acres and 0.2 acres of impervious area. The concept retrofit plan proposes excavating two feet into the existing grade and filling it with bioretention mix. The facility is to be placed on area with well-draining B soils according to USDA soil survey and an underdrain and outfall system may not be required. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #632 – AT&T Repeater Station.

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 632 is a dry extended detention pond. The facility is located west of the AT&T repeater station on the western side of Winchester Boulevard, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 0.8 acres of total drainage area, including 0.2 acres of impervious. Figure 1 shows the drainage area for the facility, which includes the rooftop of the near by AT&T repeater station. During the site assessment there were several marked underground telecom lines.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow from the facility consists of sheet flow from the surrounding property. The AT&T repeater station currently has the building downspouts positioned just upstream of the facility according to Frederick county as-builts.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing notched weir wall which appeared to be in good condition at the time of the site visit.

### Embankment:

The facility has a 2-foot vegetated embankment in moderate condition with some eroded portions lacking grass cover.

### Outflow:

The facility outfalls to a grass area.

### Overall BMP:

Overall, the facility appears to be in fair condition, the embankment had good vegetative cover but treats a very small drainage area.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out by the AT&T Repeater Station's parking lot. No maintenance of traffic or flagging operations should be required and impacts to business operations will be limited.

## Proposed Retrofit:

BMP #632 was originally designed as a dry detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 0.8-acre drainage area, including 0.2 acres of impervious. The concept retrofit plan includes excavating two feet below the existing grade and filling with bioretention mix. The area is mostly well-draining B soils and will likely not require an underdrain and outfall system. The area just downstream of the facility is to be graded at a 3 to 1 slope to tie slopes back in with the existing grade. This is displayed on the attached **Concept Plan**.

Alternatively, to the micro-bioretention the area could be designated as a non-structural practice such as a rooftop disconnect. Some minor regrading may be necessary to be the MDE SWM Manual slope requirements. Both of these options limit potential conflicts with the underground telecom lines.

### **Step 1: Watershed Factors**

BMP #632 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

### **Step 2: Terrain Factors**

BMP #632 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit includes excavating two feet down and filling with bioretention mix. A small fill embankment will be created to contain additional volume above the filter media. The downstream stream designation is I-P so thermal impacts are a limited concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #632 is 0.8 acres and has a very limited amount of impervious area. The surrounding area is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the drainage area for a microbioretention should be limited to less than an acre. During the site assessment there were several flagged underground telecom lines that may cause conflict during excavation.

### **Step 5: Community and Environmental Factors**

BMP #632 is located on the western side of Winchester Boulevard and has low visibility. Microbioretention tends to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value. Grass and additional plantings could be added to the top of the facility.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP # 630 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP 632 Location Map – Existing Conditions



Figure 2: BMP 632 Photo Locations



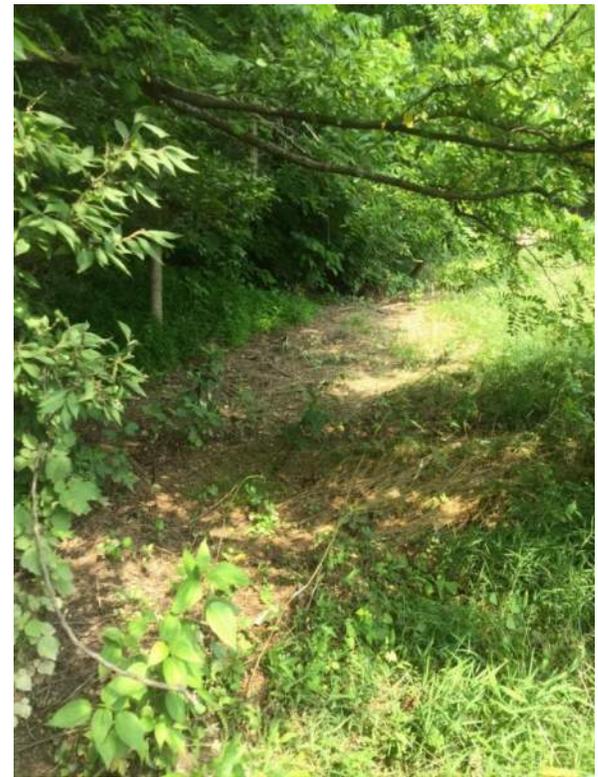
**Photo 1: View of existing notched weir wall.**



**Photo 2: View of current downspout outfall..**



**Photo 3: Overall view of facility looking west.**



**Photo 4: Overall view of facility looking to the north**



**Photo 5: View of outfall area looking northwest.**

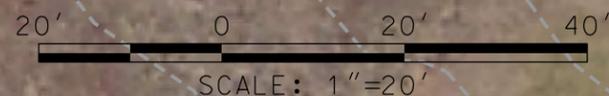
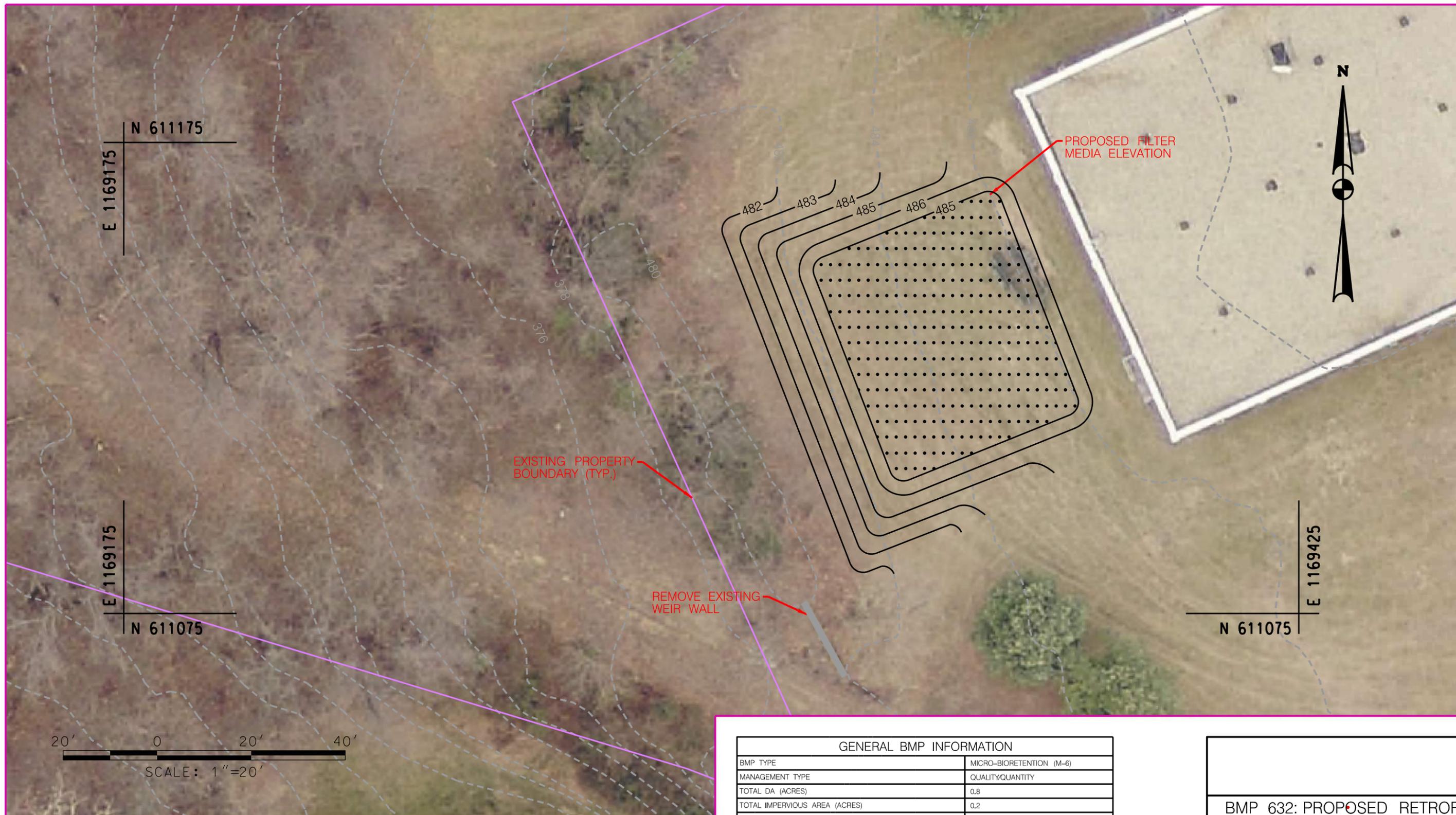


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 632	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	AT&T Repeater Station	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	On left off Winchester Blvd Just beyond Sunny Side	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.51	<b>Name/#:</b>	
<b>Northing/Easting:</b>	611,097/1,169,349	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Pond		Micro-bioretenion (M-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	0.8		0.8
Total Impervious Area within Drainage Area (acres):	0.2		0.2
WQv Required:	Unknown		653
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	653 cu.ft. 0.02
Total Treated Drainage Area (acres):	0.8	0	0.8
Total Treated Impervious Area within Drainage Area (acres):	0.2	0	0.2
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.0
Total Nitrogen:	N/A		57%
Total Phosphorus:			66%
Sediment:			70%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		4.4
TP (lbs/yr):	0		0.3
TSS (lbs/yr):	0		158.2

<b>Projected Retrofit Cost:</b>	\$24,990
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GENERAL NOTES:  
1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	MICRO-BIORETENTION (M-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	0.8
TOTAL IMPERVIOUS AREA (ACRES)	0.2
ESDv REQUIRED (CU. FT)	653
ESDv REQUIRED (AC. FT)	0.02
WATER QUALITY PROVIDED	
ESDv PROVIDED (AC. FT)	653
TOTAL TREATED DA (ACRES)	0.8
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.2

BMP 632: PROPOSED RETROFIT	
SCALE: 1" = 20'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

**Brown AND Caldwell**

Design Firm: Maryland Environmental Site Design Calculations

Project# BMP 000656

Brown and Caldwell

**P-2 Wetpond**

Date 5/22/2019

Designer: NCW

Project: Potomac Direct Watershed Assessment

Checked

Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 19.60 ac  
 Impervious Area: 6.54 ac  
 % Impervious (I): 33%  
 Minimum WQv\*: 0.33 ac-ft

Stream Use: I  
 County: Frederick

\*If %IA<15%

Existing RCN: 85 Existing tc: 0.2  
 Post Development RCN: 85 Pose Development tc: 0.2

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**

Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 33.37

$R_v = 0.350$

WQv = 0.51 ac-ft  
 22431.22 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	3.14	16%
B	0.26	13.13	67%
C	0.13	3.33	17%
D	0.06	0.00	0%

S = 0.2571

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

Rev = 0.072 ac/ft  
 3143.1 cu ft

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations  
**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000656  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**3. Forebay Sizing:** No forebay in this design

**A. Compute Forebay Sizing :**  
10% WQv  
0.05 **ac-ft**  
2243.122 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

FB Check: NOT OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
390.00	2411.00	0.055				0.000	0.00
391.00	31264.00	0.718	1.00	0.387	0.387	0.387	16,837.50
392.00	34844.00	0.800	1.00	0.759	0.759	1.145	49,891.50
393.00	38582.00	0.886	1.00	0.843	0.843	1.988	86,604.50
394.00	42478.00	0.975	1.00	0.930	0.930	2.919	127,134.50
395.00	46551.00	1.069	1.00	1.022	1.022	3.941	171,649.00
			0.00	0.000	0.000	3.941	171,649.00
			0.00	0.000	0.000	3.941	171,649.00
			0.00	0.000	0.000	3.941	171,649.00
			0.00	0.000	0.000	3.941	171,649.00

\*\*\*

WQv Check\*\*\*: OK  
10 Yr-Storm Volume (cf): 124617.9  
10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP #656 – Stanford Industrial Park, Sec. 3, Pond A

**Prioritization Ranking:** 10  
**Planning Level Cost Estimate:** \$238,238  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Southern side of Winchester Street
Northing/Easting:	608,665/1,169,969
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond
Management Type:	Quality and Quantity
Total Drainage Area (ac):	19.6
Total Impervious Area (ac):	6.5
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	22,431
Total Treated Drainage Area (ac):	19.6
Total Treated Impervious Area (ac):	6.5
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	120.0
TP (lbs/yr):	5.4
TSS (lbs/yr):	5,055.6



Existing site conditions for BMP #656



Site map for BMP #656

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 656 is a wet pond. The facility is located on the southern side of Winchester Street. The BMP Database indicates that the original design was intended to provide management for quality and quantity for 19.6 acres of total drainage area including 6.5 acres of impervious. The drainage area for the facility primarily encompasses the businesses off Dartmouth Court.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material off Winchester Street. A Maintenance of Traffic (MOT) may be required for access off Winchester Street. The staging area will be planned to not interfere with local business operations.

## PROPOSED RETROFIT

The proposed retrofit for BMP# 656 is a wet pond. The proposed retrofit will provide quality and quantity management for the original 19.6 acres and 6.5 acres of impervious area. The concept retrofit plan proposes minor regrading of the existing facility, the existing weir wall is proposed to remain and place and be modified based on final design calculations and storm data. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X
Other: MDE Dam Safety	X

# BMP# 656 – Stanford Industrial Park, Sec. 3, Pond A

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP# 656 is a wet pond. The facility is located on the southern side of Winchester Street, as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide management for quality and quantity for 19.6 acres of total drainage area including 6.5 acres of impervious. Figure 1 shows the drainage area for the facility, which primarily encompasses the development associated with Cintas Facility Service, Avanti Marble and Granite and the TNT Services Group along Dartmouth Court. As-builts are not available for this facility, but a site visit identified a 36" CMP inflow pipe with a riprap channel and a control structure consisting of a two-stage notch weir.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has one inflow point consisting of a 36" inflow pipe with a riprap channel in good condition.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the site visit notes, the control structure consists of a 2-stage notch weir and a spillway in good condition.

### Embankment:

A fill embankment is present between the pond and Winchester Street. The embankment was observed to be stable and have sufficient vegetative cover on both the upstream and downstream side of the embankment.

### Outflow:

The outfall was observed to be in good condition with minor debris in the riprap channel.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria for water quality treatment due to lack of current as-builts.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material off Winchester Boulevard. A Maintenance of Traffic (MOT) may be required for access off Winchester Street. Material storage and staging can be placed on the facility's parcel to the east of the pond.

## Proposed Retrofit:

BMP# 656 was originally designed as a wet pond. The proposed facility will provide both water quality and quantity treatment for the originally designed 19.6 acres, including the 6.5 acres of impervious. The retrofit will slightly modify the current wet pond by regrading the facility and providing an emergency spillway. The proposed retrofit may require modification of the existing weir wall as needed for final design. The grading shown on the **Concept Plan** allows for adequate storage a 10-year design storm.

Alternatively, since the facility is a wet pond and eligible to receive treatment credit new as-builts could be created to achieve full credit. This method would be more cost effective than modifying the facility.

### **Step 1: Watershed Factors**

BMP# 656 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. There are no special watershed factors and/or constraints that must be considered for retrofit design for BMP# 656 due to the stream use designation.

### **Step 2: Terrain Factors**

BMP# 656 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit proposes a permanent pool elevation 3 feet above the pond bottom. The existing weir wall is proposed to remain and be modified based on final design calculations and storm data. Per the original design, the facility does not have a forebay. In the interest of limiting large scale changes to the facility, no forebay was added since the facility is already providing water quality treatment. The concept level calculation for the proposed retrofit are provided in the attached spreadsheet.

### **Step 4: Physical Feasibility Factors**

The facility is already a wet pond and requires simple modifications described above for the County to receive impervious area credit. The proposed drainage area to BMP# 656 is 19.6 acres and is composed of largely B soils with a portion of C and A soils.

### **Step 5: Community and Environmental Factors**

BMP# 656 is located on the south side of Winchester Street with moderate visibility. Ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP# 656 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) Joint Permit Application (JPA)/General Waterway Construction Permit (GWCP): It is anticipated that a JPA/GWCP will be required. This BMP is located in non-floodprone areas per Digital Flood Insurance Rate Maps (DFIRMs); therefore, it is not located within the FEMA 100-year flood plain.
- 5) MDE Dam Safety

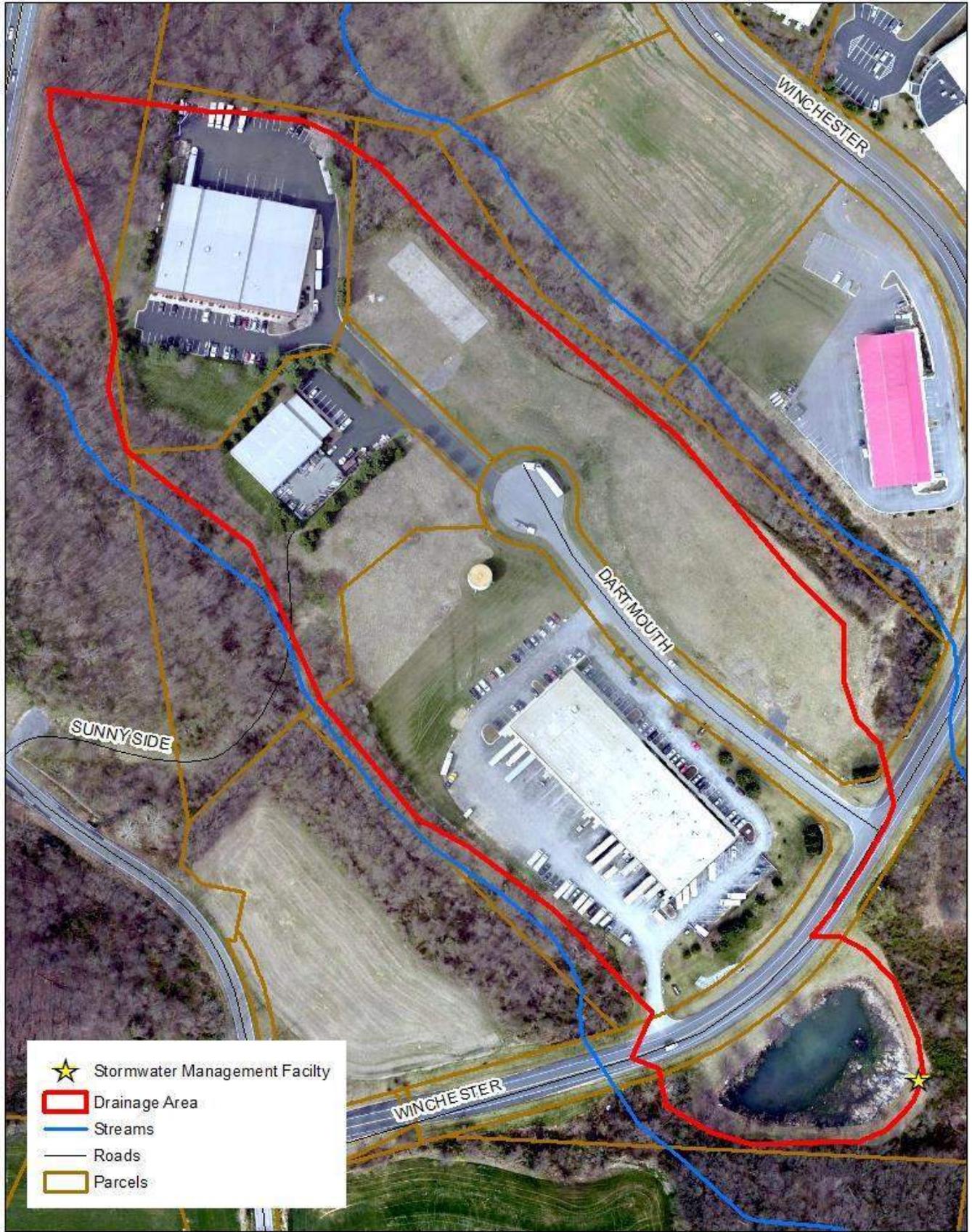


Figure 1: BMP 656 Location Map – Existing Condition



Figure 2: BMP 656 Photo Locations



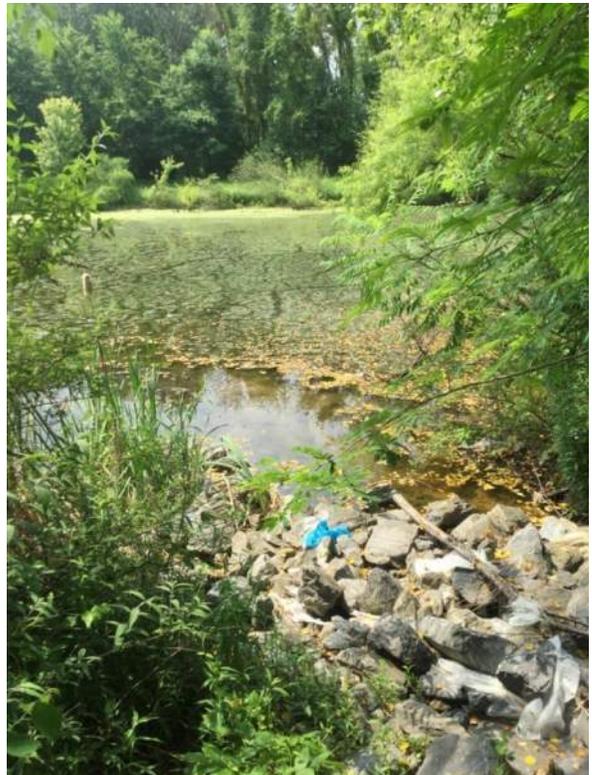
**Photo 1: View of existing weir wall structure looking east**



**Photo 2: View of outfall channel looking south**



**Photo 3: View of inflow looking west**



**Photo 4: View of inflow channel looking south**



**Photo 5: Overall view of pond looking northwest**



**Photo 6: Overall view of pond looking south**



**Photo 7: Overall view of facility looking southeast**

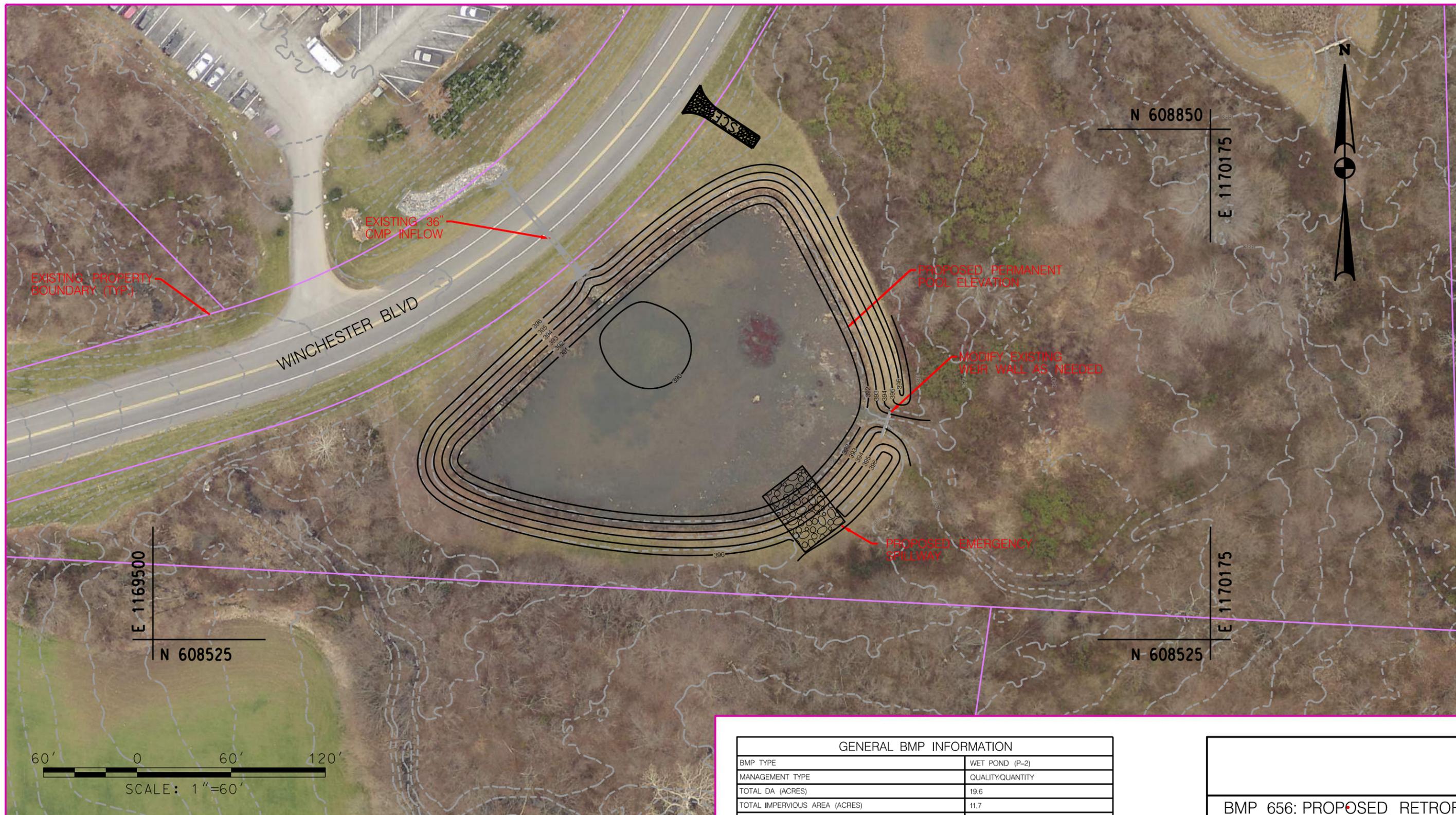


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	12/13/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 656	<b>Year Constructed:</b>	9/22/2000
<b>Structure Name:</b>	Standford Industrial Park, Sec.3, Pond A	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	South of Winchester Street	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	608,665/1,169,969	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, MP
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDJEFFE5

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Wet Pond		Wet Pond
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quality and Quantity		Quality/Quantity
Total Drainage Area (acres):	19.6		19.6
Total Impervious Area within Drainage Area (acres):	6.5		6.5
WQv Required:	Unknown		22,431
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
<b>Estimated Treatment Provided</b>	<b>Per Design</b>	<b>Per MDE 2000 Standards</b>	
WQv Provided:	Unknown	0	22,431 0.51
Total Treated Drainage Area (acres):	19.6	0	19.6
Total Treated Impervious Area within Drainage Area (acres):	6.5	0	6.5
<b>Estimated Pollutant Removal Rates</b>			
Runoff Volume Treated per Impervious Acre (in.)			0.94
Total Nitrogen:	N/A		52%
Total Phosphorus:			33%
Sediment:			66%
<b>Estimated Pollutant Load Reduction</b>			
TN (lbs/yr):	0		120.0
TP (lbs/yr):	0		5.4
TSS (lbs/yr):	0		5055.6

<b>Projected Retrofit Cost:</b>	\$238,238
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**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

**Brown AND Caldwell**

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	19.6
TOTAL IMPERVIOUS AREA (ACRES)	11.7
WQv REQUIRED (CU. FT)	22,431
WQv REQUIRED (AC. FT)	0.51
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	22,431
TOTAL TREATED DA (ACRES)	19.6
TOTAL TREATED IMPERVIOUS AREA (ACRES)	11.7

**BMP 656: PROPOSED RETROFIT**

SCALE: 1" = 60'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000657  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A):	23.89	ac	Stream Use:	I
Impervious Area:	9.34	ac	County:	Frederick
% Impervious (I):	39%			
Minimum WQv*:	0.40	ac-ft	*If %IA<15%	
Existing RCN:	90	Existing tc:		0.23
Post Development RCN:	90	Pose Development tc:		0.23

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: **Western** Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 39.10

$R_v = 0.402$

**WQv = 0.72 ac-ft**  
**31364.83 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	3.82	16%
B	0.26	16.01	67%
C	0.13	4.06	17%
D	0.06	0.00	0%

S = 0.2571

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

**Rev = 0.144 ac/ft**  
**6276.4 cu ft**

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations  
**P-2 Wetpond**  
Project: Potomac Direct Watershed Assessment

Project# BMP 000657  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**3. Forebay Sizing:** No forebay in this design

**A. Compute Forebay Sizing :**  
10% WQv  
0.07 **ac-ft**  
3136.483 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

FB Check: NOT OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
387.00	35352.00	0.812				0.000	0.00
388.00	37748.00	0.867	1.00	0.839	0.839	0.839	36,550.00
389.00	40083.00	0.920	1.00	0.893	0.893	1.732	75,465.50
390.00	42475.00	0.975	1.00	0.948	0.948	2.680	116,744.50
391.00	44924.00	1.031	1.00	1.003	1.003	3.683	160,444.00
392.00	47495.00	1.090	1.00	1.061	1.061	4.744	206,653.50
393.00	50156.00	1.151	1.00	1.121	1.121	5.865	255,479.00
			0.00	0.000	0.000	5.865	255,479.00
			0.00	0.000	0.000	5.865	255,479.00
			0.00	0.000	0.000	5.865	255,479.00
			0.00	0.000	0.000	5.865	255,479.00

\*\*\*

WQv Check\*\*\*: OK  
10 Yr-Storm Volume (cf): 174249.075  
10 Yr-Storm Check: OK

\*\*\*Includes both permanent and forebay storage.

# BMP # 657 – Stanford Industrial Park, Sec. 3, Pond B

**Prioritization Ranking:** 7  
**Planning Level Cost Estimate:** \$340,864  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Southern side of Winchester Street
Northing/Easting:	608,903.9/1,170,252
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond
Management Type:	Quality and Quantity
Total Drainage Area (ac):	23.9
Total Impervious Area (ac):	9.3
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	31,365
Total Treated Drainage Area (ac):	23.9
Total Treated Impervious Area (ac):	9.3
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	152.1
TP (lbs/yr):	7.2
TSS (lbs/yr):	6717.4



Existing site conditions for BMP # 657



Site map for BMP # 657

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 657 is a wet pond. The facility is located on the southern side of Winchester Street. The BMP Database indicates that the original design was intended to provide management for quality and quantity for 23.9 acres of total drainage area including 9.3 acres of impervious. The drainage area for the facility encompasses the development directly adjacent to and including Winchester Street.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for construction and hauling material off Winchester Street. A Maintenance of Traffic (MOT) may be required for access off Winchester Street. The staging area will be planned to not interfere with local business operations.

## PROPOSED RETROFIT

The proposed retrofit for BM # 657 is a wet pond. The proposed retrofit will provide quality and quantity management for the original 23.9 acres and 9.3 acres of impervious area. The concept retrofit plan proposes minor regrading the existing facility as well as modifying the current weir wall structure as needed further in the design process. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X
Other: MDE Dam Safety	X

# BMP# 657 – Stanford Industrial Park, Sec 3., Pond B

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP# 657 is a wet pond. The facility is located on the southern side of Winchester Street, as shown in the BMP Location map (see Figure 1). The BMP Database indicates that the original design was intended to provide management for quality and quantity for 23.9 acres of total drainage area including 9.3 acres of impervious. Figure 1 shows the drainage area for the facility, which primarily encompasses the development directly adjacent to and including Winchester Street. As-builts are not available for this facility, but a site visit identified an elliptical CMP inflow pipe with a riprap channel and a control structure consisting of notched weir and CMP low flow pipe.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

The facility has one inflow point consisting of an elliptical CMP pipe with a riprap channel in good condition.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

According to the site visit notes, the control structure consists of a notched weir and CMP low flow pipe.

### Embankment:

A fill embankment is present between the pond and Winchester Street. The embankment was observed to be stable and have sufficient vegetative cover on both the upstream and downstream side of the embankment.

### Outflow:

The outfall was observed to be in good condition with minor debris in the riprap channel.

### Overall BMP:

Overall, the facility appears to be in good condition, but does not meet criteria to treat for water quality due to lack of current as-builts. Flow could not be observed entering the facility during the site visit but was observed at the facility's outfall. The downstream channel was in moderate condition with small portions of erosion. No major problems were observed in the BMP.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material off Winchester Boulevard. A Maintenance of Traffic (MOT) may be required for access off Winchester Boulevard. Material storage and staging can be placed in the northwestern corner of the pond parcel.

## Proposed Retrofit:

BMP# 657 was originally designed as a wet pond. The proposed retrofit will modify the current wet pond configuration. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 23.9 acres, including 9.3 acres of impervious. The concept retrofit plan proposes to provide permanent storage by excavating approximately one foot below the existing BMP bottom elevation and modifying the existing weir wall to create a 2 foot deep permanent pool as shown in the **Concept Plan**. Riprap is to be added to the existing emergency spillway on the western side of the facility. Minor alterations to the downstream channel should be considered to reset riprap.

Alternatively, because the facility is a wet pond and eligible to receive treatment credit current as-builts could be made for the facility. This would be a more cost-effective method of receiving credit.

### **Step 1: Watershed Factors**

BMP# 657 is located in the Eastalco Aluminum subwatershed which is located within the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P. There are no special watershed factors and/or constraints that must be considered for retrofit design for BMP# 657 due to the stream use designation.

### **Step 2: Terrain Factors**

BMP# 657 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit proposed a permanent pool elevation 2 feet above the ponds bottom. The existing weir wall is proposed to remain and be modified based on final design calculations and storm data. Per the original design the facility does not have a forebay and seems that it should already be credited, in-order to limit large scale changes to the facility, no forebay was added. The concept level calculation for the proposed retrofit are provided in the attached spreadsheet.

### **Step 4: Physical Feasibility Factors**

The facility is already a wet pond and requires simple modifications described above for the County to receive impervious area credit. The proposed drainage area to BMP# 656 is 23.9 acres and is composed of largely B soils with a portion of C and A soils.

### **Step 5: Community and Environmental Factors**

BMP # 657 is located on the south side of Winchester Street with moderate visibility. Ponds tend to have low maintenance requirements, medium to high community acceptance, low construction costs relative to the drainage area, and provide high habitat quality.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP# 657 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) Joint Permit Application (JPA)/General Waterway Construction Permit (GWCP): It is anticipated that a JPA/GWCP will be required. This BMP is located in non-floodprone areas per Digital Flood Insurance Rate Maps (DFIRMs); therefore, it is not located within the FEMA 100-year flood plain.
- 5) MDE Dam Safety

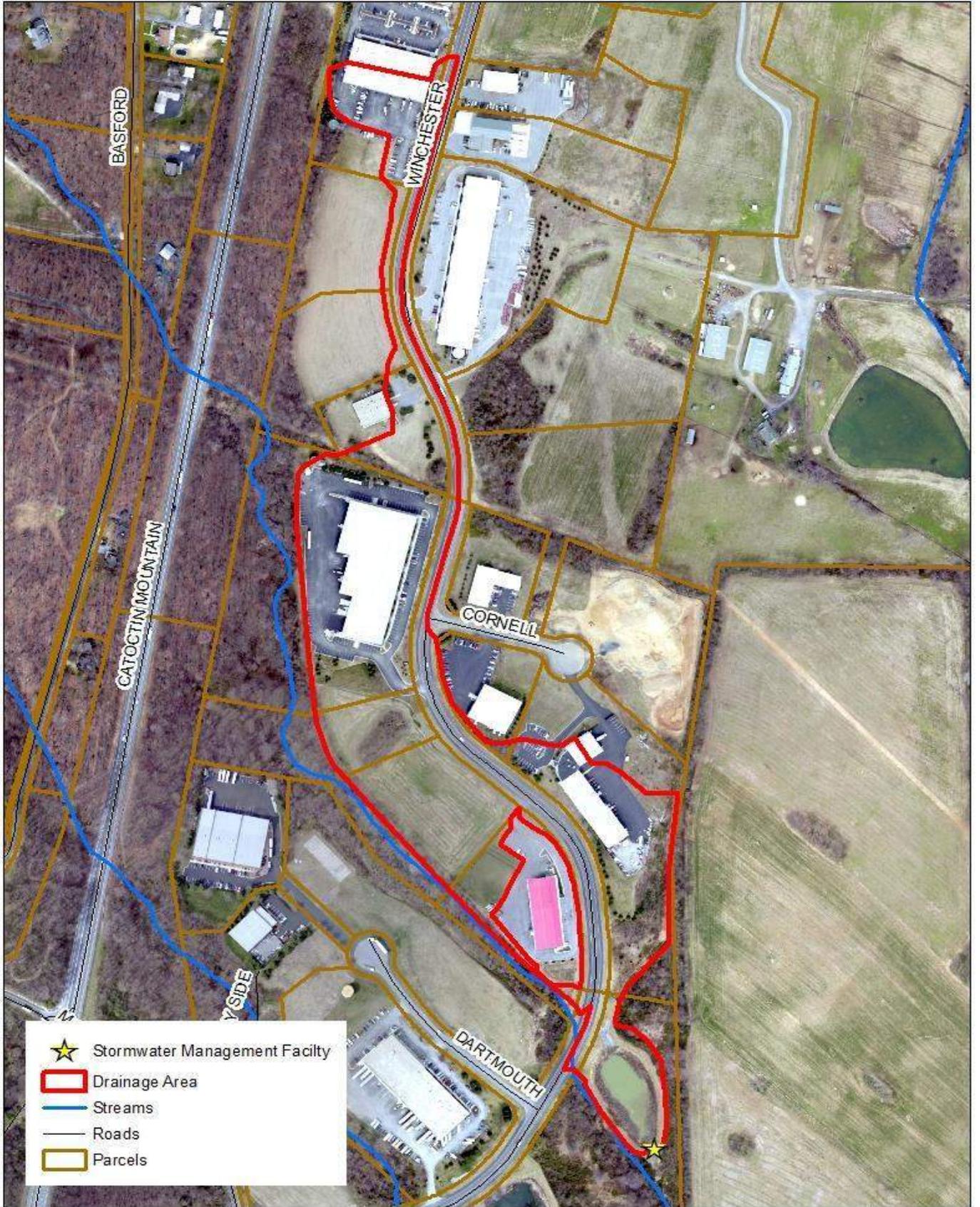


Figure 1: BMP Location Map – Existing Conditions

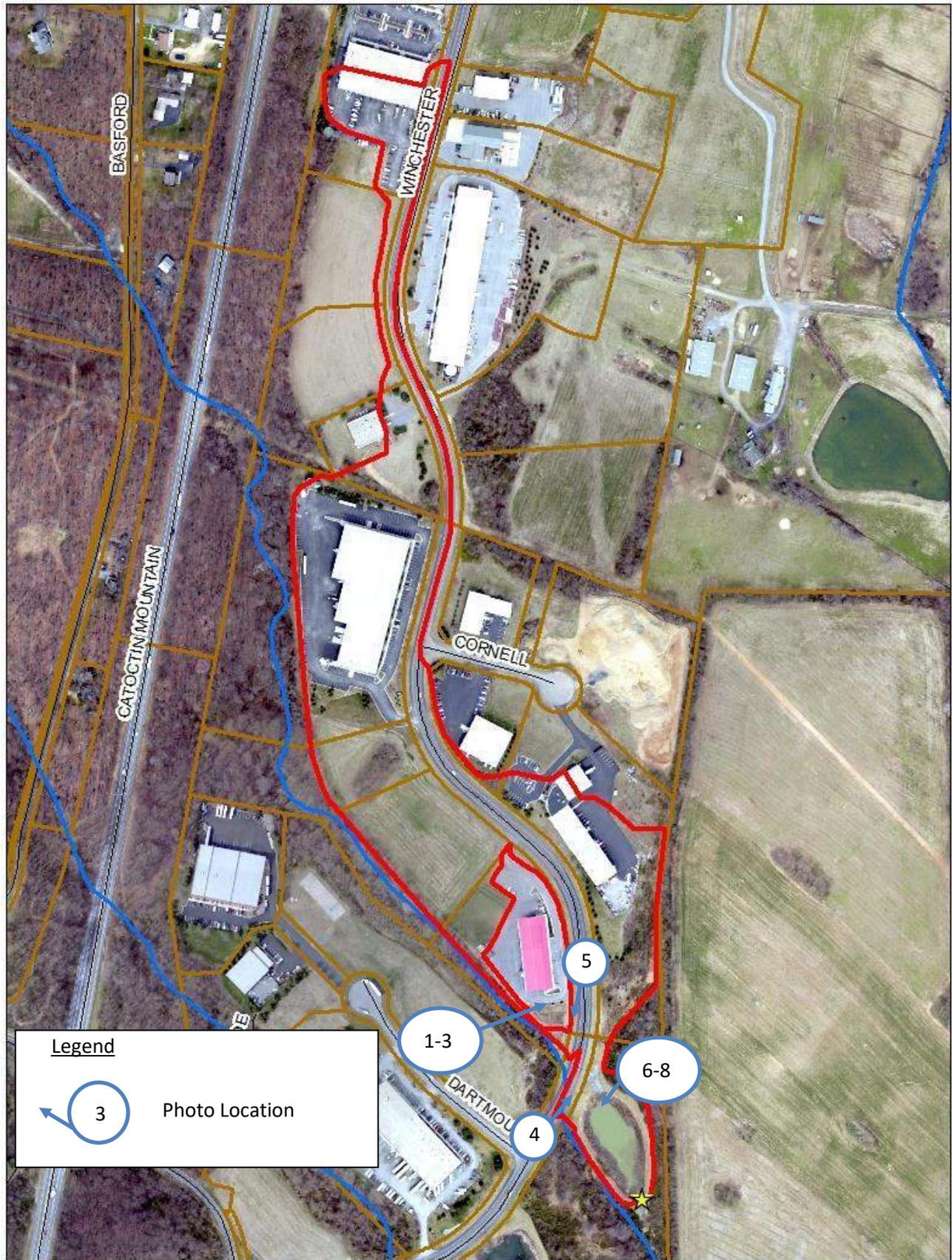
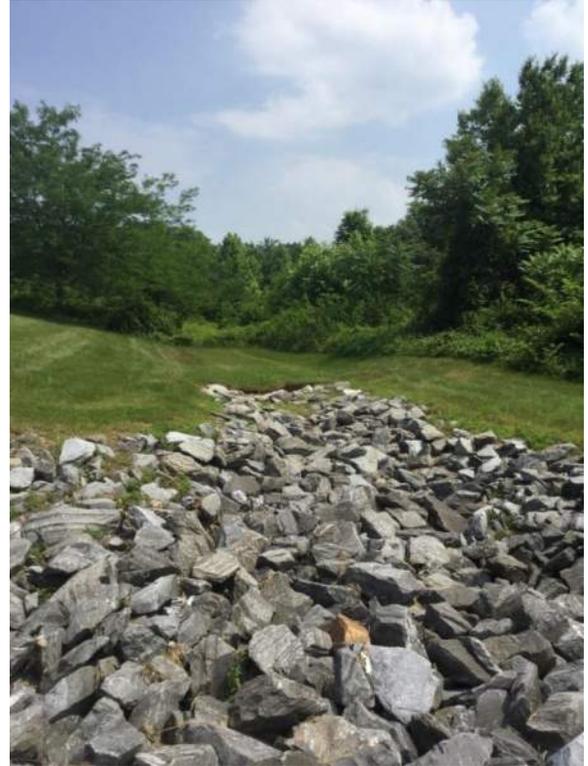


Figure 2: BMP 657 Photo Locations



**Photo 1: View of inflow looking north**



**Photo 2: View of inflow looking east**



**Photo 3: View of inflow channel looking south**



**Photo 4: Overall view of facility**



**Photo 5: Overall view of facility looking south**



**Photo 6: View of existing weir wall**



**Photo 7: View of existing low flow orifice**



**Photo 8: View of outfall channel**

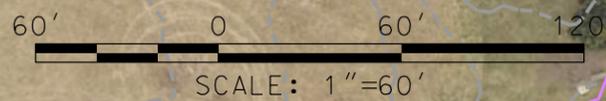
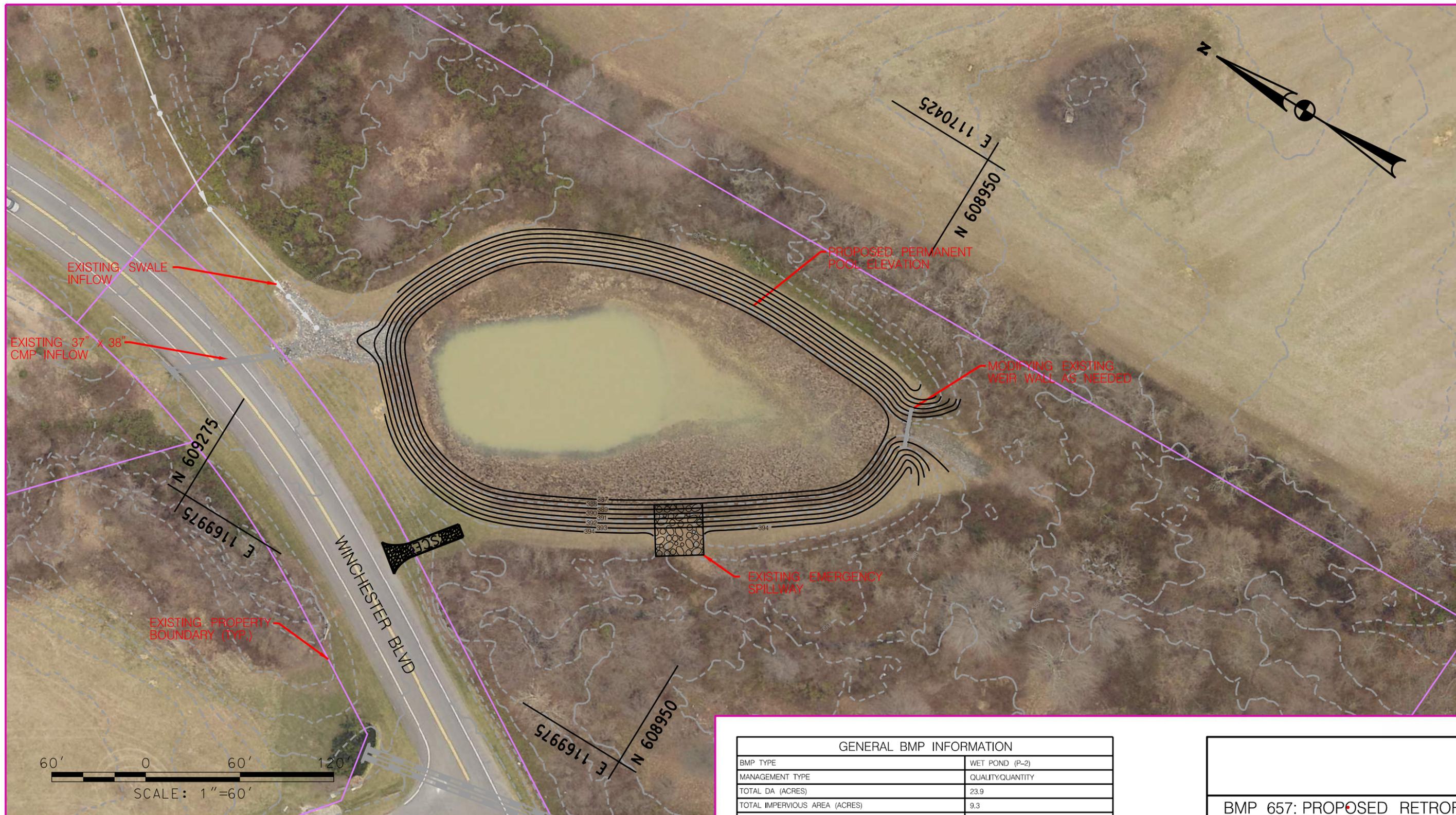


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	12/13/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 657	<b>Year Constructed:</b>	4/27/2000
<b>Structure Name:</b>	Standford Industrial Park, Sec.3, Pond B	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	South of Winchester Street	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.34, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	608,903.9/1,170,252	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, MP
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDJEFFE5

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Wet Pond		Wet Pond
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quality and Quantity		Quality/Quantity
Total Drainage Area (acres):	23.9		23.9
Total Impervious Area within Drainage Area (acres):	9.3		9.3
WQv Required:	Unknown		31,364
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	31,364 cu.ft.      0.72 ac-ft
Total Treated Drainage Area (acres):	23.9	0	23.9
Total Treated Impervious Area within Drainage Area (acres):	9.3	0	9.3
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.93
Total Nitrogen:	N/A		52%
Total Phosphorus:			33%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		152.1
TP (lbs/yr):	0		7.2
TSS (lbs/yr):	0		6717.4

<b>Projected Retrofit Cost:</b>	\$340,863
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GENERAL BMP INFORMATION	
BMP TYPE	WET POND (P-2)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	23.9
TOTAL IMPERVIOUS AREA (ACRES)	9.3
WQv REQUIRED (CU. FT)	31,365
WQv REQUIRED (AC. FT)	0.72
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	31,365
TOTAL TREATED DA (ACRES)	23.9
TOTAL TREATED IMPERVIOUS AREA (ACRES)	9.3

<b>BMP 657: PROPOSED RETROFIT</b>	
SCALE: 1" = 60'	
DESIGNED BY: <u>NCW</u>	COUNTY: <u>FREDERICK</u>
DRAWN BY: <u>NCW</u>	
CHECKED BY: _____	
DRAWING NO. _____	OF _____

**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS



Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations

**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000669  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 65.78 ac  
 Impervious Area: 11.82 ac  
 % Impervious (I): 18%  
 Minimum WQv\*: 1.10 ac-ft

Stream Use: I  
 County: Frederick  
 \*If %IA<15%

Existing RCN: N/A Existing tc: N/A  
 Post Development RCN: N/A Pose Development tc: N/A

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :**

Rainfall Zone: Western Eastern or Western

WQv = Water Quality Volume

$$WQv = (P \times R_v \times A) / 12$$

P = 0.90 inches

$R_v = 0.05 + (0.009)(I)$ ; where

I = 17.97

$R_v = 0.212$

WQv = 1.04 ac-ft  
 45499.51 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	44.07	67%
C	0.13	21.71	33%
D	0.06	0.00	0%

S = 0.2171

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate

$$Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$$

Rev = 0.223 ac/ft  
 9729.8 cu ft

Design Firm:  
Brown and Caldwell

Maryland Environmental Site Design Calculations  
**P-2 Wetpond**

Project: Potomac Direct Watershed Assessment

Project# BMP 000669  
Date 5/22/2019  
Designer: NCW  
Checked  
Practice #

**3. Forebay Sizing:** No forebay in this design

**A. Compute Forebay Sizing :**  
10% WQv  
0.10 **ac-ft**  
4549.951 **cf**

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

FB Check: NOT OK

**4. Storage Volume Comps:**

WQv is only accounted for in the Permanent Pool (\*\* Denotes Permanent Pool Elevation)

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
378.00	81165.00	1.863				0.000	0.00
379.00	84559.00	1.941	1.00	1.902	1.902	1.902	82,862.00
380.00	95930.00	2.202	1.00	2.072	2.072	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50
			0.00	0.000	0.000	3.974	173,106.50

\*\*\*

WQv Check\*\*\*: OK  
10 Yr-Storm Volume (cf): 252775.05  
10 Yr-Storm Check: NOT OK

\*\*\*Includes both permanent and forebay storage.

# BMP #669 – Spring Ridge

**Prioritization Ranking:** 11  
**Planning Level Cost Estimate:** \$271,224  
**Estimated Cost/Impervious Acre:** \$36,652

<u>General BMP Information:</u>	
Structure Location:	Directly off Stanford Ct. cul-de-sac
Northing/Easting:	635,640/1,215,003
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Wet Pond (P-2)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	65.8
Total Impervious Area (ac):	11.8
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	45,500
Total Treated Drainage Area (ac):	65.8
Total Treated Impervious Area (ac):	11.8
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	243.8
TP (lbs/yr):	22.0
TSS (lbs/yr):	11,680.4



Existing site conditions for BMP #669



Site map for BMP #669

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 669 is an extended detention dry pond however the facility has a permanent pool and appears to be a wet pond. The facility was constructed to the south east of the end of Stanford Court. The BMP Database indicates that the original design for BMP# 669 provides water quantity management. The drainage area and impervious area designed for are unknown. The facility appears to be an in-line pond based on findings from the site visit. Further investigation will be necessary.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the end of Stanford Court. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to minimize disruption to property owners.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
JPA Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP #669 is a wet pond (P-2). The proposed retrofit will provide quantity and quality management for a GIS-delineated 65.8-acre drainage area, including 11.8 acres of impervious area. The retrofit concept includes regarding the current pond banks and creating a 10-foot wide vegetated aquatic bench at the base of the permanent pool and an emergency spillway on the southern side of the facility. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# BMP #669 - Spring Ridge, Sec. D-2D, SWM Quality Str. #6

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP #669 is a dry extended detention pond, however it appears the facility is actually a wet pond designed to retain a permanent pool. The facility is located east of the end of Standford Court as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for an unknown drainage area. Figure 1 shows the GIS delineated drainage area for the facility, which encompasses much of the surrounding farm land and some of the impervious area in the nearby business parks.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from the surrounding properties as well as a stream with active base flow.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility currently has a notched concrete weir wall at the eastern end of the facility.

### Embankment:

The facility has a 4-foot vegetated embankment in good condition.

### Outflow:

The facility has an existing notched, concrete weir wall.

### Overall BMP:

Overall, the facility appears to be in good condition but does not meet criteria to treat for water quality as the county does not have the required as-builts.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out of from the end of Standford Court. Construction vehicles will have to mount a curb to reach the facility. Staging and material storage should be placed to minimize disruptions to the residential property owners.

## Proposed Retrofit:

BMP #669 was originally designed as a dry extended detention pond but appears to be a wet pond. The proposed retrofit will provide both water quality and quantity treatment for a GIS delineated 65.8-acre drainage area, including 11.8 acres of impervious surface. The retrofit concept includes minor regrading the existing pond banks to create a vegetated aquatic bench at the base of the permanent pool and construction of an emergency spillway on the southern side of the facility. The current notched weir wall is to remain in place and be modified as necessary to create a permanent pool. These proposed design elements are displayed on the attached **Concept Plan**.

### Step 1: Watershed Factors

BMP #669 is located in the Lingamore Creek – Lower Mainstem subwatershed found in the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

## **Step 2: Terrain Factors**

BMP #669 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The retrofit includes regrading the existing pond banks to create a permanent pool and an aquatic bench, and adding an emergency spillway to the southern side of the facility. The existing notched weir wall is to be modified as necessary. The downstream stream use is I-P so thermal impact are of a limited concern. The facility also appears to be an in-line pond which may limit the amount of work that can be done to the facility.

## **Step 4: Physical Feasibility Factors**

According to the Maryland Stormwater Design Manual, the minimum drainage area for a wet pond is 25 acres. The proposed drainage area to BMP #669 is 65.8 acres, making a wet pond a suitable retrofit. The area is composed of largely B soils with a portion of C soils.

## **Step 5: Community and Environmental Factors**

BMP #669 is located to the southeast of the end of Stanford Court and has moderate visibility. Wet Ponds tend to have low maintenance requirements, high community acceptance, moderate construction costs, and high habitat value.

## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of OID 53 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) JPA Permit



Figure 1: BMP 669 Location Map – Existing Conditions

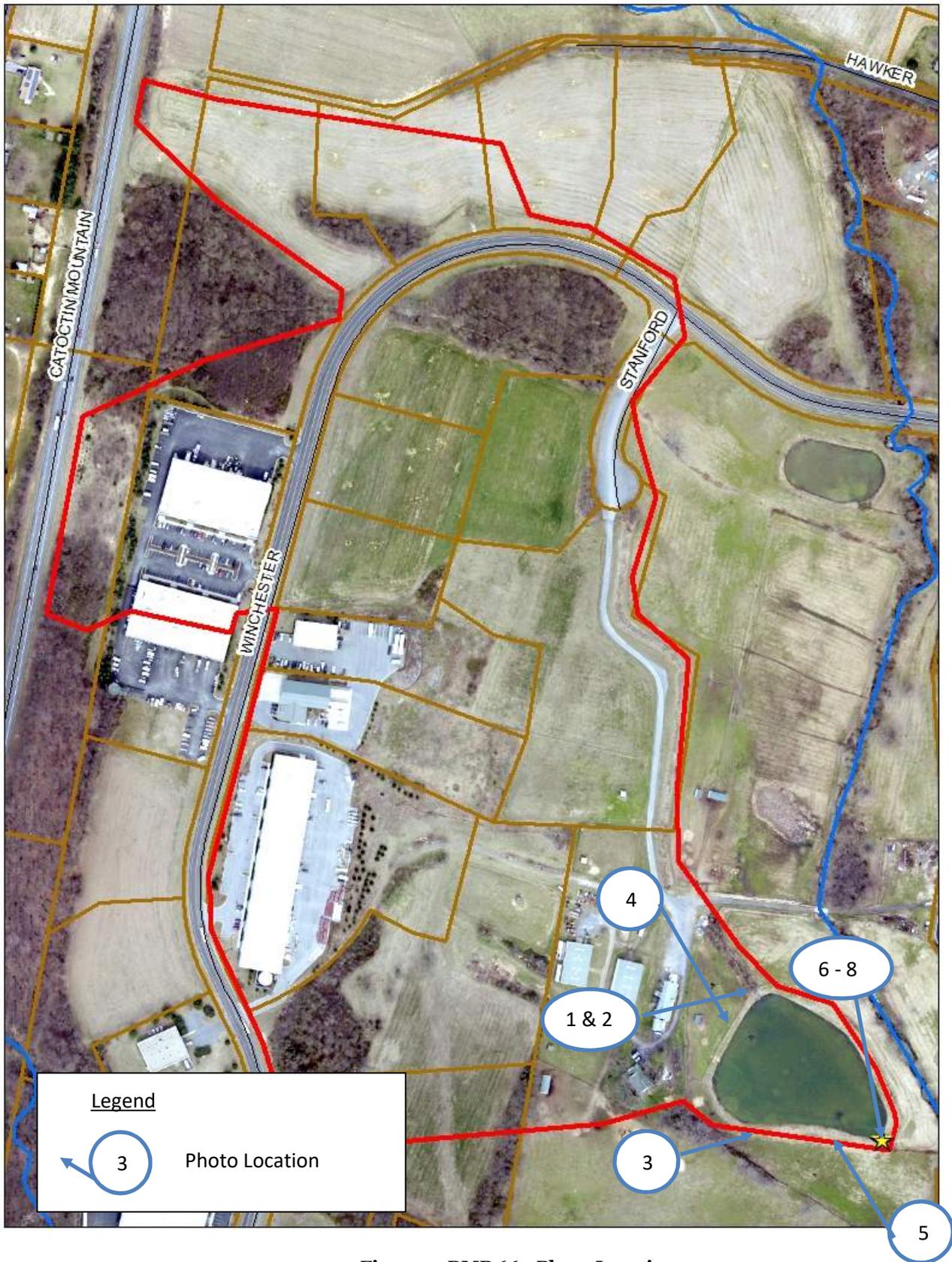
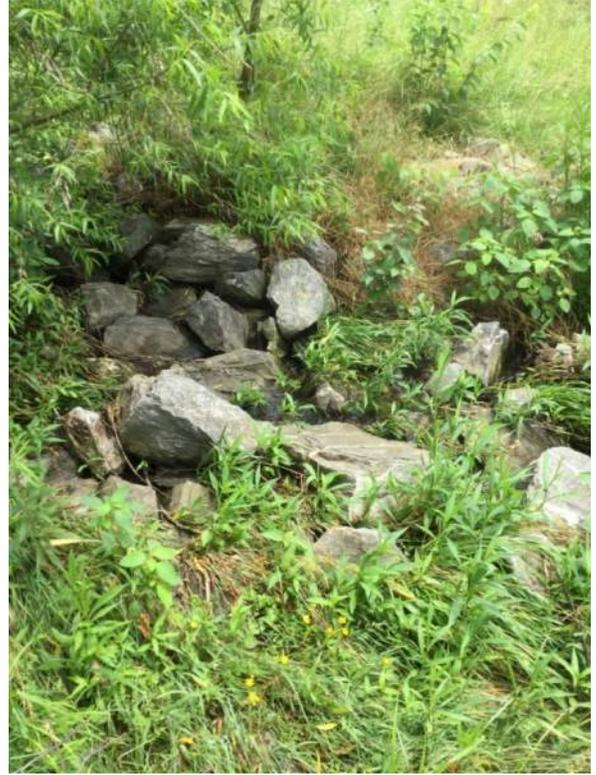


Figure 2: BMP 669 Photo Locations



**Photo 1: View of inflow looking north.**



**Photo 2: View of inflow channel.**



**Photo 3: Overall view of facility looking east .**



**Photo 4: Overall view of facility looking east.**



**Photo 5: Overall view of facility looking west.**



**Photo 6: View of existing weir wall.**



**Photo 7: View of existing weir wall, looking northeast.**



**Photo 8: View of outfall channel .**



Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 669	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Spring Ridge, Sec. D-2D, SWM Quality Str. #6	<b>NPDES Watershed:</b>	Potomac Direct Frederick Couty Watershed
<b>Location:</b>	Directly off Standford Ct. cul-de-sac	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.41, -77.34	<b>Name/#:</b>	
<b>Northing/Easting:</b>	635,640/1,215,003	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/21/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/20/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Wet Pond (P-2)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	N/A		65.8
Total Impervious Area within Drainage Area (acres):	N/A		11.8
WQv Required:	Unknown		45,499
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	45,500 cu.ft.      1.04 ac-ft
Total Treated Drainage Area (acres):	N/A	0	65.8
Total Treated Impervious Area within Drainage Area (acres):	N/A	0	11.8
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.06
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		243.8
TP (lbs/yr):	0		22.0
TSS (lbs/yr):	0		11680.4

<b>Projected Retrofit Cost:</b>	\$271,224
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**GENERAL NOTES:**

1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	WET POND (F-2)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	65.8
TOTAL IMPERVIOUS AREA (ACRES)	11.8
WQv REQUIRED (CU. FT)	45,500
WQv REQUIRED (AC. FT)	1.04
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	45,500
TOTAL TREATED DA (ACRES)	65.8
TOTAL TREATED IMPERVIOUS AREA (ACRES)	11.8

OID 669: PROPOSED RETROFIT

SCALE: 1" = 80'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Brown AND Caldwell**

Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000783  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 4.18 ac Stream Use: I  
 Impervious Area: 0.68 ac  
 % Impervious (I): 16%  
 Minimum WQv\*: 0.07 ac-ft \*If %I<15%  
 Existing RCN: 65 Existing tc: 0.16  
 Post Development RCN: 65 Pose Development tc: 0.16

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A)/12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 16.27  
 $R_v = 0.196$   
 $WQv = 0.06$  ac-ft  
 2682.207 cf

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	2.68	64%
C	0.13	1.50	36%
D	0.06	0.00	0%

S = 0.2132

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  Rev = 0.018 ac/ft  
 775.231 cu.ft

**3. Forebay Sizing:**

Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.02 ac-ft  
 670.55175 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.031044063  
 $W$  (ft/sec) = 0.0004  
 $E' = 2.3$   
 $As$  (sf) = 178.5033594

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2	Af (sf) =	1788.138
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
354.00	2016.00	0.046				0.000	0.00
355.00	2016.00	0.046	1.00	0.046	0.046	0.046	2,016.00
356.00	2016.00	0.046	1.00	0.046	0.046	0.093	4,032.00
357.00	2681.00	0.062	1.00	0.054	0.054	0.146	6,380.50
358.00	3402.00	0.078	1.00	0.070	0.070	0.216	9,422.00
359.00	4180.00	0.096	1.00	0.087	0.087	0.303	13,213.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1008
WQv Check***:	OK	Surface Storage	9181

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #783 – Sunrise, Section II

**Prioritization Ranking:** 18  
**Planning Level Cost Estimate:** \$87,465  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	3260 Sunrise Ct. – At Back of Lot.
Northing/Easting:	599,936/1,154,720
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	4.2
Total Impervious Area (ac):	0.7
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	2,682
Total Treated Drainage Area (ac):	4.2
Total Treated Impervious Area (ac):	0.7
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	15.9
TP (lbs/yr):	1.4
TSS (lbs/yr):	718.3



Existing site conditions for BMP# 783



Site map for BMP# 783

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 783 is a dry extended detention pond. The facility was constructed on the western side of Sunrise Drive. The BMP Database indicates that the original design for BMP# 783 provides water quantity management for a total drainage area of 4.2 acres with 0.7 acres of impervious surface. The drainage area encompasses several surrounding properties and a large portion of Sunrise Drive.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from Sunrise Drive to the east. Basic flagging operations should be considered to safely move construction vehicles on and off the site.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 783 is bioretention practice (F-6). The proposed retrofit will provide quantity and quality management for the original 4.2 acres and 0.7 acres of impervious area. The concept retrofit plan excavating 2’ feet below the existing facility bottom and filled with bioretention mix. The existing concrete riser is to have a perforated PVC underdrain tied in at the base of the filter media. The downstream outfall channel was heavily eroded and incised and is proposed to be regraded and a step pool system created for energy dispersion. It may be possible for the same treatment credit to be achieved by a regenerative stormwater conveyance alone.

# BMP #783– Sunrise, Section II, SWM Basin #1

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 783 is a dry extended detention pond. The facility is located west of Sunrise Drive as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 4.2 acres of total drainage area including 0.7 acres of impervious surface. Figure 1 shows the drainage area for the facility, which encompasses several nearby properties and a large portion of Sunrise Drive.

## General Observations:

A site visit was conducted on June 19, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding property, and three grass swale inflows.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. Some of the riprap was displaced and had vegetation growing in it.

### Embankment:

The facility has a 4-foot vegetated embankment in good condition.

### Outflow:

The facility outfalls to an eroded stream channel and has been targeted for a potential step pool system.

### Overall BMP:

Overall, the facility appears to be in moderate condition. The facility was graded unevenly, was ponding during the time of the site visit and has become overgrown.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and for hauling material in and out from Sunrise Drive. Basic flagging operations should be considered to protect construction vehicles entering and leaving the site. The area has steep slopes, so a longer stabilized construction entrance should be considered.

## Proposed Retrofit:

BMP #783 was originally designed as a dry detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 4.2 acres, including 0.7 acres of impervious surface. The concept retrofit plan includes excavating 2 feet below the existing facility bottom and filling with 2 feet of bioretention mix. The grass swale inflows will have riprap for energy dispersion due to their steep slopes. A proposed emergency spillway will be constructed on the northern side of the facility. The existing concrete riser will remain in place and a perforated PVC underdrain will be installed at the base of the filter media. The downstream outfall channel will be graded as a step pool system, slowly widening as it progresses downstream for energy dispersion as it flows into the downstream stream. These proposed design elements are displayed on the attached **Concept Plan**.

Alternatively, it may be possible to achieve full treatment credit from a regenerative stormwater conveyance alone. This should be considered an option during the final design process.

### **Step 1: Watershed Factors**

BMP #783 is located in the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

### **Step 2: Terrain Factors**

BMP #783 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit includes excavation to two feet below the existing facility bottom and installation of bioretention mix. The existing concrete riser is to remain in place and a perforated PVC underdrain tied in with an emergency spillway installed on the northern side of the facility. The outfall channel is to be regraded and riprap added to create a step pool system. The downstream stream use is I-P so thermal impacts are not a concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #630 is 4.2 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres, so a bioretention is a suitable practice for this site. The area surrounding the BMP is steep and there is a forest conservation area to the northwest of the facility. Impacts to the conservation area should be avoided completely.

### **Step 5: Community and Environmental Factors**

BMP #783 is located just west of Sunrise Drive and has moderate visibility. Bioretention practices tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #783 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit





Figure 2: BMP 783 Photo Locations



**Photo 1: View of eastern grass swale inflow.**



**Photo 2: View of southern grass swale inflow.**



**Photo 3: View of western grass swale inflow.**



**Photo 4: View of existing concrete riser.**



**Photo 5: Overall view of facility looking east.**



**Photo 6: View of facility CMP outfall.**



**Photo 7: View of outfall channel targeted for step pool system.**

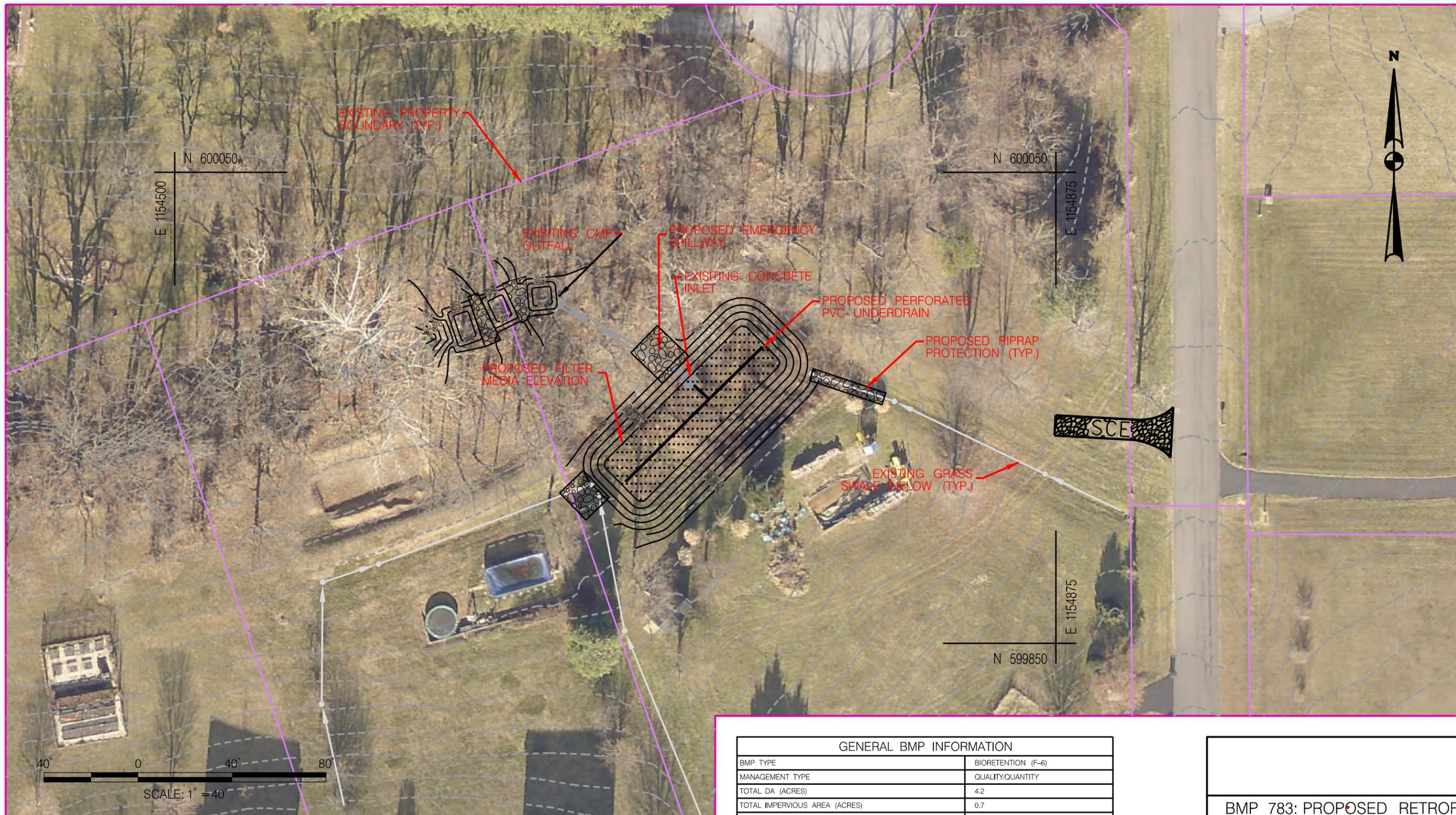


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/19/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 783	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Sunrise, Section II, SWM Basin #1	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	3260 Sunrise Ct. - At Back of Lot.	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.31, -77.56	<b>Name/#:</b>	
<b>Northing/Easting:</b>	599,936/1,154,720	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
		<b>Maintenance Owner:</b>	
		<b>Inspection Date:</b>	06/19/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/11/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	4.2		4.2
Total Impervious Area within Drainage Area (acres):	0.7		0.7
WQv Required:	Unknown		2,980
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	2,682 cu.ft.      0.07 ac-ft.
Total Treated Drainage Area (acres):	4.2	0	4.2
Total Treated Impervious Area within Drainage Area (acres):	0.7	0	0.7
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			1.09
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		15.9
TP (lbs/yr):	0		1.4
TSS (lbs/yr):	0		718.3

<b>Projected Retrofit Cost:</b>	\$87,465
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**GENERAL NOTES:**  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

**Brown AND Caldwell**

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	4.2
TOTAL IMPERVIOUS AREA (ACRES)	0.7
WQv REQUIRED (CU. FT)	2,682
WQv REQUIRED (AC. FT)	0.07
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	2,682
TOTAL TREATED DA (ACRES)	4.2
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.7

**BMP 783: PROPOSED RETROFIT**

SCALE: 1" = 40'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000784  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 2.19 ac Stream Use: I  
 Impervious Area: 0.45 ac  
 % Impervious (I): 21%  
 Minimum WQv\*: 0.04 ac-ft \*If %I < 15%  
 Existing RCN: 68 Existing tc: 0.1  
 Post Development RCN: 68 Pose Development tc: 0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 20.55  
 $R_v = 0.235$   
**WQv = 0.04 ac-ft**  
**1680.8715 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	1.40	64%
C	0.13	0.79	36%
D	0.06	0.00	0%

S = 0.2132

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$   
**Rev = 0.014 ac/ft**  
**613.633 cu.ft**

**3. Forebay Sizing:**

Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.01 ac-ft  
 420.21788 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.019454531  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 111.8635547$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	2	Af (sf) =	1120.581
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
350.00	1420.00	0.033				0.000	0.00
351.00	1420.00	0.033	1.00	0.033	0.033	0.033	1,420.00
352.00	2410.00	0.055	1.00	0.044	0.044	0.077	3,335.00
353.00	1980.00	0.045	1.00	0.050	0.050	0.127	5,530.00
354.00	2811.00	0.065	1.00	0.055	0.055	0.182	7,925.50
			0.00	0.000	0.000	0.182	7,925.50
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	1382.5
WQv Check***:	OK	Surface Storage	2395.5

\*\*\*Includes forebay, subsurface, and surface storage

# BMP #784 – Sunrise, Section II

**Prioritization Ranking:** 18  
**Planning Level Cost Estimate:** \$62,475  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Behind the houses off Sunrise Court Cul-de-sac
Northing/Easting:	559,607/1,154,209
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	2.2
Total Impervious Area (ac):	0.5
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	1,681
Total Treated Drainage Area (ac):	2.2
Total Treated Impervious Area (ac):	0.5
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	8.5
TP (lbs/yr):	0.8
TSS (lbs/yr):	421.6



Existing site conditions for BMP# 784



Site map for BMP# 784

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 784 is an extended detention dry pond. The facility was constructed west of the end of Sunrise Drive. The BMP Database indicates that the original design for BMP# 784 provides water quantity management for a total drainage area BMP of 2.2 acres with 0.5 acres of impervious surface. The drainage area encompasses several of the adjacent properties and a portion of sunrise drive.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the western end of Sunrise Drive. Basic flagging operations should be used to safely move construction vehicles on and off the site.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 784 is a bioretention practice (F-6). The proposed retrofit will provide quantity and quality management for the original 2.2 acres and 0.5 acres of impervious area. The concept retrofit includes excavating two feet below the existing pond surface and back filling with 2 feet of bioretention mix. The existing concrete riser is to remain in place and a perforated PVC underdrain is to be tied in at the base of the filter media. The area south of the facility is a forest conservation area which should not be impacted.

## BMP #784– Sunrise, Section II, SWM Basin #2

### Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County’s Urban BMP Database (BMP Database), BMP # 784 is a dry extended detention pond. The facility is located west of the end of Sunrise Drive as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 2.2 acres of total drainage area including 0.5 acres of impervious surface. Figure 1 shows the drainage area for the facility, which encompasses several nearby properties and a large portion of Sunrise Drive.

### General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

#### Inflow:

Inflow to the facility consists of sheet flow from surrounding property, and three grass swale inflows.

#### Pretreatment:

This facility does not have a forebay or pretreatment section.

#### Control Structure and Spillways:

The facility has an existing concrete riser with a low flow pipe covered in a stone jacket. Some of the riprap was displaced and had vegetation growing in it.

#### Embankment:

The facility has a 4-foot vegetated embankment in good condition.

#### Outflow:

The facility has outfall to a grass swale located in a forest conservation area.

#### Overall BMP:

Overall, the facility appears to be in good condition but does not meet criteria to treat for water quality.

### Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from Sunrise Drive. Basic flagging operations should be considered to protect construction vehicles entering and leaving the site. The area has steep slopes so a longer stabilized construction entrance should be considered.

### Proposed Retrofit:

BMP #784 was originally designed as a dry extended detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 2.2 acres, including 0.5 acres of impervious. The concept retrofit plan includes excavation to 2 feet below the existing facility bottom and filling with 2 feet of bioretention mix. The grass swale inflows will have riprap for energy dispersion due to their steep slopes. The existing concrete riser is to remain in place and a perforated PVC underdrain will be installed at the base of the filter media. These proposed design features are displayed on the attached **Concept Plan**.

#### **Step 1: Watershed Factors**

BMP #784 is located in the Potomac Direct Frederick County 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

#### **Step 2: Terrain Factors**

BMP #784 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No

special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit includes excavation to two feet below the existing facility bottom and installation of bioretention mix. The existing concrete riser is to remain in place with a perforated PVC underdrain tied in, and an emergency spillway will be constructed on the northern side of the facility. The downstream stream use is I-P so thermal impacts are not a concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #734 is 5.2 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres, so a bioretention practice is suitable for this site. The area surrounding the BMP is steep and there is a forest conservation area to the south of the facility. Impacts to the conservation area should be avoided completely.

### **Step 5: Community and Environmental Factors**

BMP #784 is located just west of Sunrise Drive and has moderate visibility. Bioretention practices tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #783 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



Figure 1: BMP Location Map – Existing Conditions

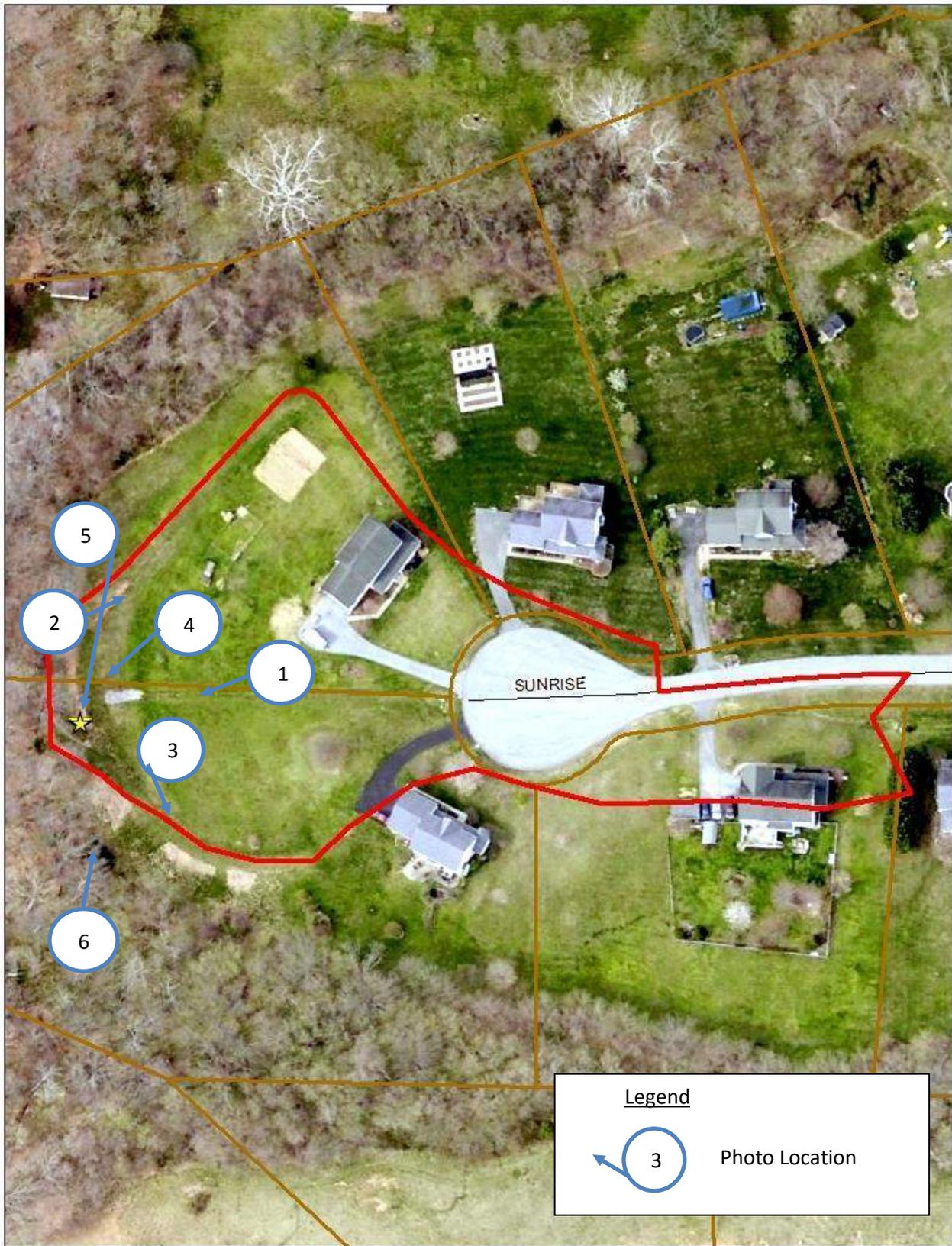


Figure 2: BMP 784 Photo Locations



**Photo 1: View of eastern grass swale inflow.**



**Photo 2: View of northern grass swale inflow.**



**Photo 3: View of southern grass swale inflow.**



**Photo 4: Overall view of facility looking southwest.**



**Photo 5: View of facility existing concrete riser.**



**Photo 6: View facility CMP outfall.**

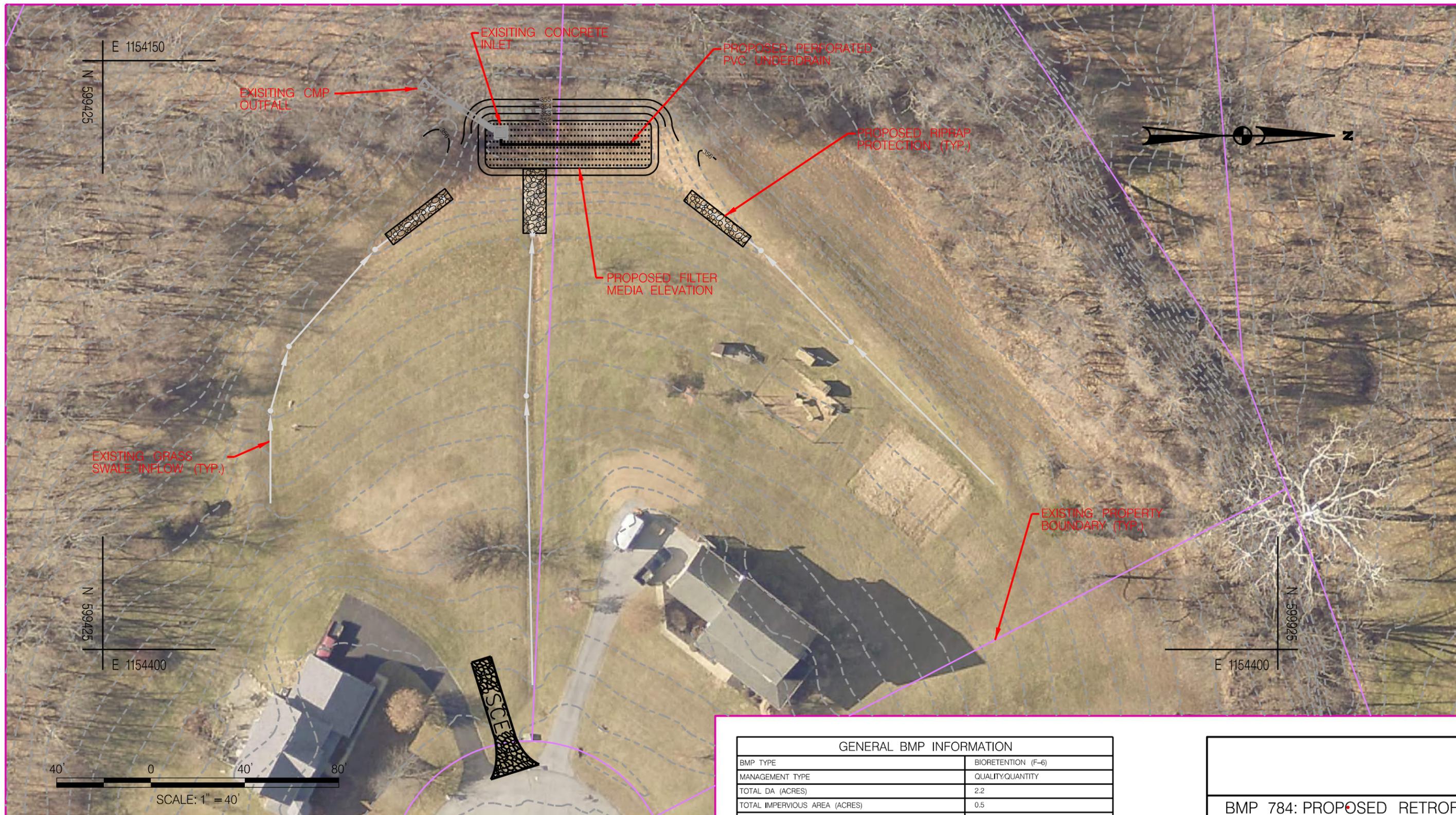


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 784	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Sunrise, Section II, SWM Basin #2	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Behind the houses off Sunrise Court Cul-de-sac.	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.31, -77.56	<b>Name/#:</b>	
<b>Northing/Easting:</b>	559,607/1,154,209	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	III-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/18/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/11/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	2.2		2.2
Total Impervious Area within Drainage Area (acres):	0.5		0.5
WQv Required:	Unknown		1,868
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
<b>Estimated Treatment Provided</b>	<b>Per Design</b>	<b>Per MDE 2000 Standards</b>	
WQv Provided:	Unknown	0	1,681 cu.ft.      0.04 ac-ft
Total Treated Drainage Area (acres):	2.2	0	2.2
Total Treated Impervious Area within Drainage Area (acres):	0.5	0	0.5
<b>Estimated Pollutant Removal Rates</b>			
Runoff Volume Treated per Impervious Acre (in.)			1.03
Total Nitrogen:	N/A		68%
Total Phosphorus:			59%
Sediment:			73%
<b>Estimated Pollutant Load Reduction</b>			
TN (lbs/yr):	0		8.5
TP (lbs/yr):	0		0.8
TSS (lbs/yr):	0		421.6

<b>Projected Retrofit Cost:</b>	\$124,950
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	2.2
TOTAL IMPERVIOUS AREA (ACRES)	0.5
WQv REQUIRED (CU. FT)	1,681
WQv REQUIRED (AC. FT)	0.04
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	1,681
TOTAL TREATED DA (ACRES)	2.2
TOTAL TREATED IMPERVIOUS AREA (ACRES)	0.5

BMP 784: PROPOSED RETROFIT  
 SCALE: 1" = 40'  
 DESIGNED BY: NCW COUNTY: FREDERICK  
 DRAWN BY: NCW  
 CHECKED BY: \_\_\_\_\_  
 DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_



Design Firm: Maryland Environmental Site Design Calculations Project# BMP 000800  
 Brown and Caldwell F-6 Bioretention Date 10/10/2018  
 Project: Potomac Driect Watershed Assessment Designer: NCW  
 Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): 2.86 ac Stream Use: I  
 Impervious Area: 1.26 ac  
 % Impervious (I): 44%  
 Minimum WQv\*: 0.05 ac-ft \*If %I<15%  
 Existing RCN: 82 Existing tc: 0.1  
 Post Development RCN: 82 Pose Development tc: 0.1

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: Western Eastern or West  
 WQv = Water Quality Volume BMP Type: Bioretention  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = 44.06  
 $R_v = 0.447$   
**WQv = 0.10 ac-ft**  
**4171.959 cf**

**2. Compute Recharge Volume Requirement\*\***

\*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.00	0%
B	0.26	1.83	64%
C	0.13	0.51	18%
D	0.06	0.51	18%

S = 0.2006

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  **Rev = 0.071 ac/ft**  
**3072.517 cu.ft**

**3. Forebay Sizing:**

Stone diaphragm and grass strip implemented

**A. Compute Forebay Sizing :**

25% WQv:  
 0.02 ac-ft  
 1042.9898 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.048286563  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 277.6477344$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
						0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00
			0.00	0.000	0.000	0.000	0.00

WQv: NOT OK As: NOT OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) = 2                      Af (sf) = 2781.306  
k (ft/day) = 0.5  
hf (ft) = 1  
tf (days) = 2                      Af Check: OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
334.00	2800.00	0.064				0.000	0.00
335.00	2800.00	0.064	1.00	0.064	0.064	0.064	2,800.00
336.00	2800.00	0.064	1.00	0.064	0.064	0.129	5,600.00
337.00	3358.00	0.077	1.00	0.071	0.071	0.199	8,679.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check: NOT OK                      Subsurface Storage                      1400  
WQv Check\*\*\*: OK                                      Surface Storage                              3079

\*\*\*Includes forebay, subsurface, and surface storage

# BMP# 800 – Canal Run, Townhouse Ph. 1T- ED Facility

**Prioritization Ranking:** 12  
**Planning Level Cost Estimate:** \$162,435  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	Off Swains Lock Ct.- Near Ballenger Creek Pk
Northing/Easting:	589,635/1,162,100
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	2.9
Total Impervious Area (ac):	1.3
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	4,172
Total Treated Drainage Area (ac):	2.9
Total Treated Impervious Area (ac):	1.3
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	12.1
TP (lbs/yr):	1.5
TSS (lbs/yr):	879.7



Existing site conditions for BMP# 800



Site map for BMP# 800

## EXISTING SITE CONDITIONS

According to Frederick County’s Urban BMP Database (BMP Database), BMP# 800 is an extended detention dry pond. The facility was constructed on the western side of Ballenger Creek Pike in the southeastern corner of the Canal Run Townhome Development. The BMP Database indicates that the original design for BMP# 800 provides water quantity management and the total drainage area for the BMP is 2.9-acre drainage area, including 1.3 acres of impervious. The drainage area encompasses the majority of the Canal Run Townhouses.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the Canal Run Parking lot. No Maintenance of Traffic (MOT) will be required, and the staging area will be planned to not interfere with the residents of Canal Run.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X

## PROPOSED RETROFIT

The proposed retrofit for BMP# 800 is a bioretention practice (F-6). The proposed retrofit will provide quantity and quality management for the original 2.9-acre drainage area including the 1.3 acres of impervious surface. The concept retrofit plan includes redirecting the current storm drain configuration to flow directly into BMP #800. The banks will be regraded and the bottom 2 feet of the facility will be filled with bioretention mix. A concrete riser will be installed on the northern side of the facility with a perforated PVC underdrain tied in. The proposed outfall will be to the northeast of the facility to an unnamed tributary. The stream the facility outfalls to a use I-P stream so thermal impacts are not a concern.

# BMP #800 - Canal Run, Townhouse Ph. 1T - ED Facility

## Existing Site Conditions:

**SWM Era:** 1985-2002

According to Frederick County's Urban BMP Database (BMP Database), BMP # 800 is a dry extended detention pond. The facility is located on the western side of Ballenger Creek Pike as shown in the BMP Location map (see **Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 2.9 acres of total drainage area, including 1.3 acres of impervious surface. Figure 1 shows the drainage area for the facility, which encompasses a large portion of the nearby Canal Run Townhomes.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding property and according to Frederick County provided as-builts, an 8-inch PVC inflow pipe that could not be located during the site visit.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has no notable control structures that were visible during the site visit or shown on the as-builts.

### Embankment:

The facility has a 2-foot vegetated embankment in moderate condition.

### Outflow:

The facility has no outfall structure.

### Overall BMP:

Overall, the facility appears to be in poor condition with limited ground cover and large amounts of debris and does not meet criteria to treat for water quality.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from the Canal Run Townhomes Parking lot. Construction vehicles will have to mount a curb to reach the facility. Staging and material storage will need to be placed to minimize disturbance to the residents of the Canal Run Townhomes.

## Proposed Retrofit:

BMP #800 was originally designed as a dry detention pond. The proposed retrofit will provide both water quality and quantity treatment for the originally designed 2.9 acre drainage area, including 1.3 acres of impervious surface. The concept retrofit plan includes reconfiguration of the existing storm drain system so that flow is directed to BMP #800. The facility's banks will be regraded and the bottom two feet of the facility will be filled with bioretention mix. A concrete riser will be installed on the northern side of the facility with a perforated PVC underdrain at the base of the media. The facility's proposed outfall will be to the northeast to an unnamed tributary. These proposed design elements are displayed on the attached **Concept Plan**.

Alternatively, some or all of the proposed treatment credit can potentially be met through Filtera systems installed at the curb inlets collecting sheet flow from the surrounding parking lot. Filteras should be considered during the final design process.

### Step 1: Watershed Factors

BMP #800 is located in the Potomac Direct 8-digit watershed (02140301). The Stream Use Designation for the downstream waterbody is Use I-P.

## **Step 2: Terrain Factors**

BMP #800 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

## **Step 3: Stormwater Treatment Suitability**

The proposed retrofit includes reconfiguration of the existing storm drain system to serve as the inflow for BMP #800. The facility's banks will be regraded and the bottom two feet of the facility will be filled with bioretention mix. A concrete riser will be installed and connected to a perforated PVC underdrain at the base of the filter media, with the facility outfall discharging to the northeast. The downstream stream use is I-P so thermal impacts are not a concern.

## **Step 4: Physical Feasibility Factors**

The proposed drainage area to BMP #800 is 2.9 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres, so a bioretention is a suitable practice for this area.

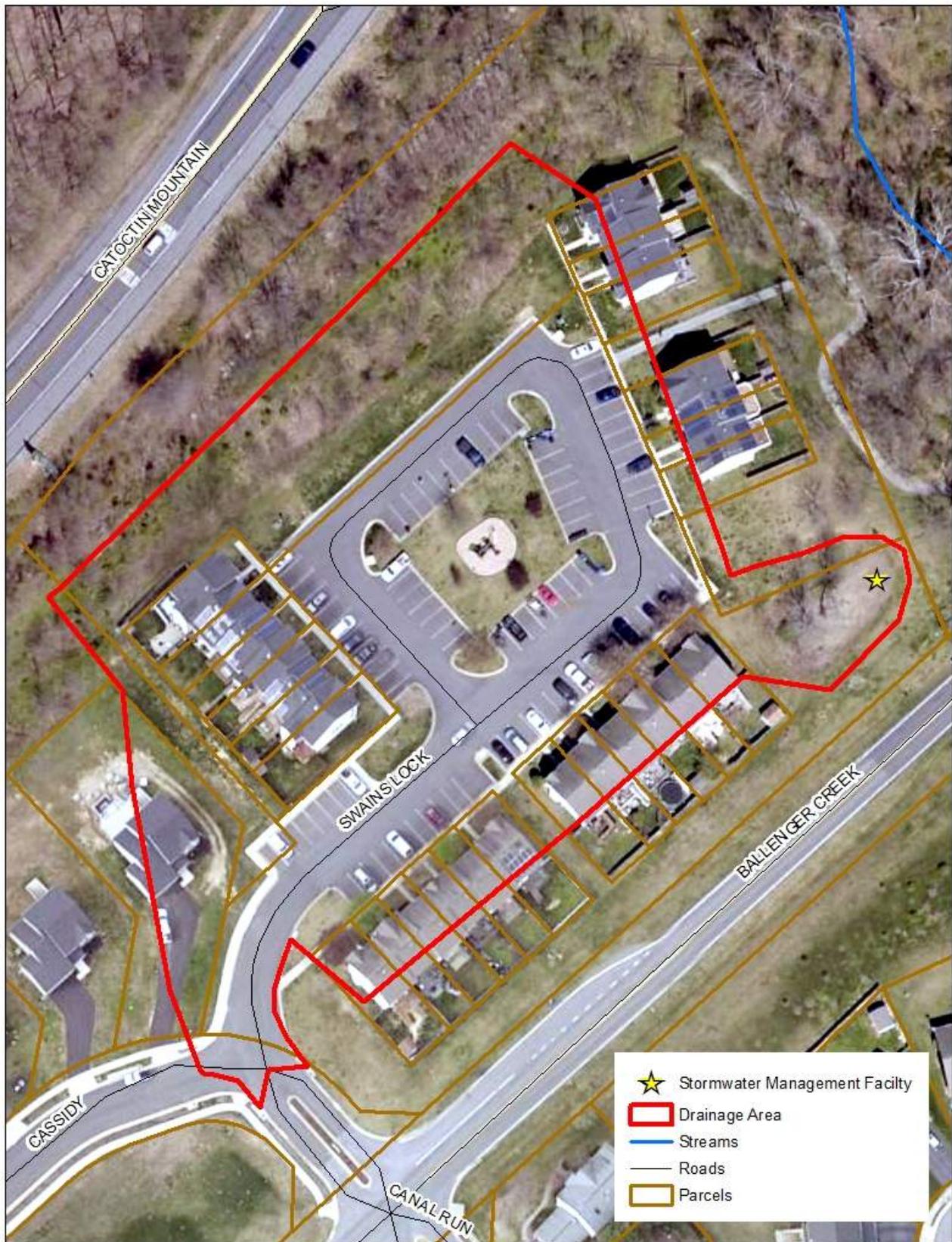
## **Step 5: Community and Environmental Factors**

BMP #800 is located on the western side of Ballenger Creek Pike and has moderate visibility. Bioretention practices tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

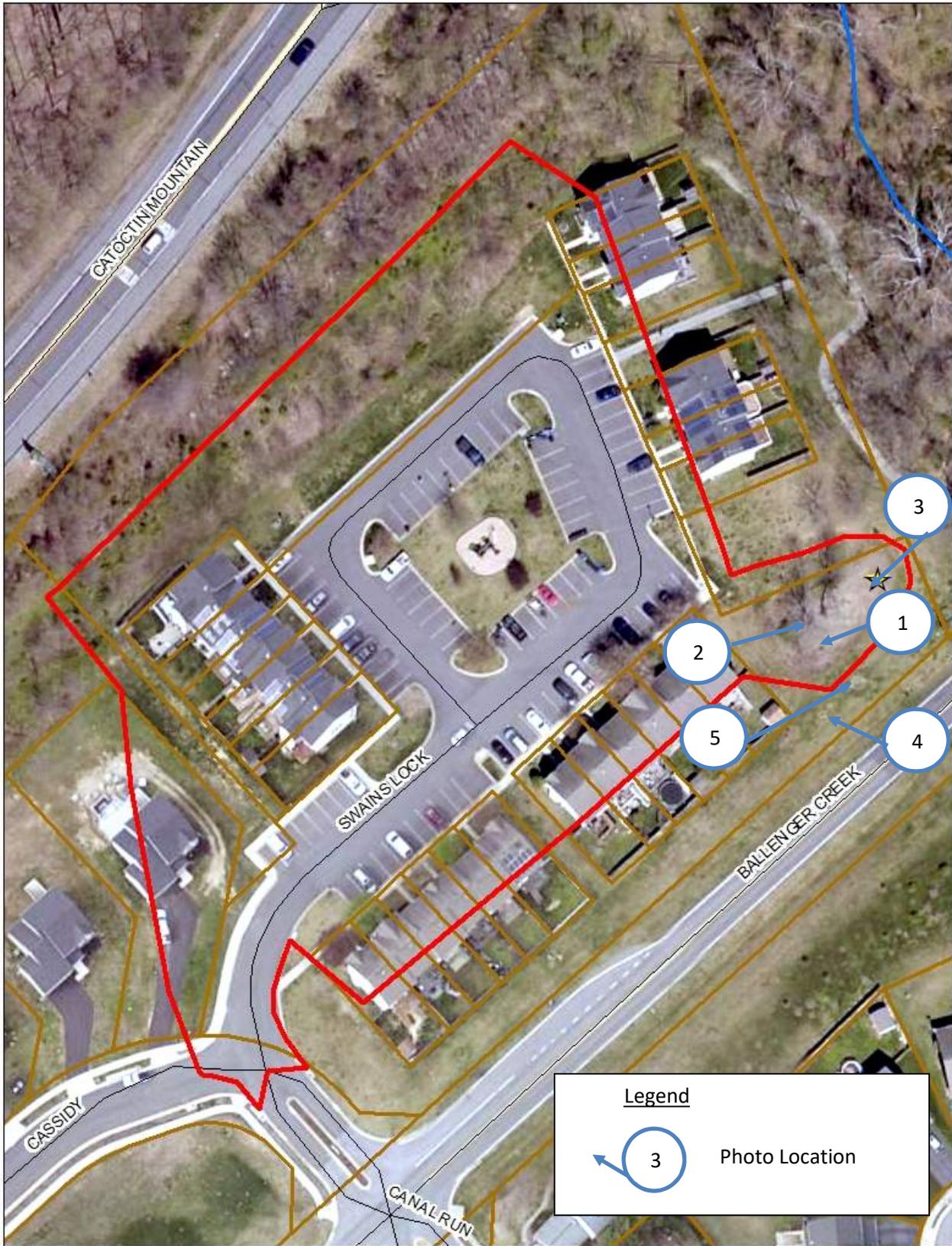
## **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #800 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit



**Figure 1: BMP 800 Location Map – Existing Conditions**



**Figure 2: BMP 800 Photo Locations**



**Photo 1: View of assumed inflow location.**



**Photo 2: Overall view of facility looking north.**



**Photo 3: Overall view of facility looking south.**



**Photo 4: View of stormdrain manhole connection east of the facility.**



**Photo 5: View of roadside swale east of the facility.**

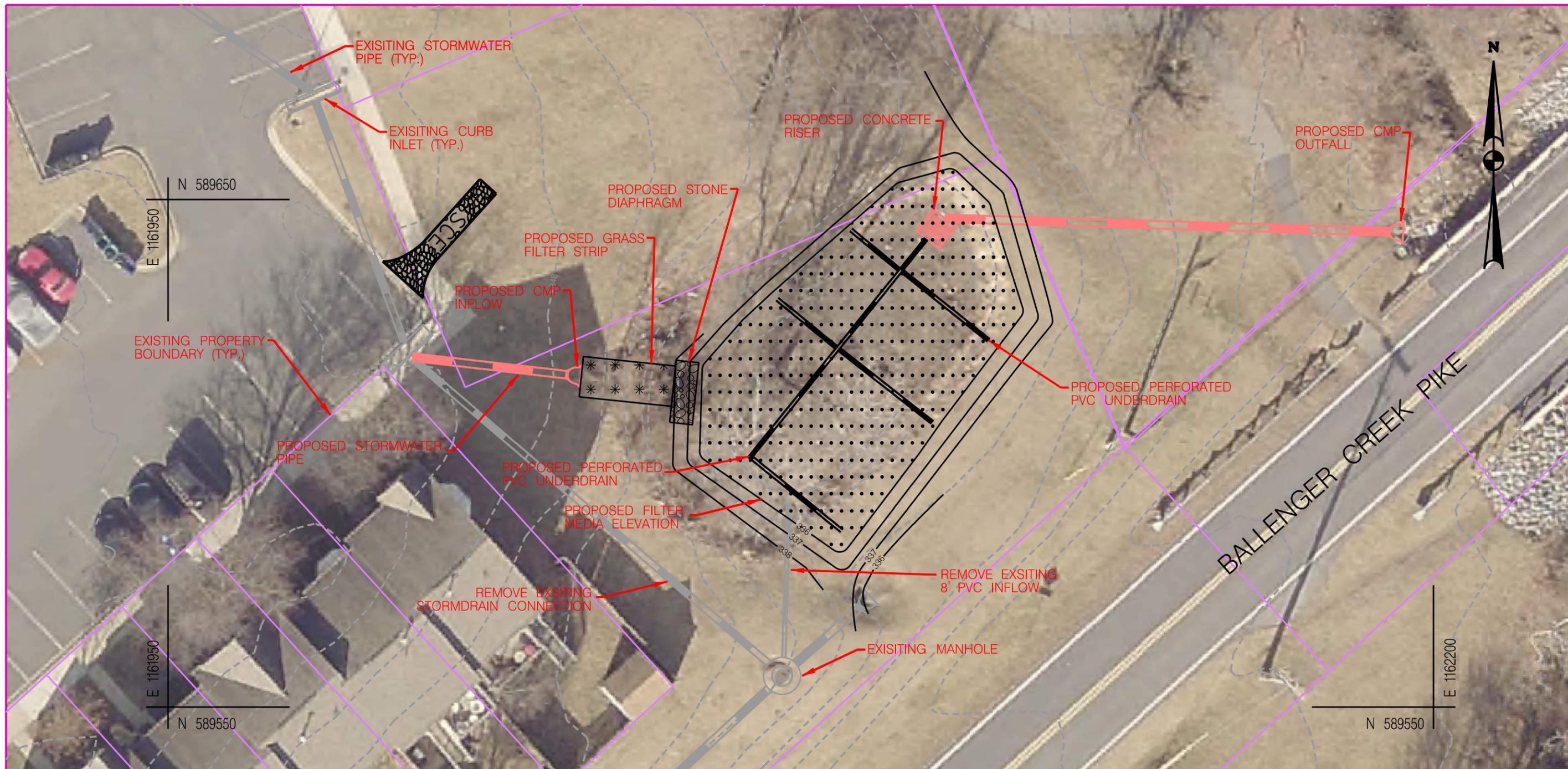


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/18/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	BMP 800	<b>Year Constructed:</b>	10/6/1994
<b>Structure Name:</b>	Canal Run, Townhouse Ph. 1T - ED Facility	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	Off Swains Lock Ct. - Near Ballenger Creek Pk	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.28, -77.53	<b>Name/#:</b>	
<b>Northing/Easting:</b>	589,635/1,162,100	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>		<b>Inspection Date:</b> 06/18/2018	
		<b>Inspection Team:</b> NW, KK	
		<b>Last Significant Rainfall:</b> 06/11/2018	
		<b>Rainfall Source:</b> www.wunderground.com	
		<b>Station:</b> KMDDOUBS2	

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	Dry Extended Detention		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	Quantity		Quality/Quantity
Total Drainage Area (acres):	2.9		2.9
Total Impervious Area within Drainage Area (acres):	1.3		1.3
WQv Required:	Unknown		4,172
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	4,172 cu.ft. .10 ac-ft
Total Treated Drainage Area (acres):	2.9	0	2.9
Total Treated Impervious Area within Drainage Area (acres):	1.3	0	1.3
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.91
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		12.1
TP (lbs/yr):	0		1.5
TSS (lbs/yr):	0		879.7

<b>Projected Retrofit Cost:</b>	\$162,435
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**GENERAL NOTES:**

1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY/QUANTITY
TOTAL DA (ACRES)	2.9
TOTAL IMPERVIOUS AREA (ACRES)	1.3
WQv REQUIRED (CU. FT)	4,171
WQv REQUIRED (AC. FT)	0.1
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	4,171
TOTAL TREATED DA (ACRES)	2.9
TOTAL TREATED IMPERVIOUS AREA (ACRES)	1.3

**BMP 800: DRY POND RETROFIT**

SCALE: 1" = 20'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_



Design Firm: Maryland Environmental Site Design Calculations Project# **OID 55**  
**F-6 Bioretention** Date **10/10/2018**  
 Brown and Caldwell Designer: **NCW**  
 Project: **Potomac Driect Watershed Assessment** Checked  
 Practice #

**Drainage Area Data**

Contributing Drainage Area to Practice (A): **2.55** ac Stream Use: **I**  
 Impervious Area: **1.02** ac  
 % Impervious (I): **40%**  
 Minimum WQv\*: **0.04** ac-ft \*If %I < 15%  
 Existing RCN: N/A Existing tc: N/A  
 Post Development RCN: N/A Pose Development tc: N/A

**1. Compute Target Sizing Requirements:**

**A. Compute WQv for Drainage Area to Practice :** Rainfall Zone: **Western** Eastern or West  
 WQv = Water Quality Volume BMP Type: **Bioretention**  
 $WQv = (P \times R_v \times A) / 12$   
 P = 0.90 inches  
 $R_v = 0.05 + (0.009)(I)$ ; where I = **40.00**  
 $R_v = 0.410$   
**WQv = 0.08 ac-ft**  
**3415.6485 cf**

**2. Compute Recharge Volume Requirement\*\*** \*\* Included in WQv

**A. Compute Recharge Factor (S)**

HSG	S	Acres	% of DA
A	0.38	0.36	14%
B	0.26	1.73	68%
C	0.13	0.46	18%
D	0.06	0.00	0%

S = 0.2534

**B. Compute Recharge Volume (Rev)**

Rev = Recharge rate  
 $Rev = \frac{(S \times R_v \times A)}{12 \text{ in/ft}}$  **Rev = 0.066 ac/ft**  
**2885.084 cu.ft**

**3. Forebay Sizing:**

**A. Compute Forebay Sizing :**

25% WQv:  
 0.02 ac-ft  
 853.91213 cf

**B. Sedimentation Surface Area**

$As = (Qo/W) \times E'$   
 $Qo = WQv/;$  0.039532969  
 $W \text{ (ft/sec)} = 0.0004$   
 $E' = 2.3$   
 $As \text{ (sf)} = 227.3145703$

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
396.00	725.00	0.017				0.000	0.00
397.00	1100.00	0.025	1.00	0.021	0.021	0.021	912.50
			0.00	0.000	0.000	0.021	912.50
			0.00	0.000	0.000	0.021	912.50
			0.00	0.000	0.000	0.021	912.50
			0.00	0.000	0.000	0.021	912.50

WQv: OK As: OK

**4. Filter Surface Area:**

**A. Compute Filter Bed Area :**

$$A_f = WQv(df)/[(k)(hf+df)(tf)]$$

df (ft) =	4	Af (sf) =	2732.5188
k (ft/day) =	0.5		
hf (ft) =	1		
tf (days) =	2	Af Check:	OK

**5. Storage Computation**

Porosit (n) 0.25

Elevation (ft)	Area (sf)	Area (acre)	Change (ft)	Average Area (acre)	Incremental Volume (ac/ft)	Cumulative Volume (ac/ft)	Cumulative Volume (cf)
384.00	3150.00	0.072				0.000	0.00
385.00	3150.00	0.072	1.00	0.072	0.072	0.072	3,150.00
386.00	3150.00	0.072	1.00	0.072	0.072	0.145	6,300.00
387.00	3150.00	0.072	1.00	0.072	0.072	0.217	9,450.00
388.00	3150.00	0.072	1.00	0.072	0.072	0.289	12,600.00
389.00	3862.00	0.089	1.00	0.080	0.080	0.370	16,106.00
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		
			0.00	0.000	0.000		

Filter Media  
Top of Grade

75% Storage Check:	OK	Subsurface Storage	3150
WQv Check***:	OK	Surface Storage	3506

\*\*\*Includes forebay, subsurface, and surface storage

# OID# 55 – POTD-2018-FBIO-002

**Prioritization Ranking:** 15  
**Planning Level Cost Estimate:** \$124,950  
**Estimated Cost/Impervious Acre:** \$124,950

<u>General BMP Information:</u>	
Structure Location:	4965 Winchester Boulevard
Northing/Easting:	612,108/1,171,319
NPDES Watershed:	Potomac Direct Frederick County
MDE 8 Digit Watershed:	02140301
<u>Proposed BMP Retrofit General Information:</u>	
BMP Type:	Bioretention (F-6)
Management Type:	Quality, Quantity
Total Drainage Area (ac):	2.6
Total Impervious Area (ac):	1.0
<u>Water Quality Treatment Provided:</u>	
WQv Provided (cu.ft):	3,415
Total Treated Drainage Area (ac):	2.6
Total Treated Impervious Area (ac):	1.0
<u>Estimated Pollutant Load Reductions:</u>	
TN (lbs/yr):	10.5
TP (lbs/yr):	1.2
TSS (lbs/yr):	731.2



Existing site conditions for BMP # 127



Site map for BMP # 127

## EXISTING SITE CONDITIONS

There was no available information in Frederick County’s Urban BMP Database (BMP Database) and no as-builts available, but during the site visit the facility was classified as a dry extended detention pond. The facility is constructed on the western side of Winchester Boulevard in a field located behind R.E. Willard Plumbing. The facility has a 2.6- acre drainage area, including 1.0 acres of impervious area. The drainage area includes all of the nearby rooftop and parking lot as well as a large pervious area.

## ANTICIPATED SITE CONSTRAINTS

The site can be accessed for maintenance and hauling material from the R.E. Willard Plumbing parking lot. No Maintenance of Traffic (MOT) will be required and staging area should be planned to avoid interference with business operations.

<b>Required Permitting</b>	
Frederick County SWM Review:	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction:	X

## PROPOSED RETROFIT

The proposed retrofit for OID 55 is a bioretention practice (F-6). The proposed retrofit will provide quantity and quality management for the original 2.6 acre drainage area, including 1.0 acres impervious area. The retrofit concept includes excavating two feet below the existing grade and filling with two feet of bioretention mix. The concept proposes a one-foot fill embankment to create the sediment forebay. The retrofit concept proposes a perforated underdrain tied into the existing concrete riser structure and outfall to the southwest in an existing grass swale. The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

# OID 55 - POTD-2018-FBIO-002

## Existing Site Conditions:

**SWM Era:** 1985-2002

There was limited information available in Frederick County's Urban BMP Database (BMP Database) for OID 55 and no as-builts are available. However, during the site visit the facility was categorized as a dry extended detention pond. The facility is located on the western side of Winchester Boulevard as shown in the BMP Location map (**see Figure 1**). The BMP Database indicates that the original design was intended to provide quantity management for 2.6 acres of total drainage area, including 1.0 acres of impervious. Figure 1 shows the drainage area for the facility, which encompasses much of the surrounding pervious area as well as the R.E. Willard Plumbing rooftop and parking lot.

## General Observations:

A site visit was conducted on June 18, 2018. **Figure 2** shows the location of photos taken during the visit.

### Inflow:

Inflow to the facility consists of sheet flow from surrounding property and a downspout from the R.E. Willard Plumbing building.

### Pretreatment:

This facility does not have a forebay or pretreatment section.

### Control Structure and Spillways:

The facility has an existing concrete riser with PVC low flow orifice covered in a stone jacket.

### Embankment:

The facility has a 2-foot vegetated embankment in moderate condition.

### Outflow:

The facility outfalls to an existing grass swale in a forested area.

### Overall BMP:

Overall, the facility appears to be in good condition but does not meet criteria to treat for water quality treatment.

## Access, Right-of-Way, and MOT:

The site can be accessed for maintenance and hauling material in and out from the R.E. Willard Plumbing parking lot. No Maintenance of Traffic (MOT) will be necessary. Staging and material storage should be placed as to not interrupt business operations.

## Proposed Retrofit:

OID 55 appears to have been originally designed as a dry extended detention pond but is proposed to be retrofitted to a Bioretention (F-6). The proposed retrofit will provide both water quality and quantity treatment for the originally designed 2.6-acre drainage area, including 1.0 acres of impervious surface. The retrofit concept includes excavating to two feet below the existing facility bottom and back filling with two feet of bioretention mix. A one foot fill embankment will be constructed to all for a sedimentation forebay on the northern side of the facility. The existing concrete riser is to remain in place and a perforated PVC underdrain will be constructed and tied in at the base of the filter media. The current outfall location will be retained. These proposed design elements are displayed on the attached **Concept Plan**.

### Step 1: Watershed Factors

OID 55 is located in the Potomac Direct Frederick County 8-digit watershed (02140301). The downstream stream designation is I-P as of January 2019 but was previously designated as III-P.

### Step 2: Terrain Factors

OID 55 is not located in a region of Frederick County that is prone to karst geology per the Maryland Geologic Survey report (Stratigraphy of the Frederick Valley and Its Relationship to Karst Development, 2004) or the Geology GIS layer. No special terrain factors and/or constraints must be considered for this retrofit design.

### **Step 3: Stormwater Treatment Suitability**

The retrofit concept includes excavating two feet below the existing facility bottom and filling with two feet of bioretention mix. A one-foot fill embankment will be constructed to create the sediment forebay. A perforated PVC underdrain will be connected to the existing concrete riser and outfall to the exiting grass swale to the southwest of the facility. The downstream stream use is I-P so thermal impacts are of a limited concern.

### **Step 4: Physical Feasibility Factors**

The proposed drainage area to OID is 2.6 acres and is composed of largely B soils with a portion of C soils. According to the Maryland Stormwater Design Manual, the maximum drainage area for a bioretention is 5 acres, so bioretention is a suitable practice for this area.

### **Step 5: Community and Environmental Factors**

OID 55 is located on the western side of Winchester Boulevard and has low visibility. Bioretention practices tend to have moderate maintenance requirements, moderate community acceptance, moderate construction costs, and low habitat value.

### **Step 6: Location and Permitting Factors**

The anticipated permits/reviews required for the retrofit of BMP #800 include:

- 1) Frederick County Stormwater Management Review
- 2) Erosion and Sediment Control (ESC)
- 3) Grading Permit
- 4) JPA



Figure 1: OID 55 Location Map – Existing Conditions



Figure 2: OID 55 Photo Locations



**Photo 1: View of inflow into the facility.**



**Photo 2: Overall view of facility looking to the southwest.**



**Photo 3: Overall view of facility looking north.**



**Photo 4: View of existing concrete riser.**



**Photo 5: View of existing outfall.**



**Photo 6: View of existing outfall channel.**

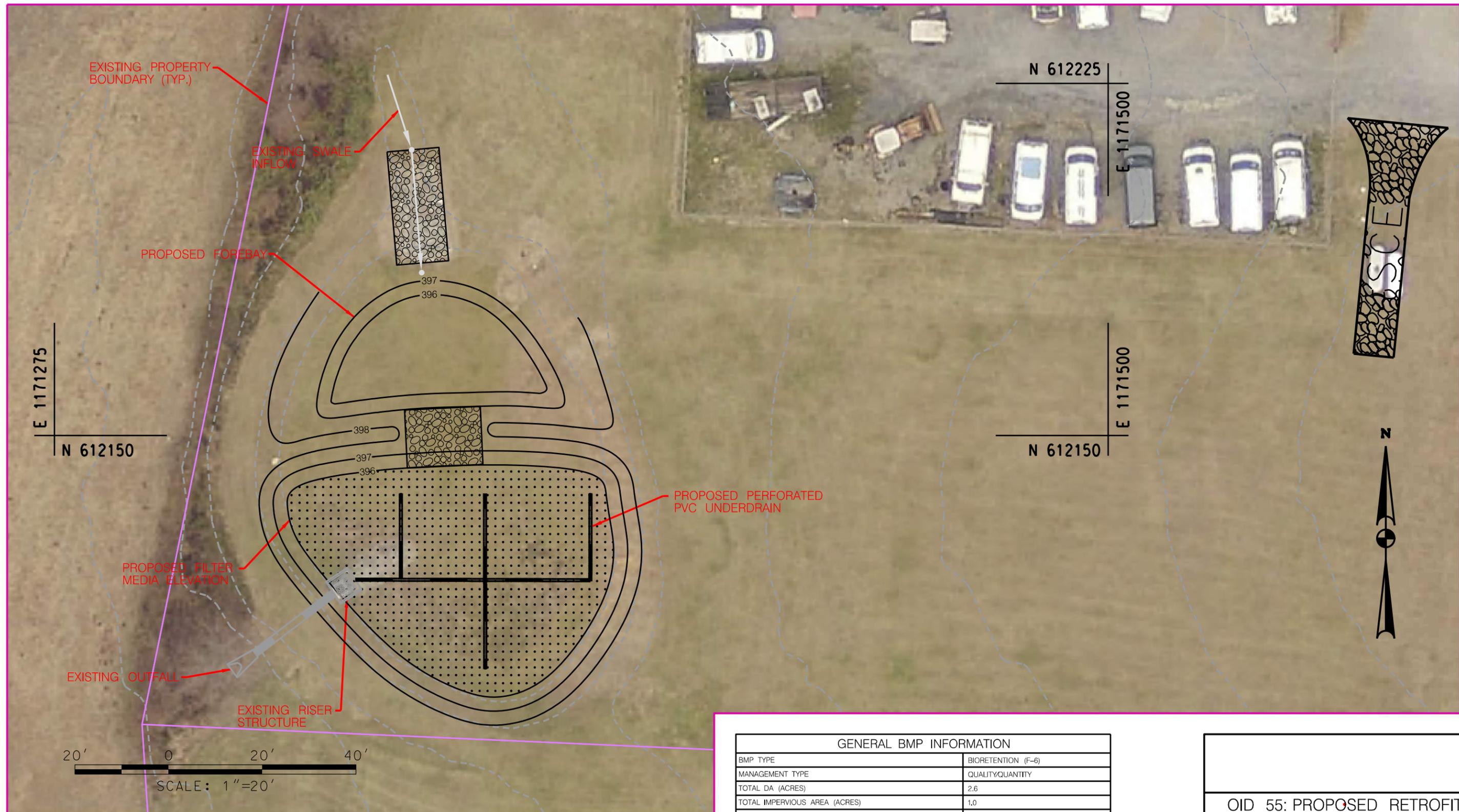


Storm Water Management Retrofit Evaluation			
<b>Report Date:</b>	6/21/2018	<b>Design Approval:</b>	
<b>Structure No (NPDES/BMP Number):</b>	OID 55	<b>Year Constructed:</b>	N/A
<b>Structure Name:</b>	POTD-2018-FBIO-002	<b>NPDES Watershed:</b>	Potomac Direct Frederick County Watershed
<b>Location:</b>	4965 Winchester Boulevard	<b>MDE 8 Digit:</b>	02140301
<b>Latitude, Longitude:</b>	39.35, -77.50	<b>Name/#:</b>	
<b>Northing/Easting:</b>	612,108/1,171,319	<b>Land-River Segment:</b>	
		<b>Stream Use:</b>	I-P
<b>Maintenance Owner:</b>			
		<b>Inspection Date:</b>	06/18/2018
		<b>Inspection Team:</b>	NW, KK
		<b>Last Significant Rainfall:</b>	06/20/2018
		<b>Rainfall Source:</b>	www.wunderground.com
		<b>Station:</b>	KMDDOUBS2

BMP Description			
General BMP Information	Existing Condition		Proposed Condition
BMP Type:	N/A		Bioretention (F-6)
BMP Classification:	N/A		Stormwater Treatment (ST) Practice
Management Type:	N/A		Quality/Quantity
Total Drainage Area (acres):	N/A		2.6
Total Impervious Area within Drainage Area (acres):	N/A		1.0
WQv Required:	Unknown		3,415
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes
Adequate ROW (Y/N):	Yes		Yes
Adequate Access (Y/N):	Yes		Yes
Estimated Treatment Provided	Per Design	Per MDE 2000 Standards	
WQv Provided:	Unknown	0	3,415 cu.ft.
Total Treated Drainage Area (acres):	N/A	0	2.6
Total Treated Impervious Area within Drainage Area (acres):	N/A	0	1.0
Estimated Pollutant Removal Rates			
Runoff Volume Treated per Impervious Acre (in.)			0.93
Total Nitrogen:	N/A		33%
Total Phosphorus:			52%
Sediment:			66%
Estimated Pollutant Load Reduction			
TN (lbs/yr):	0		10.5
TP (lbs/yr):	0		1.2
TSS (lbs/yr):	0		731.2

<b>Projected Retrofit Cost:</b>	\$124,950
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GENERAL NOTES:  
 1. GRADING IS BASED ON EXISTING 2 (TWO) FOOT CONTOURS. IT IS ASSUMED ALL INTERMEDIATE CONTOURS ARE TIED INTO CORRESPONDING EXISTING CONTOURS

GENERAL BMP INFORMATION	
BMP TYPE	BIORETENTION (F-6)
MANAGEMENT TYPE	QUALITY QUANTITY
TOTAL DA (ACRES)	2.6
TOTAL IMPERVIOUS AREA (ACRES)	1.0
WQv REQUIRED (CU. FT)	3,415
WQv REQUIRED (AC. FT)	0.07
WATER QUALITY PROVIDED	
WQv PROVIDED (CU. FT)	3,415
TOTAL TREATED DA (ACRES)	2.6
TOTAL TREATED IMPERVIOUS AREA (ACRES)	1.0

OID 55: PROPOSED RETROFIT

SCALE: 1" = 20'

DESIGNED BY: NCW COUNTY: FREDERICK

DRAWN BY: NCW

CHECKED BY: \_\_\_\_\_

DRAWING NO. \_\_\_\_\_ OF \_\_\_\_\_

**Brown AND Caldwell**

**POTOMAC DIRECT WATERSHED ASSESSMENT  
SITE ID: POTD-133-R-2009**

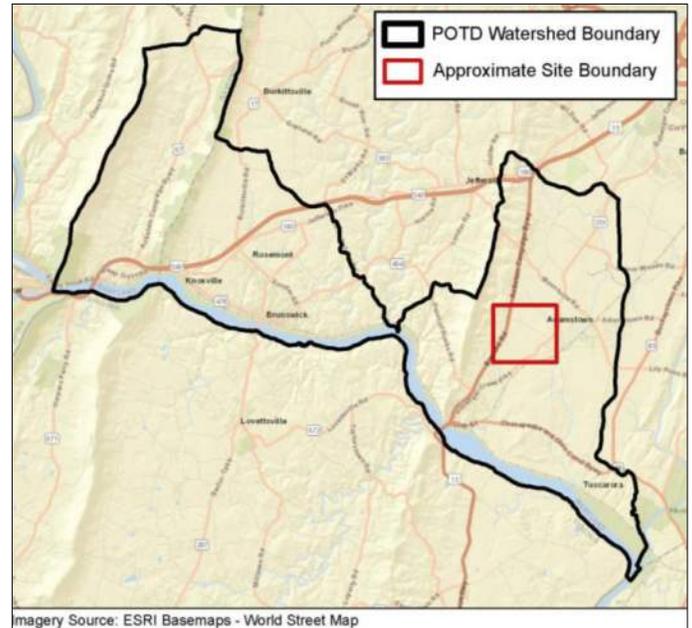
**Prioritization Ranking: 3**

**Planning/Construction Level Cost Estimate: \$791,266**

**Estimated Cost/Impervious Acre: \$35,000**

<i>General BMP Information:</i>	
<b>Structure Location:</b>	4501 E Basford Rd
<b>Northing/Easting:</b>	4354193.78/283524.88
<b>NPDES Watershed:</b>	Potomac River Frederick County
<b>MDE 8 Digit Watershed</b>	02140301
<b>Stream Use Class:</b>	III-P

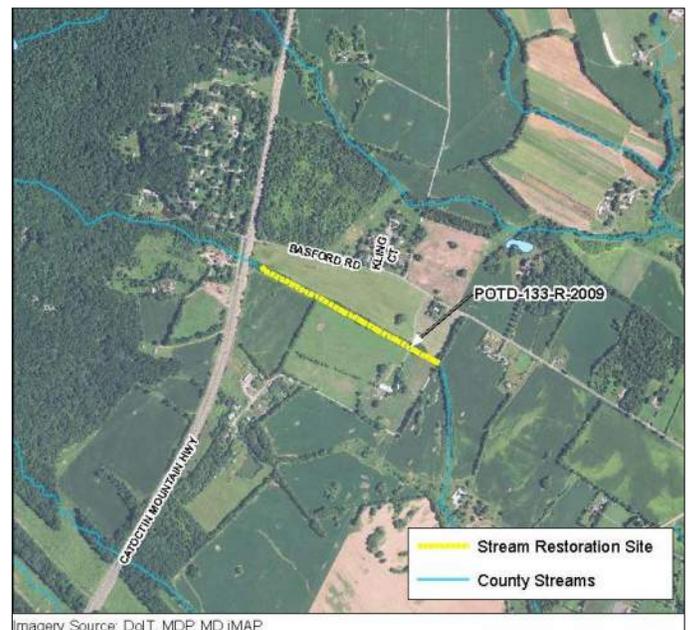
<i>Proposed Restoration General Information:</i>	
<b>Restoration Type:</b>	Stream Restoration
<b>Functional Lift Potential:</b>	Biological
<b>Project Length (LF):</b>	2,261



**Watershed Area Map**

<i>Estimated Treatment/Reductions:</i>	
<b>Impervious Area Credit (ac):</b>	22.61
<b>TN (lbs/yr):</b>	170
<b>TP (lbs/yr):</b>	154
<b>TSS (lbs/yr):</b>	101,463

<i>Required Permitting</i>	
<b>Frederick County SWM Review</b>	X
<b>Erosion and Sediment Control (ESC):</b>	X
<b>Grading Permit:</b>	X
<b>Joint Permit Application (JPA)/General Waterway Construction Permit:</b>	X
<b>Construction NOI:</b>	X
<b>MDE Floodplain Acknowledgement</b>	X



**Vicinity Map**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-133-R-2009**

**EXISTING SITE CONDITIONS**

This site exists within a primarily forested watershed with some suburban development and active agriculture. The land adjacent to the stream corridor is primarily row crop and pasture with a thin wooded riparian zone adjacent to the stream. The existing stream is unstable and exhibits a high rate of active erosion. Indicators of this erosion include 1 to 4 foot, vertical, raw, and incised banks, which are present on at least one side of the stream throughout the reach. The stream appears to have been straightened and channelized, and it contains few natural meanders and little hydraulic diversity to attenuate flow. The stream is incised and disconnected from the floodplain; therefore, higher flood flows are contained within the channel, exacerbating erosion. Large trees existing on the eroding banks are unstable, and many have already fallen into the stream. Culverts within the reach appear undersized and may be frequently overtopped, as evidenced by erosion surrounding the culverts and along the road. The property owners have placed wood along the culvert inlet in an attempt to reduce erosion. Two overhead powerlines cross the stream, one near the start of the reach and one at the end of the reach.

**PROPOSED RESTORATION**

Given the extent of channel instability and bank erosion, full restoration of this stream is recommended. The proposed stream restoration will follow the principles of Natural Channel Design (NCD), and establish long-term, self-maintaining stream stability. The design will re-establish a stable cross section, planform, and profile throughout the reach. A floodplain connection will be reestablished either by raising the channel invert to access the existing floodplain or by constructing a bankfull bench at a lower elevation; this will reduce flood flow velocity, facilitate deposition of fine grain sediments in the floodplain, increase local groundwater levels, and facilitate subsurface nutrient processing in the riparian area. Stable riffles will be created within the restored channel using reinforced bed material, sized to transport sediment and enhance hyporheic flow. Geomorphic structures, such as step pools, cross vanes, and sills, may be incorporated into the design to provide grade control, energy dissipation, and bank protection if conditions warrant. These geomorphic structures will also facilitate nitrogen load reduction and increase hydraulic diversity. Log structures and woody debris will provide habitat diversity and a carbon source to facilitate in-stream nitrogen processing.

The existing channel is primarily straight and lacks natural meanders; therefore, a more stable planform and meander pattern will be established to reduce flow velocities and increase hydraulic diversity. Culverts located under driveways will be resized to convey appropriate stream flows, and an imbricated headwall may be placed around the culverts to prevent further erosion. Geomorphic structures will be placed at critical points such as the upstream and downstream ends of the restoration and at culvert outfalls; these structures may also be placed along the reach where conditions warrant.

Clearing and grading will be the minimum necessary to perform the stream restoration and stream buffer planting. Coir matting will be placed along the top of restored stream banks, and all disturbed areas will be seeded with an erosion cover crop and a native herbaceous and woody seed mix and strawed. Streambank and stream buffer area will be planted following earthwork with a diverse mix of native vegetation. A 150-foot wide riparian buffer corridor is proposed along the stream channel. This includes approximately 4 acres of existing forest, 3.5 acres of active agriculture, and 0.5 acres of utility right-of-way. Within the utility rights-of-way the planting will be modified to accommodate the requirements of the utilities - it is anticipated to be herbaceous riparian area.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-133-R-2009**

**ANTICIPATED SITE CONSTRAINTS**

This site contains minimal foreseeable constraints to restoration. Two overhead powerlines run across the reach, but the associated towers are at a distance from the stream, and the lines are at a height that they should not impact the proposed work.

**STREAM BENEFITS**

The implementation of these restoration techniques is expected to lead to an uplift of stream functions to the biological level. The majority of the contributing watershed is forested, and in-stream habitat for aquatic and semi-aquatic organisms will be improved in the restored channel and buffer to create more opportunities for a healthy ecosystem.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-133-R-2009**  
**Existing Conditions Photos**  
**Date taken: April 18, 2018**



**Photo 1: Looking downstream at 3' tall, raw, actively eroding banks with exposed roots and large wood debris littered across the stream.**



**Photo 2: Looking downstream at a tortuous meander with a 3' tall, undercut, actively eroding bank with exposed tree roots and falling trees**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-133-R-2009**  
**Existing Conditions Photos**  
**Date taken: April 18, 2018**



**Photo 3: Looking downstream at a 3' tall, incised, actively eroding bank with exposed roots and woody debris littered across the stream**



**Photo 4: Looking across the stream at a 3' tall, incised, raw, actively eroding bank with exposed roots and no connection to floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-133-R-2009**  
**Existing Conditions Photos**  
**Date taken: April 18, 2018**



**Photo 5: Looking across the stream at a 4' tall, vertical, raw, actively with a falling tree and minimal riparian vegetation**



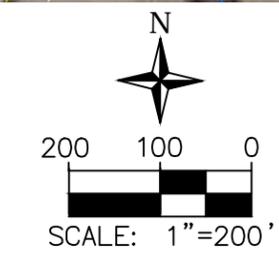
**Photo 6: Looking downstream at an undersized culvert exhibiting over-road flow and active erosion on the road banks**

# Potomac Direct Watershed Assessment

## SITE ID: POTD-133-R-2009



	Existing Stream Channel		Existing Fence		Full Restoration
	Site Boundary		FEMA Floodplain		Oxbow Channel
	Parcels		Power Line ROW		Riparian Enhancement
	Contours		Proposed Access		Photo Locations
	DNR Wetlands		Proposed Easement Area		





**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**

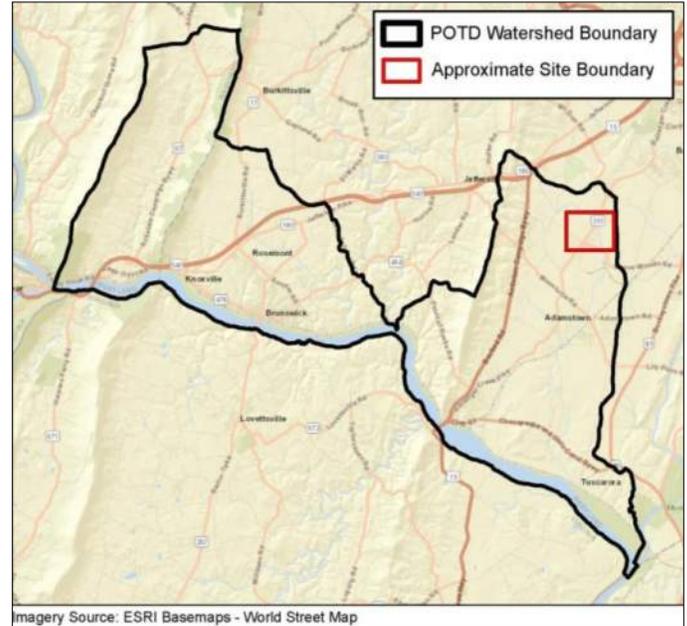
**Prioritization Ranking: 2**

**Planning/Construction Level Cost Estimate: \$2,341,150**  
(POTD-139-R-2010 = \$1,397,200 | POTD-132-R-2009 = \$943,950)

**Estimated Cost/Impervious Acre: \$35,000**

<i>General BMP Information:</i>	
<b>Structure Location:</b>	4651 Cap Stine Rd
<b>Northing/Easting:</b>	4358696.63/286453.65
<b>NPDES Watershed:</b>	Potomac River Frederick County
<b>MDE 8 Digit Watershed</b>	02140301
<b>Stream Use Class:</b>	III-P

<i>Proposed Restoration General Information:</i>	
<b>Restoration Type:</b>	Stream Restoration
<b>Functional Lift Potential:</b>	Physiochemical
<b>Project Length (LF):</b>	6,689



**Watershed Area Map**

<i>Estimated Treatment/Reductions:</i>	
<b>Impervious Area Credit (ac):</b>	66.89
<b>TN (lbs/yr):</b>	502
<b>TP (lbs/yr):</b>	455
<b>TSS (lbs/yr):</b>	300,202

<i>Required Permitting</i>	
<b>Frederick County SWM Review</b>	X
<b>Erosion and Sediment Control (ESC):</b>	X
<b>Grading Permit:</b>	X
<b>Joint Permit Application (JPA)/General Waterway Construction Permit:</b>	X
<b>Construction NOI:</b>	X
<b>MDE Floodplain Acknowledgement</b>	X



**Vicinity Map**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**

**EXISTING SITE CONDITIONS**

This site exists within a primarily agricultural watershed with some areas of suburban development. The land adjacent to the stream corridor is primarily row crop. The existing stream is unstable and exhibits a high rate of active erosion. Indicators of this erosion include 2 to 7 foot vertical, raw, and incised banks, which are present on at least one side of the stream throughout the reach. The northeastern channel appears to have been straightened to accommodate the surrounding agricultural fields; it is entrenched and lacking in hydraulic variability. The northwestern channel has an unstable meander pattern (including tortuous meanders). The southern section of the stream is a deep, incised channel. All sections of stream are disconnected from the floodplain, which likely contributes to high in-stream velocities, shear stress, and bank erosion during storm events. The confluence of the two upstream reaches is poorly aligned and appears to experience high erosion during flood flows - high near-bank-stress is evident downstream of this confluence. The culverts under Manor Woods Road are poorly aligned, causing sediment deposition that restricts conveyance and leads to erosion around the culvert headwall. The adjacent riparian corridor at the downstream end of the reach is forested and the upstream riparian corridor is composed of low-cut grass and cultivated crops. A low-water stream-crossing exists halfway along the northeastern reach that will be maintained post-restoration. An overhead powerline crosses the stream near the confluence of the two upstream channels.

**PROPOSED RESTORATION**

Given the extent of channel instability and bank erosion, full restoration of this stream is recommended. The proposed stream restoration will follow the principles of Natural Channel Design (NCD), and establish long-term, self-maintaining stream stability. The design will re-establish a stable cross section, planform, and profile throughout the reach. A floodplain connection will be reestablished either by raising the channel invert to access the existing floodplain or by constructing a bankfull bench at a lower elevation; this will reduce flood flow velocity, facilitate deposition of fine grain sediments in the floodplain, increase local groundwater levels, and facilitate subsurface nutrient processing in the riparian area. Stable riffles will be created within the restored channel using reinforced bed material, sized to transport sediment and enhance hyporheic flow. Geomorphic structures, such as step pools, cross vanes, and sills, may be incorporated into the design to provide grade control, energy dissipation, and bank protection if conditions warrant. These geomorphic structures will also facilitate nitrogen load reduction and increase hydraulic diversity. Log structures and woody debris will provide habitat diversity and a carbon source to facilitate in-stream nitrogen processing.

In areas where tortuous meanders are proposed to be abandoned, such as the upstream end of the northwestern reach, oxbow channels will be established to provide alternative flow paths and habitat diversity. The northeastern channel will be realigned to increase sinuosity. Geomorphic structures will be placed at critical points such as the upstream and downstream ends of the restoration, at culvert outfalls, and at the stream confluence; these structures may also be placed along the reach where conditions warrant. The confluence of the two upstream reaches will be re-aligned and stabilized. At the entrance to the culverts under Manor Woods Road the channel will be re-aligned and widened to improve conveyance through the culverts and reduce sediment deposition. An imbricated rock headwall will be placed around the culverts to prevent further erosion.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**

Clearing and grading will be the minimum necessary to perform the stream restoration and stream buffer planting. Coir matting will be placed along the top of restored stream banks, and all disturbed areas will be seeded with an erosion cover crop and a native herbaceous and woody seed mix and strawed. Streambank and stream buffer area will be planted following earthwork with a diverse mix of native vegetation. A 150-foot wide riparian buffer corridor is proposed along the stream channel. This includes approximately 15 acres of existing forest, 7 acres of active agriculture, and 1 acre of utility right-of-way. Within the utility right-of-way the planting will be modified to accommodate the requirements of the utility - it is anticipated to be herbaceous riparian area.

**ANTICIPATED SITE CONSTRAINTS**

This site contains minimal foreseeable constraints to restoration. An overhead powerline runs across the reach, but the associated towers are at a distance from the stream, and the lines are at a height that they should not impact the proposed work. Existing culverts at the upstream and downstream limits provide grade control. Various driveways allow for construction access.

**STREAM BENEFITS**

The implementation of these restoration techniques is expected to lead to an uplift of stream functions to the physiochemical level. In-stream habitat for aquatic and semi-aquatic organisms will be improved in the restored channel and buffer which will create more opportunities for a healthy ecosystem; however, a functional lift of biological cannot be ensured due to the condition of the contributing watershed including suburban development, active agriculture, and minimal stormwater management upstream.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 1: Looking upstream at farthest upstream point of POTD-132-R-2009, with actively eroding banks, exposed root systems, and minimal vegetative cover.**



**Photo 2: Looking upstream near Ballenger Creek Pike at raw, actively eroding banks, minimal vegetative cover, and exposed roots.**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 3: Looking downstream at 2' tall, undercut, actively eroding banks with minimal connection to floodplain and a low-cut grass riparian corridor**



**Photo 4: Looking downstream at a 4' tall, vertical, actively eroding bank with a low-cut grass riparian corridor and no connection to floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 5: Looking upstream at a 3' tall, incised, actively eroding bank with exposed roots and unstable trees**



**Photo 6: Looking upstream at a 3' tall, vertical, raw, actively eroding bank with exposed roots and falling trees, and a raw, actively eroding point bar**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-139-R-2010 & POTD-132-R-2009**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 7: Looking upstream at a 7' tall, raw, actively eroding bank with exposed roots and falling trees**

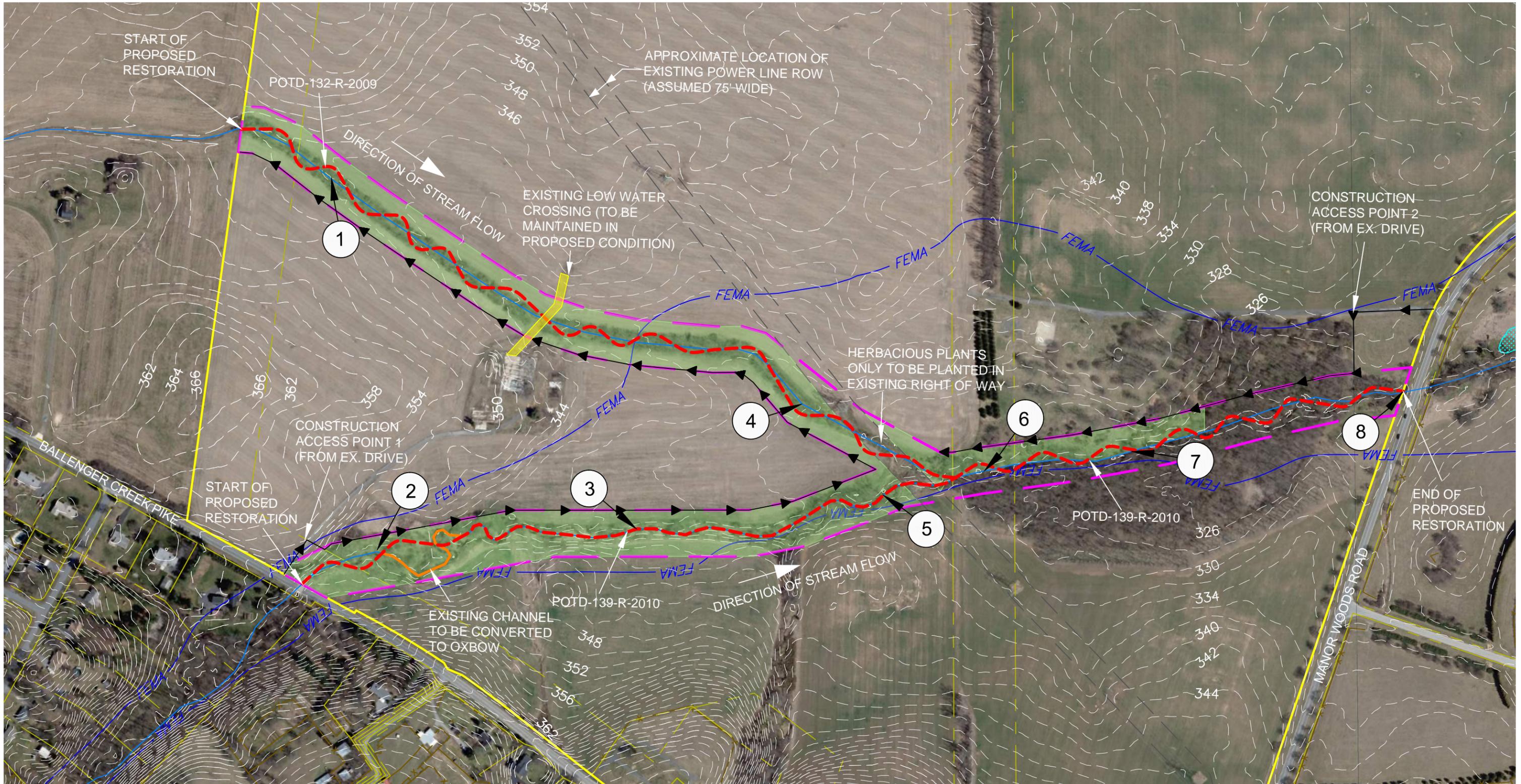


**Photo 8: Looking downstream at four culverts in parallel that exhibit active erosion and overflow – this is the downstream limit of restoration**

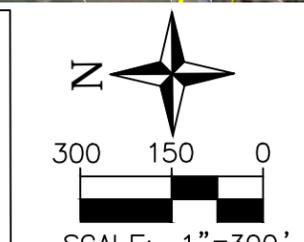


# Potomac Direct Watershed Assessment

## SITE ID: POTD-139-R-2010 & 132-R-2009



Existing Stream Channel	Existing Fence	Full Restoration
Site Boundary	FEMA Floodplain	Oxbow Channel
Parcels	Power Line ROW	Riparian Enhancement
Contours	Proposed Access	Photo Locations
DNR Wetlands	Proposed Easement Area	





**POTOMAC DIRECT WATERSHED ASSESSMENT  
SITE ID: POTD-301-R-2013**

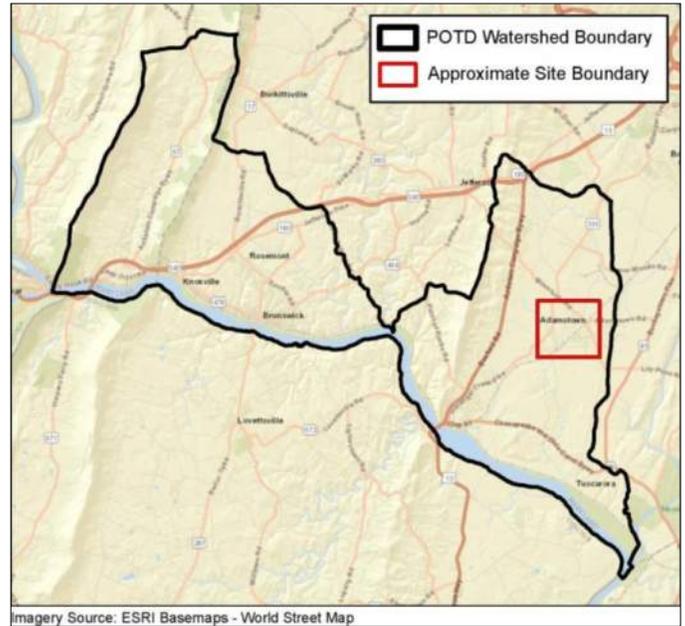
**Prioritization Ranking: 1**

**Planning/Construction Level Cost Estimate: \$1,816,500**

**Estimated Cost/Impervious Acre: \$35,000**

<i>General BMP Information:</i>	
<b>Structure Location:</b>	5308 Doubs Rd
<b>Northing/Easting:</b>	4353334.68/285642.31
<b>NPDES Watershed:</b>	Potomac River Frederick County
<b>MDE 8 Digit Watershed</b>	02140301
<b>Stream Use Class:</b>	III-P

<i>Proposed Restoration General Information:</i>	
<b>Restoration Type:</b>	Stream Restoration
<b>Functional Lift Potential:</b>	Physiochemical
<b>Project Length (LF):</b>	5,190

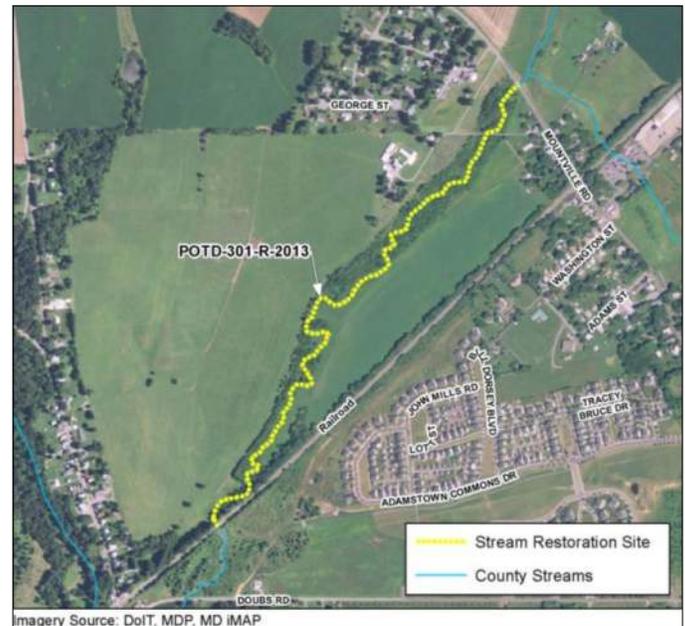


Imagery Source: ESRI Basemaps - World Street Map

**Watershed Area Map**

<i>Estimated Treatment/Reductions:</i>	
<b>Impervious Area Credit (ac):</b>	51.90
<b>TN (lbs/yr):</b>	389
<b>TP (lbs/yr):</b>	353
<b>TSS (lbs/yr):</b>	232,927

<i>Required Permitting</i>	
<b>Frederick County SWM Review</b>	X
<b>Erosion and Sediment Control (ESC):</b>	X
<b>Grading Permit:</b>	X
<b>Joint Permit Application (JPA)/General Waterway Construction Permit:</b>	X
<b>Construction NOI:</b>	X
<b>CSX*</b>	X
<b>MDE Floodplain Acknowledgement</b>	X



Imagery Source: DoIT, MDP, MD IMAP

**Vicinity Map**

*\*GIS Data indicates stream may flow onto CSX property near the downstream end of reach. If it does, CSX approval will be needed. Confirmation of exact stream location will need to be determined at the next design phase*

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**

**EXISTING SITE CONDITIONS**

This site begins downstream of a culvert at Mountville Road, and ends beneath a bridge on CSX property. Presently, the contributing watershed is primarily agricultural, suburban, and industrial, and the land adjacent to the stream corridor is primarily row crop. The existing stream crosses under a driveway bridge, which appears to be in good condition, 100 feet downstream of Mountville Road. The existing stream is unstable and exhibits a high rate of active erosion. Indicators of this erosion include 2 to 6 foot, vertical, raw, and incised banks, which are present on at least one side of the stream throughout the reach. The stream is disconnected from the floodplain; therefore, higher flood flows are contained within the channel. This contributes to higher in-stream velocities and shear stress – exacerbating stream bank erosion. Vegetation was found sloughed into the stream in many sections which also indicates active erosion. Based on field indicators, the stream appears to be widening versus incising, and there are no visible headcuts or bedrock. The adjacent riparian corridor is primarily forested, and non-forested areas are currently grass. The forested buffer was planted approximately 10 years ago by the Chesapeake Bay Foundation (CBF); however, it is not fully functional due to floodplain disconnection. In addition, trees located next to the stream banks are falling into the stream as a result of bank erosion. No overhead utilities are found on-site.

**PROPOSED RESTORATION**

Given the extent of channel instability and bank erosion, full restoration of this stream is recommended. The proposed stream restoration will follow the principles of Natural Channel Design (NCD), and establish long-term, self-maintaining stream stability. The design will re-establish a stable cross section, planform, and profile throughout the reach. A floodplain connection will be reestablished either by raising the channel invert to access the existing floodplain or by constructing a bankfull bench at a lower elevation; this will reduce flood flow velocity, facilitate deposition of fine grain sediments in the floodplain, increase local groundwater levels, and facilitate subsurface nutrient processing in the riparian area. Stable riffles will be created within the restored channel using reinforced bed material, sized to transport sediment and enhance hyporheic flow. Geomorphic structures, such as step pools, cross vanes, and sills, may be incorporated into the design to provide grade control, energy dissipation, and bank protection if conditions warrant. These geomorphic structures will also facilitate nitrogen load reduction and increase hydraulic diversity. Log structures and woody debris will provide habitat diversity and a carbon source to facilitate in-stream nitrogen processing.

Due to the large size of the existing channel, channel relocation may be expensive; therefore, the proposed restoration and stabilization will occur mostly along the existing stream. Bank stabilization will prevent lateral erosion and future widening of the stream. Geomorphic structures will be placed at critical points such as the upstream and downstream ends of the restoration and at culvert outfalls; these structures may also be placed along the reach where conditions warrant. In areas where tortuous meanders are proposed to be abandoned, such as the in the center of the reach in the vicinity of Photo 5, a stable planform will be established and oxbow channels will be established to provide alternative flow paths and habitat diversity.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**

Clearing and grading will be the minimum necessary to perform the stream restoration and stream buffer planting. Coir matting will be placed along the top of restored stream banks, and all disturbed areas will be seeded with an erosion cover crop and a native herbaceous and woody seed mix and strawed. Streambank and stream buffer area will be planted following earthwork with a diverse mix of native vegetation. Access paths will run along the west side of the existing stream to avoid impacting existing wetlands. A 250-foot wide riparian buffer corridor is proposed along the stream channel. This includes approximately 18 acres of existing forest and 2 acres of land in active agriculture that will be converted to forested buffer. Existing riparian buffer planted in the CBF reforestation project will be minimally impacted.

**ANTICIPATED SITE CONSTRAINTS**

This site contains minimal foreseeable constraints to restoration. Railroad tracks exist downstream, limiting access from upstream only. Wetlands on the east side of the site will limit construction access to the west side. The existing riparian buffer planted by CBF will be disturbed to the minimum extent practicable.

**STREAM BENEFITS**

The implementation of these restoration techniques is expected to lead to an uplift of stream functions to the physiochemical level. In-stream habitat for aquatic and semi-aquatic organisms will be improved in the restored channel and buffer, which will create more opportunities for a healthy ecosystem; however, a functional lift of biological cannot be ensured due to the condition of the contributing watershed, including industrial and suburban development, active agriculture, and minimal stormwater management upstream.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**  
**Existing Conditions Photos**  
**Date taken: February 8, 2019**



**Photo 1: Looking downstream at bridge opening beneath Mountville Road, which is the upstream start of the reach.**



**Photo 2: Looking upstream at driveway bridge opening, which will be maintained in proposed condition.**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 3: Looking upstream at 4' tall vertical, raw, actively eroding banks with vegetation collapsing into stream**



**Photo 4: Looking downstream at a tortuous meander with 3' tall, raw, actively eroding banks with minimal riparian vegetation and no connection to floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 5: Looking across stream at a 4' tall, incised, actively eroding bank with exposed roots and a large tree collapsing into the stream**



**Photo 6: Looking across stream at a 5' vertical, raw, actively eroding bank with minimal riparian vegetation and no connection to floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-301-R-2013**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 7: Looking downstream at a 3' tall, vertical, actively eroding bank with sloughed vegetation and minimal riparian corridor**

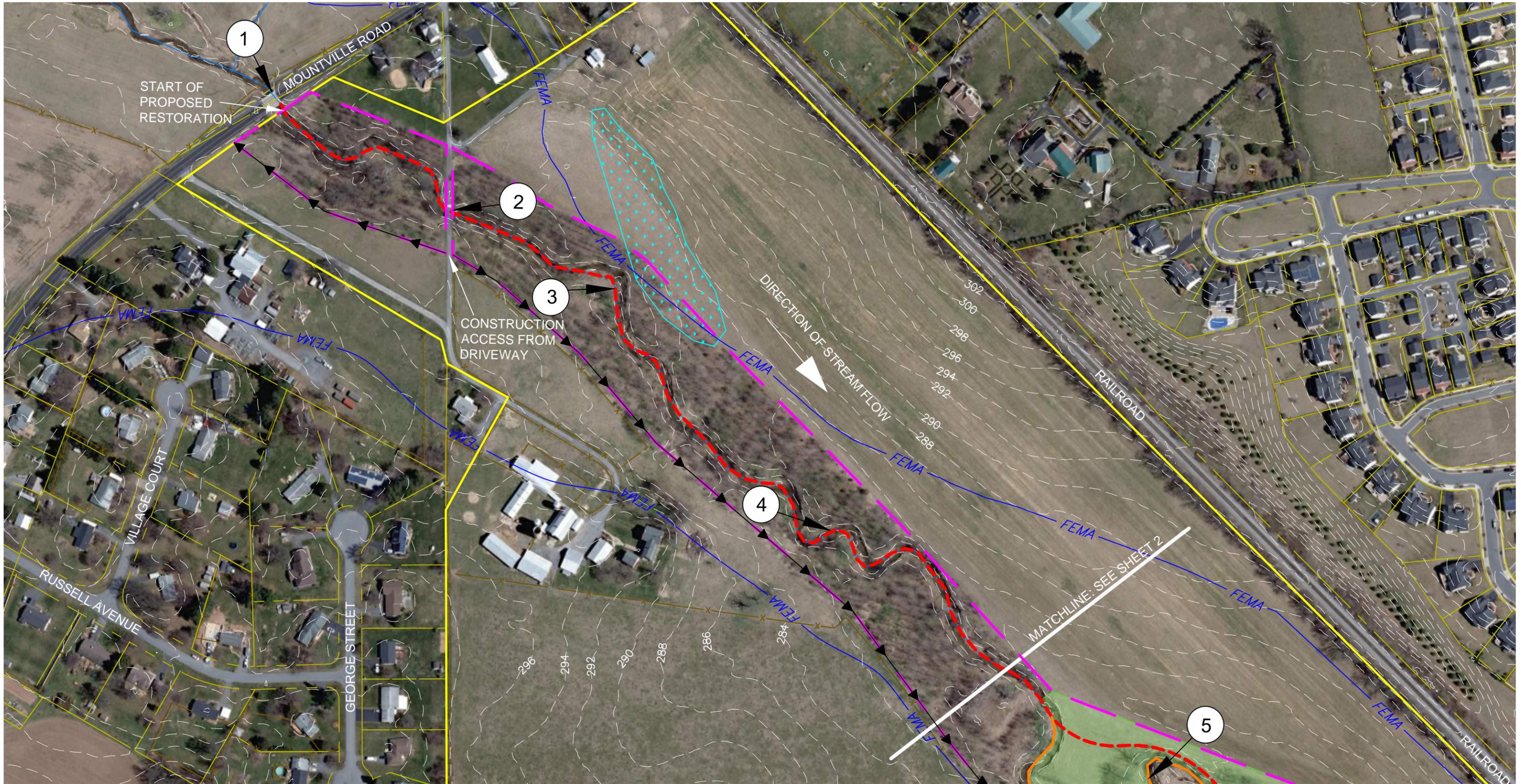


**Photo 8: Looking downstream at downstream bridge where railroad tracks cross the stream – this is the downstream limit of restoration**



# Potomac Direct Watershed Assessment

## SITE ID: POTD-301-R-2013

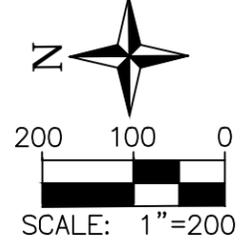


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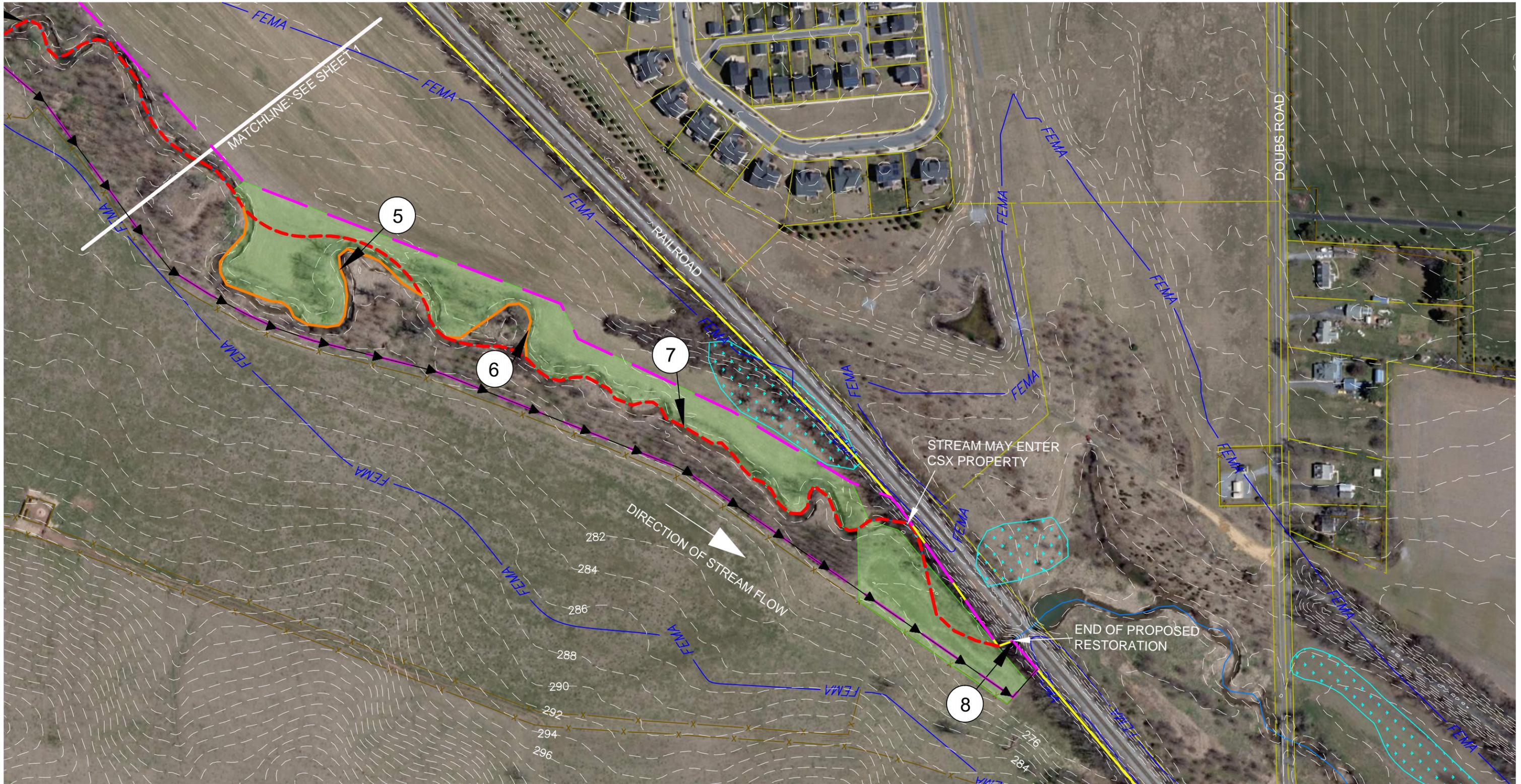
**SHEET**  
**1**

	Existing Stream Channel		Existing Fence		Full Restoration
	Site Boundary		FEMA Floodplain		Oxbow Channel
	Parcels		Power Line ROW		Riparian Enhancement
	Contours		Proposed Access		Photo Locations
	DNR Wetlands		Proposed Easement Area		



# Potomac Direct Watershed Assessment

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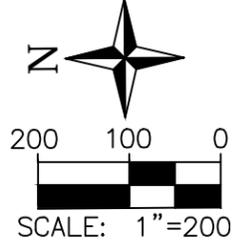


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**SHEET**  
**2**

Stream Restoration Reach	Existing Fence	Full Restoration
Site Boundary	FEMA Floodplain	Oxbow Channel
Parcels	Power Line ROW	Riparian Enhancement
Contours	Proposed Access	Photo Locations
DNR Wetlands	Proposed Easement Area	



**POTOMAC DIRECT WATERSHED ASSESSMENT  
SITE ID: POTD-2018-STRE-0001**

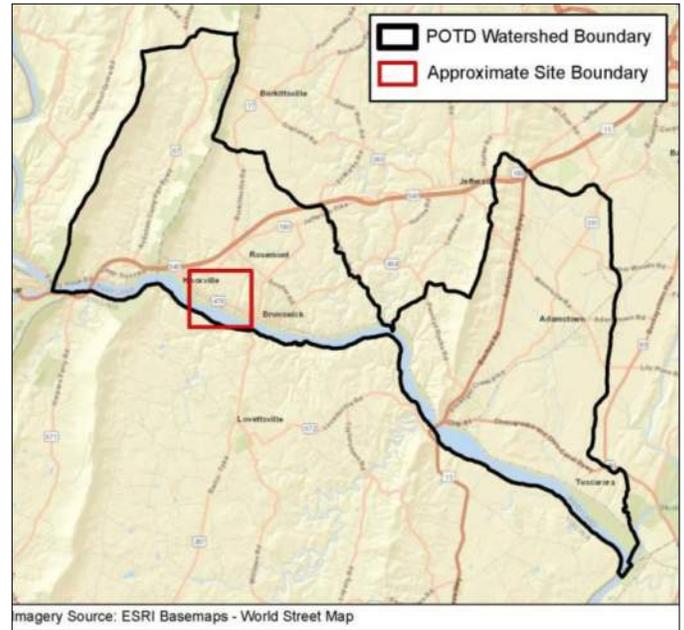
**Prioritization Ranking: 9**

**Planning/Construction Level Cost Estimate: \$191,450**

**Estimated Cost/Impervious Acre: \$35,000**

<i>General BMP Information:</i>	
<b>Structure Location:</b>	602 Tritapoe Rd
<b>Northing/Easting:</b>	4355569.93/271683.40
<b>NPDES Watershed:</b>	Potomac River Frederick County
<b>MDE 8 Digit Watershed</b>	02140301
<b>Stream Use Class:</b>	I-P

<i>Proposed Restoration General Information:</i>	
<b>Restoration Type:</b>	Stream Restoration
<b>Functional Lift Potential:</b>	Physiochemical
<b>Project Length (LF):</b>	547



**Watershed Area Map**

<i>Estimated Treatment/Reductions:</i>	
<b>Impervious Area Credit (ac):</b>	5.47
<b>TN (lbs/yr):</b>	41
<b>TP (lbs/yr):</b>	37
<b>TSS (lbs/yr):</b>	24,549

<i>Required Permitting</i>	
<b>Frederick County SWM Review</b>	X
<b>Erosion and Sediment Control (ESC):</b>	X
<b>Grading Permit:</b>	X
<b>Joint Permit Application (JPA)/General Waterway Construction Permit:</b>	X
<b>Construction NOI:</b>	X
<b>MDE Floodplain Acknowledgement</b>	X



**Vicinity Map**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**

**EXISTING SITE CONDITIONS**

This site exists within a primarily forested watershed with some areas of suburban development. The land adjacent to the stream corridor is residential, and the riparian corridor surrounding the stream is primarily lawn. The existing stream is unstable and exhibits a high rate of active erosion. Indicators of this erosion include 1 to 5 foot, vertical, raw, and incised banks, which are present on at least one side of the stream throughout the reach. The stream is disconnected from the floodplain; therefore, higher flood flows are contained within the channel - exacerbating stream bank erosion. The channel becomes considerably more entrenched as it approaches the downstream highway bridge. Animal enclosure fencing, found in place at the entrance and exit of the culvert, accumulates organic matter and debris and increases flooding potential. Small cobble was found placed around the entrance of the culvert in attempts to limit headwall erosion. Adjacent houses are at risk of flooding in large storm events, and personal property including sheds are within the floodplain and are at risk of being damaged.

**PROPOSED RESTORATION**

Given the extent of channel instability and bank erosion, as well as public safety hazards, full restoration of this stream is recommended. The proposed stream restoration will follow the principles of Natural Channel Design (NCD), and establish long-term, self-maintaining stream stability. The design will re-establish a stable cross section, planform, and profile throughout the reach. Reconnecting to the existing floodplain is not feasible given site constraints; however, a bankfull bench may be established at a lower elevation, which will reduce flood flow velocity, facilitate deposition of fine grain sediments in the bench, increase local groundwater levels, and facilitate subsurface nutrient processing in the riparian area. Stable riffles will be created within the restored channel using reinforced bed material, sized to transport sediment and enhance hyporheic flow. Geomorphic structures, such as step pools, cross vanes, and sills may be incorporated into the design to provide grade control, energy dissipation, and bank protection if conditions warrant. These geomorphic structures will also facilitate nitrogen load reduction and increase hydraulic diversity. Log structures and woody debris will provide habitat diversity and a carbon source to facilitate in-stream nitrogen processing.

The current channel fits narrowly between houses and yard structures, so the stream will be restored in the current planform with minor modifications. Due to the steep channel slope and limited space to relocate the stream, the channel will be restored as a Rosgen type A/B channel with low sinuosity and a low width to depth ratio. Fencing surrounding culverts needs to be redesigned and replaced to reduce build-up of debris, and structures on properties such as footbridges and sheds should be relocated to less vulnerable locations. Imbricated rock wingwalls may be placed around the headwall to prevent further erosion.

Clearing and grading will be the minimum necessary to perform the stream restoration and stream buffer planting. Coir matting will be placed along the top of restored stream banks, and all disturbed areas will be seeded with an erosion cover crop and a native herbaceous and woody seed mix and strawed. Streambank and stream buffer area will be planted following earthwork with a diverse mix of native vegetation. A 25-foot wide riparian buffer corridor is proposed along the lower half of the stream channel. This includes approximately 0.05 acres of existing forest, and 0.2 acres of lawn. Trees will not be planted within a 20-foot wide swath beneath the powerline.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**

**ANTICIPATED SITE CONSTRAINTS**

Primary site constraints include property fencing used as animal enclosures; residential traffic management; small yards and minimal mobility for large equipment; and minimal width for riparian buffer planting. An overhead powerline runs across the reach, but the associated poles are at a distance from the stream, and the lines are at a height that they should not impact the proposed work. Approval and coordination of up to six (6) property owners would likely be needed.

**STREAM BENEFITS**

The implementation of these restoration techniques is expected to lead to an uplift of stream functions to the geomorphic level. In-stream habitat for aquatic and semi-aquatic organisms will be improved in the restored channel and buffer which will create more opportunities for a healthy ecosystem; however, a functional lift of physiochemical cannot be ensured due to the condition of the contributing watershed including dense residential development.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 1: Looking downstream at 3' tall vertical, raw, actively eroding banks with vegetation sloughing into stream**



**Photo 2: Looking downstream at actively eroding and widening banks and a pedestrian bridge within the floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 3: Looking downstream at culvert opening blocked by chain-link fence, which accumulates organic matter and causes flooding and overtopping**



**Photo 4: Looking downstream at a 5' tall, vertical, actively eroding bank with a mowed grass riparian corridor**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**

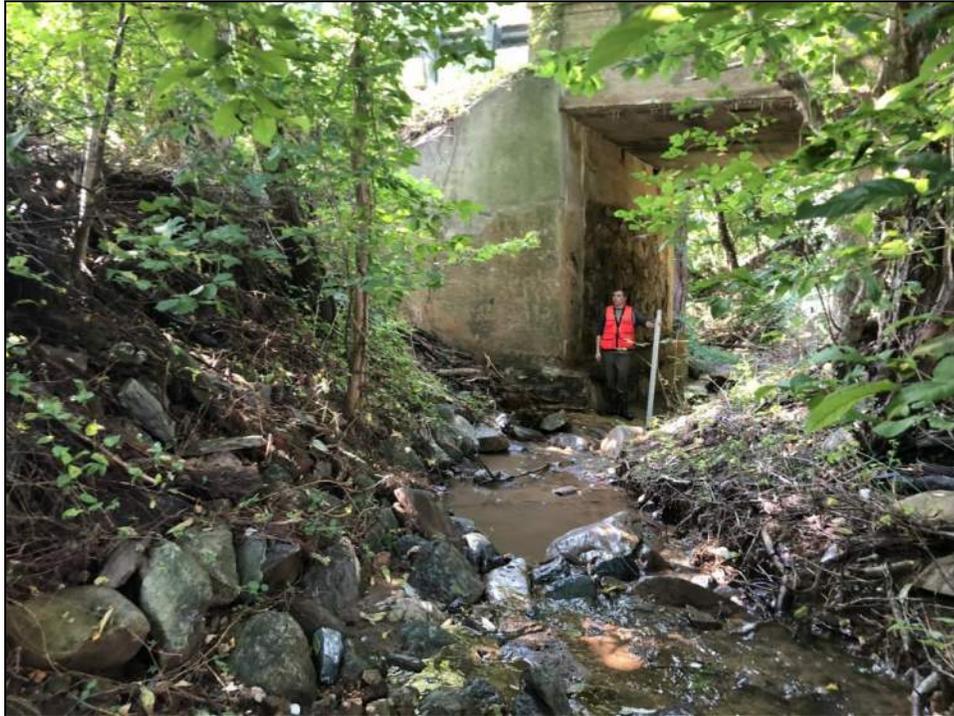


**Photo 5: Looking downstream at existing footbridge. Existing sheds are not currently impacted at baseflow but are within floodplain**



**Photo 6: Looking upstream at existing footbridge. Existing shed is not currently impacted at baseflow but is within floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0001**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 7: Looking downstream at a raw, actively eroding banks with exposed roots and no connection to floodplain**

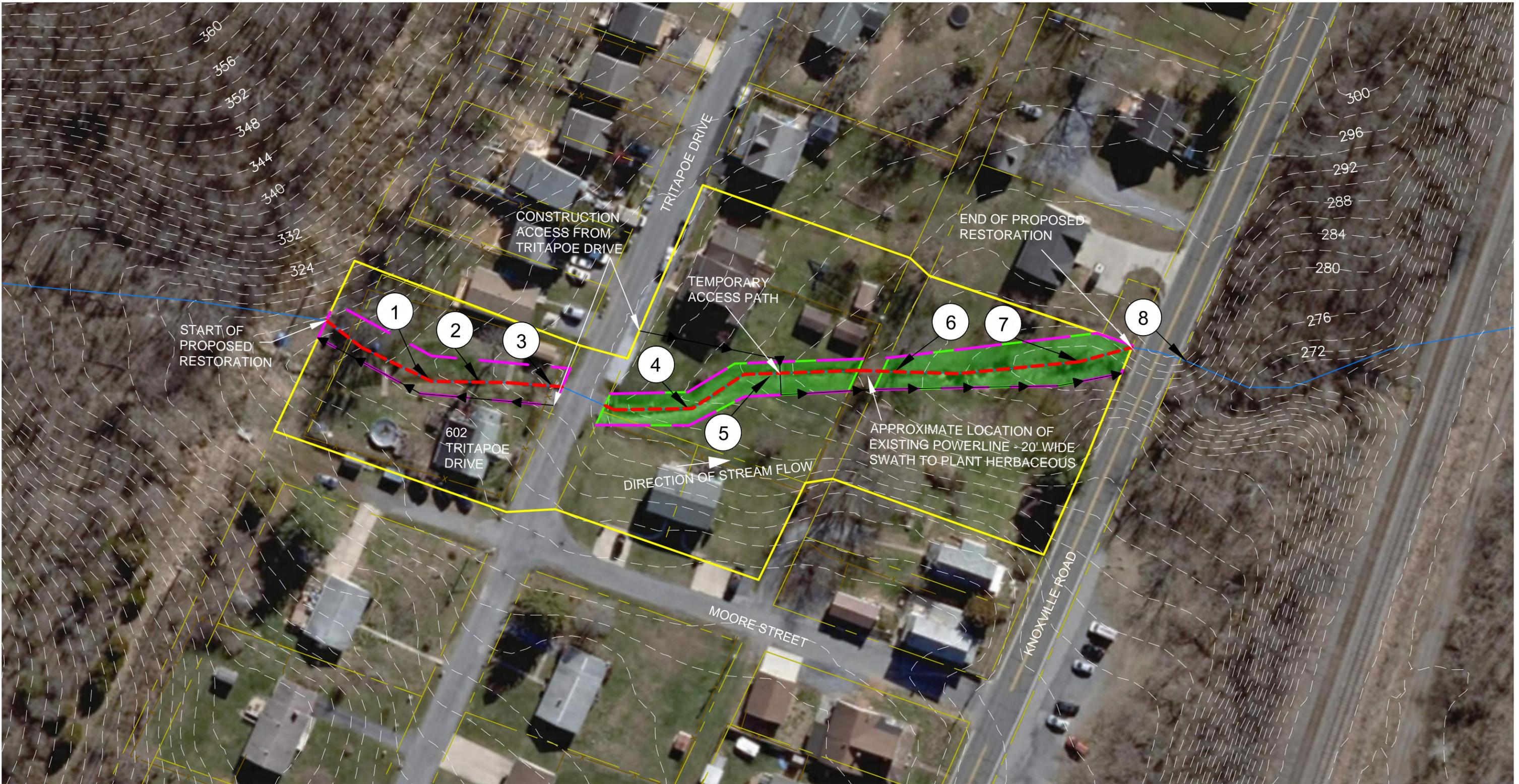


**Photo 8: Looking downstream from under the road at incised, vertical, actively eroding banks – this is the limit of restoration.**

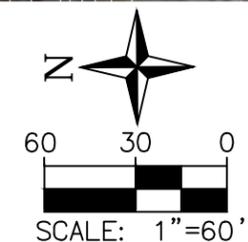


# Potomac Direct Watershed Assessment

## SITE ID: POTD-2018-STRE-0001



Existing Stream Channel	Existing Fence	Full Restoration
Site Boundary	FEMA Floodplain	Oxbow Channel
Parcels	Power Line ROW	Riparian Enhancement
Contours	Proposed Access	Photo Locations
DNR Wetlands	Proposed Easement Area	





**POTOMAC DIRECT WATERSHED ASSESSMENT  
SITE ID: POTD-2018-STRE-0005 R1**

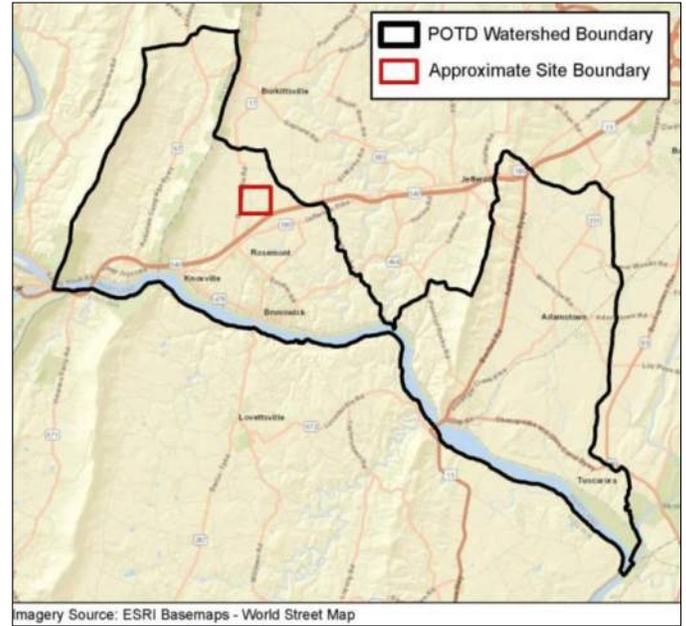
**Prioritization Ranking: 4**

**Planning/Construction Level Cost Estimate: \$812,000**

**Estimated Cost/Impervious Acre: \$35,000**

<i>General BMP Information:</i>	
<b>Structure Location:</b>	1129 Brentland Rd
<b>Northing/Easting:</b>	4359617.93/273081.50
<b>NPDES Watershed:</b>	Potomac River Frederick County
<b>MDE 8 Digit Watershed</b>	02140301
<b>Stream Use Class:</b>	I-P

<i>Proposed Restoration General Information:</i>	
<b>Restoration Type:</b>	Stream Restoration
<b>Functional Lift Potential:</b>	Physiochemical
<b>Project Length (LF):</b>	2,370

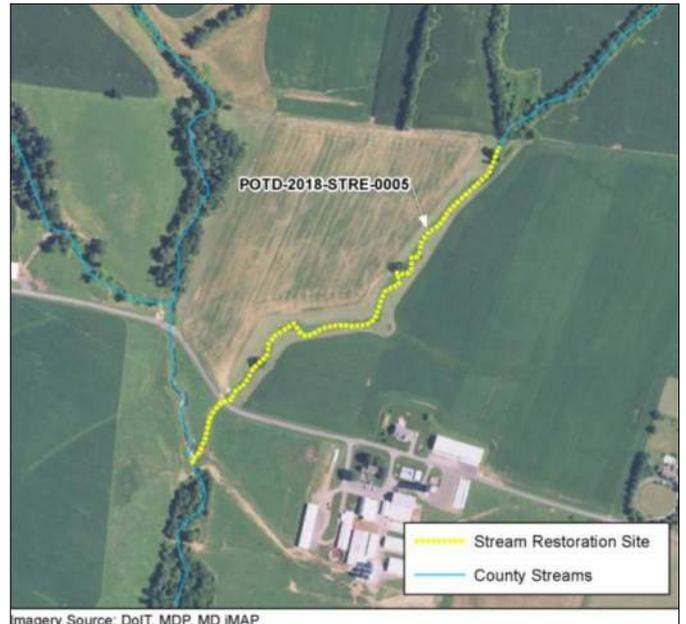


Imagery Source: ESRI Basemaps - World Street Map

**Watershed Area Map**

<i>Estimated Treatment/Reductions:</i>	
<b>Impervious Area Credit (ac):</b>	23.7
<b>TN (lbs/yr):</b>	178
<b>TP (lbs/yr):</b>	161
<b>TSS (lbs/yr):</b>	106,366

<i>Required Permitting</i>	
<b>Frederick County SWM Review</b>	X
<b>Erosion and Sediment Control (ESC):</b>	X
<b>Grading Permit:</b>	X
<b>Joint Permit Application (JPA)/General Waterway Construction Permit:</b>	X
<b>Construction NOI:</b>	X
<b>MDE Floodplain Acknowledgement</b>	X



Imagery Source: DoIT, MDP, MD IMAP

**Vicinity Map**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0005 R1**

**EXISTING SITE CONDITIONS**

This site exists within a primarily agricultural watershed, and the land adjacent to the stream corridor is primarily low-cut grass and row crop. The existing stream is unstable and exhibits a high rate of active erosion. Indicators of this erosion include 2 to 4 foot, vertical, raw, and incised banks, which are present on at least one side of the stream throughout the reach. The stream is disconnected from the floodplain; therefore, higher flood flows are contained within the channel. This contributes to higher in-stream velocities and shear stress – exacerbating stream bank erosion. Vegetation found sloughed into the stream in many sections also indicates active erosion. Based on field indicators, the stream appears to be widening versus incising, and there are no visible headcuts or bedrock. Concrete and rock have been placed on some banks in an attempt to limit ongoing erosion. At the road crossing is an under-sized culvert that exhibits signs of over-road flow and erosion along the downstream slope. There is significant sediment deposition upstream of the culvert, indicating active erosion is occurring upstream. An overhead powerline crosses the stream along the south side of Brentland Road. An adjacent tributary was recently restored and ties in to the end of POTD-2018-STRE-0005 R1.

**PROPOSED RESTORATION**

Given the extent of channel instability and bank erosion, full restoration of this reach is recommended. The proposed stream restoration will follow the principles of Natural Channel Design (NCD), and establish long-term, self-maintaining stream stability. The design will re-establish a stable cross section, planform, and profile throughout the reach. A floodplain connection will be reestablished either by raising the channel invert to access the existing floodplain or by constructing a bankfull bench at a lower elevation; this will reduce flood flow velocity, facilitate deposition of fine grain sediments in the floodplain, increase local groundwater levels, and facilitate subsurface nutrient processing in the riparian area, while also allowing the property owner to keep the adjacent land in active agriculture. Stable riffles will be created within the restored channel using reinforced bed material, sized to transport sediment and enhance hyporheic flow. Geomorphic structures, including step pools, cross vanes, and sills, may be incorporated into the design to provide grade control, energy dissipation, and bank protection if conditions warrant; these geomorphic structures will also facilitate nitrogen load reduction and increase hydraulic diversity. Log structures and woody debris will provide habitat diversity and a carbon source to facilitate in-stream nitrogen processing.

The stream channel currently has adequate sinuosity; therefore, some of the proposed restoration and stabilization may occur mostly within the existing stream. In areas where tortuous meanders are proposed to be abandoned, such as in the center of the reach, oxbow channels will be established to provide alternative flow paths and habitat diversity. Current bed material contains a significant amount of large cobble that may be re-used in the reinforced bed mix to reduce materials cost. Concrete and rock placed on the banks by the property owner will be removed, and proper bank stabilization will be implemented to prevent lateral erosion and widening of the stream. The culvert at Brentland Road may be re-sized to prevent overtopping and erosion around the headwall; if it cannot be replaced, stabilization measures will be incorporated to limit erosion when the road overtops. Care will be taken to preserve several large, mature trees along the stream.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
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Clearing and grading will be the minimum necessary to perform the stream restoration and stream buffer planting. Coir matting will be placed along the top of restored stream banks, and all disturbed areas will be seeded with an erosion cover crop and a native herbaceous and woody seed mix and strawed. Streambank and buffer area will be planted following earthwork with a diverse mix of native vegetation. A 100-foot wide riparian buffer corridor is proposed along the stream channel. This includes approximately 5 acres of active agriculture. Trees will not be planted within a 20-foot wide swath beneath the powerline at Brentland Road.

**ANTICIPATED SITE CONSTRAINTS**

This site contains minimal foreseeable constraints to restoration. A culvert exists at Brentland Road to provide grade control. An overhead powerline runs along Brentland Road, but the associated poles are at a distance from the stream, and the lines are at a height that they should not impact the proposed work. Construction access will be easy due to proximity to the main road and a lack of riparian forest. Ongoing agriculture in adjacent fields may limit channel relocation. The landowner has expressed her preference for a “mowed” stream buffer – this could limit the width of the riparian buffer adjacent to the stream, and consideration should be taken to address her concerns.

**STREAM BENEFITS**

The implementation of these restoration techniques is expected to lead to an uplift of stream functions to the biological level. The contributing stream and adjacent waterways have established riparian buffers, there is no residential or industrial development within the contributing watershed, and in-stream habitat for aquatic and semi-aquatic organisms will be improved in the restored channel and buffer to create more opportunities for a healthy ecosystem.

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0005 R1**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 1: Looking downstream at 4' tall vertical, actively eroding banks with vegetation sloughing into stream**



**Photo 2: Looking downstream at a tortuous meander with 4' tall, vertical, actively eroding banks with grassy riparian vegetation and no connection to floodplain**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
**SITE ID: POTD-2018-STRE-0005 R1**  
**Existing Conditions Photos**  
**Date taken: August 9, 2018**



**Photo 3: Looking downstream at a 3' tall, incised, raw actively eroding bank with vegetation sloughing into stream and no connection to floodplain**



**Photo 4: Looking across stream at a 4' tall actively eroding banks with piled stone reinforcement placed by farmer in an attempt to slow erosion**

**POTOMAC DIRECT WATERSHED ASSESSMENT**  
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**Existing Conditions Photos**  
**Date taken: August 9, 2018**



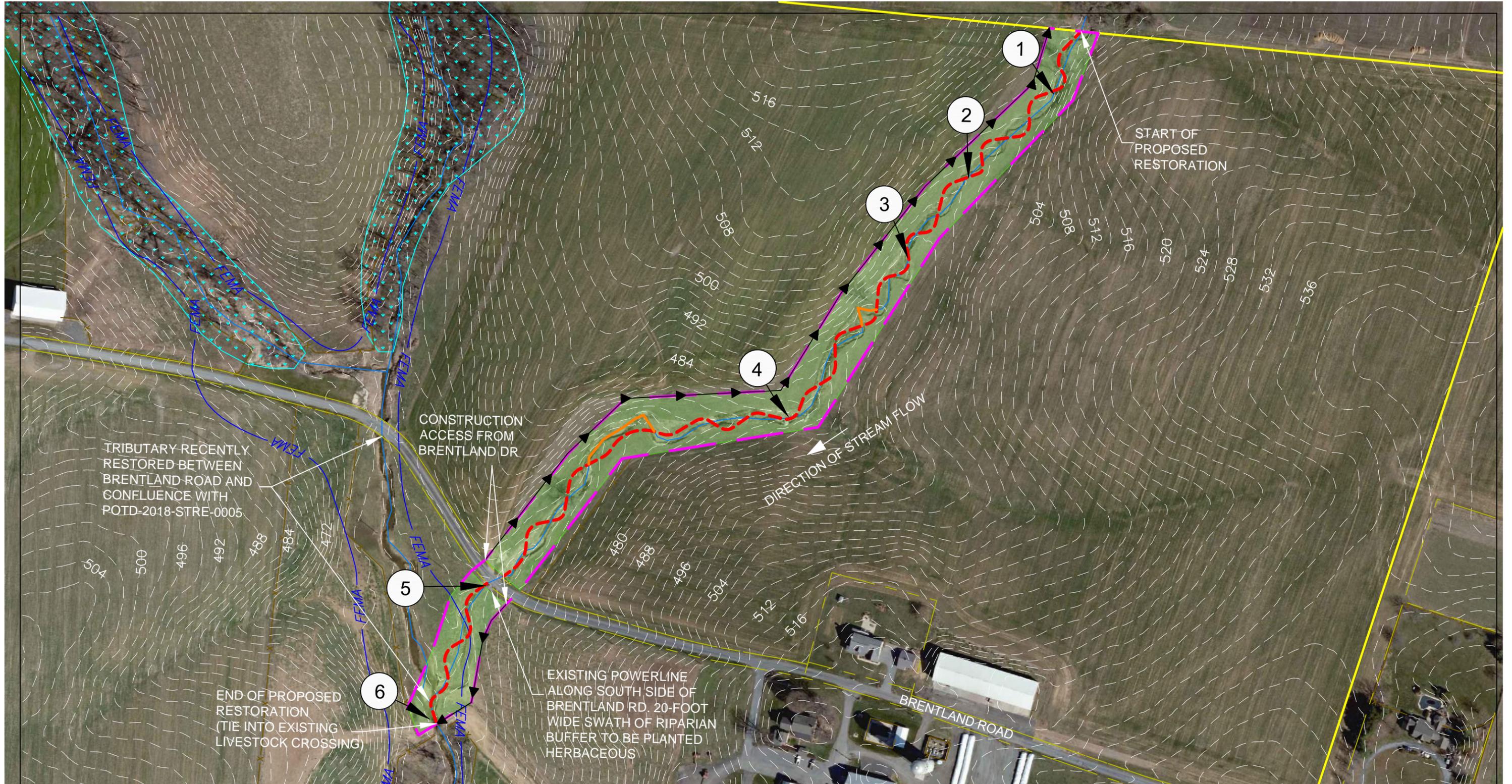
**Photo 5: Looking upstream at an under-sized culvert at a road-crossing, with signs of over-road flow and active erosion along downstream face of roadway**



**Photo 6: Looking downstream at a cattle crossing that indicates the end of the restoration site.**

# Potomac Direct Watershed Assessment

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