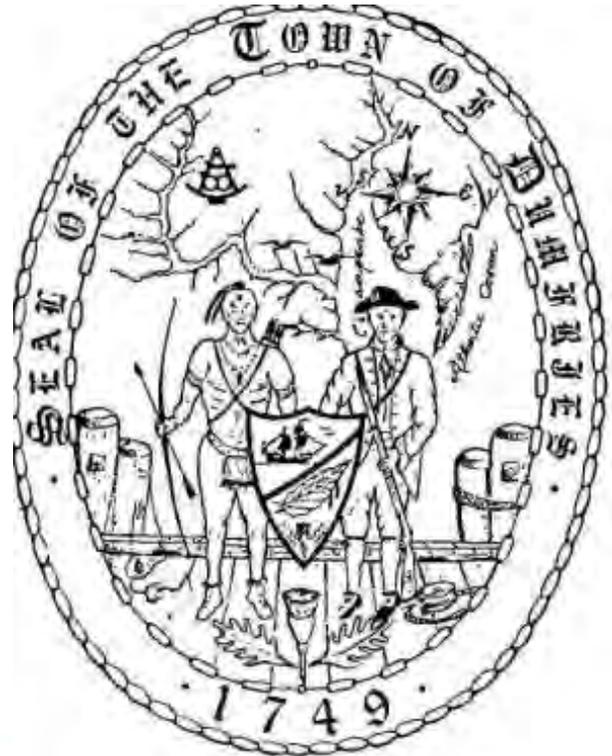
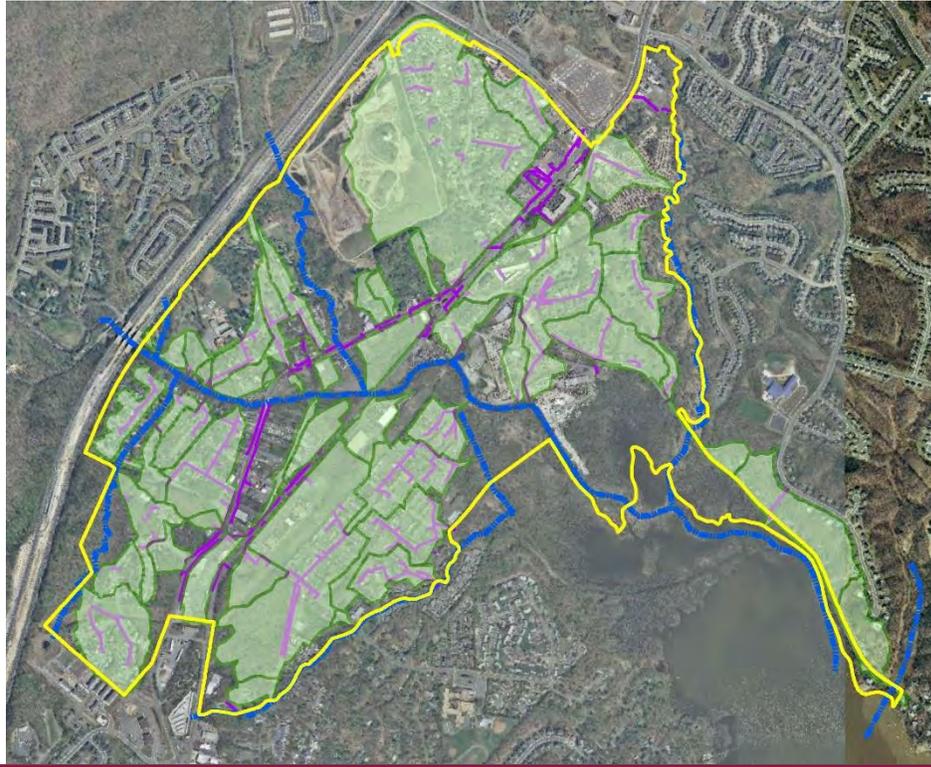


CHESAPEAKE BAY TMDL ACTION PLAN

MS4 Permit Cycle 2018 - 2023
Town of Dumfries



PREPARED FOR:

Town of Dumfries
17755 Main Street
Dumfries, Virginia 22026

April 4, 2016

Revised April 25, 2016

Adopted August 3, 2016



Draper Aden Associates
Engineering • Surveying • Environmental Services

DAA Project Number: **B15147-01**

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1.0 INTRODUCTION

Since 2003, the Town of Dumfries (Town) has been subject to the General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit). The Town's most recent permit (VAR040117) was issued by the Virginia Department of Environmental Quality (DEQ) effective July 1, 2013 and will expire June 30, 2018; this permit time period is hereinafter referred to as the first permit cycle.

The second MS4 permit cycle will be effective July 1, 2018 and will expire June 30, 2023. As of the date of this report, it is anticipated the second permit cycle will require an additional 35 percent pollutant reductions for nitrogen (N), phosphorus (P), and total suspended solids (TSS). The required pollutant of concern (POC) reductions are based on the impervious and pervious (managed turf) acreage within the MS4 service area and the required reduction in loading rates for the Potomac River Basin based on Table 3b found in the Department of Environmental Quality's (DEQ) Chesapeake Bay TMDL Special Condition Guidance document dated 05/18/2015 (DEQ Guidance).

This Action Plan recommends implementation of stormwater best management practices (BMPs) to reduce the applicable pollutants of concerns (POC) as currently required for the second permit cycle.

2.0 POC REQUIRED OFFSETS

2.1 Estimated 2nd Permit Cycle POC Load Reduction Requirement

During the first permit cycle, the proposed best management practice (BMP) implementation plan as outlined in the Town's Action Plan results in a 'credit' of pollutant removal for the POCs, as shown in Table 2A below.

			<i>BMP Implementation</i>			
			<i>Estimated Reduction of POC (lbs/yr)</i>			
Pollutant	Subsource	1st Permit Cycle Total Est. Reduction Required (lbs/yr)	Street Sweeping	Exist. BMP A - Bioretention	Total Est. Acheived	Total Add'l Required for 1st Permit Cycle (lbs/yr)
Nitrogen	Regulated Urban Impervious	13.831	20.225	6.895	27.120	-13.289
	Regulated Urban Pervious	10.435	0.000	0.509	0.509	9.925
Totals:		24.266	20.225	7.404	27.630	-3.364
Phosphorous	Regulated Urban Impervious	2.363	3.152	0.569	3.721	-1.359
	Regulated Urban Pervious	0.513	0.000	0.018	0.018	0.496
Totals:		2.876	3.152	0.587	3.739	-0.863
Total Suspended Solids	Regulated Urban Impervious	2135.316	8536.667	411.660	8948.327	-6813.011
	Regulated Urban Pervious	265.656	0.000	7.639	7.639	258.017
Totals:		2400.972	8536.667	419.299	8955.966	-6554.993

Table 2A: Total POC Estimated Reductions Achieved during the 1st Permit Cycle

The resulting estimated pollutant removals for the second permit cycle are shown in Table 2B below.

		A	B	C	D
Pollutant/Subsource		1st Permit Cycle Total Est. Reduction Required (lbs/yr)	Total Est. Acheived Reduction with 1st Permit Cycle BMPs (lbs/yr)	Total Est. 2nd Permit Cycle Reduction Required (lbs/yr)	Total Add'l Required for 2nd Permit Cycle (lbs/yr): (A+C)-B
Nitrogen					
	Regulated Urban Impervious	13.831	27.1204	96.817707	83.5284
	Regulated Urban Pervious	10.435	0.5091	73.041738	82.9671
Totals:		24.266	27.6295	169.859445	166.4955
Phosphorous					
	Regulated Urban Impervious	2.363	3.7213	16.538256	15.1795
	Regulated Urban Pervious	0.513	0.0178	3.593455	4.0890
Totals:		2.876	3.7392	20.131711	19.2685
Total Suspended Solids					
	Regulated Urban Impervious	2135.316	8948.3271	14947.214520	8134.2038
	Regulated Urban Pervious	265.656	7.6385	1859.590425	2117.6077
Totals:		2400.972	8955.9656	16806.804945	10251.8115

Table 2B: Total Additional Estimated POC Reductions Required for 2nd Permit Cycle

3.0 MEANS & METHODS TO MEET POC LOAD REDUCTIONS

3.1 Potential BMPs

Various potential BMPs were reviewed and evaluated throughout the Town, including new BMPs, retrofitting existing features, and stream restoration to comply with the second permit cycle pollutant removal requirements. The main criteria for determining whether a BMP is viable and cost-effective is the size and characteristics of the BMPs contributing drainage area (CDA). The BMPs CDA must be within the MS4 area and include a substantial impervious area. For the purposes of this plan, Town-owned properties were first evaluated; refer to Appendix A for figures of each area described below.

1. Dominion Drive: This parcel (GPIN 8189-61-4333) located adjacent to Dominion Drive between Curtis Drive and Lyda Lane was considered for a BMP location; however, the Lyda Lane stream restoration provided significantly more POC reductions to meet the second permit cycle requirements (refer to Section 3.1).
2. Merchant Park: The park site has a small MS4 CDA with a limited amount of impervious area. The cost of BMP implementation would outweigh the pollutant removal realized, and, therefore, this site was deemed not viable.
3. Tebbs Lane: This parcel (GPIN 8188-69-1470) located north of Tebbs Lane and west of Wilmer Porter Court was considered for a BMP retrofit; however, due to the steep topography, there is limited space for improvements. There is also high potential for encountering existing emergent wetlands; therefore, this site was deemed not viable.
4. Ginn Memorial Park: The park site has a small MS4 CDA and limited amount of impervious area. The cost of BMP implementation would outweigh the pollutant removal realized, and, therefore, this site was deemed not viable.
5. Old Dumfries Waste Water Treatment Plant (WWTP): The old WWTP site has a small contributing MS4 drainage area. The cost of BMP implementation would outweigh the pollutant removal realized, and, therefore, this site was deemed not viable.

3.2 Nutrient Credit Purchase Option

In accordance with § 62.1-44.19:21 of the Code of Virginia, “an MS4 permittee may acquire, use, and transfer nutrient credits for purposes of compliance with any waste load allocations established as effluent limitations in an MS4 permit” This applies to POCs for phosphorous, nitrogen, and sediment; purchase of sediment reduction credits was signed into law by the Governor on March 1, 2016.

The permittee may use such credits for compliance purposes only if (i) the credits, whether annual, term, or perpetual, are generated and applied for purposes of compliance for the same calendar year; (ii) the credits are acquired no later than a date following the calendar year in which the credits are applied as specified by the Department consistent with the permittee's Virginia Stormwater Management Program (VSMP) permit annual report deadline under such permit; (iii) the credits are generated in the same locality or tributary, ...; and (iv) the credits either are point source nitrogen or point source phosphorus credits generated by point sources covered by the general permit issued pursuant to § 62.1-44.19:14, or are certified pursuant to § 62.1-44.19:20. An MS4 permittee may enter into an agreement with one or more other MS4 permittees within the same locality or within the same or adjacent eight-digit hydrologic unit code to collectively meet the sum of any waste load allocations in their permits. Such permittees shall submit to the Department for approval a compliance plan to achieve their aggregate permit waste load allocations.

Currently, there is one non-point source nutrient credit bank within the Town’s HUC code 02070011 with 33 and 516 available nutrient credits for phosphorous and nitrogen, respectively. There are three (3) non-point source nutrient credit banks within the adjacent HUC. Refer to Appendix B. The cost per pound of POC removal for phosphorus and nitrogen as of this date is approximately \$25,000. Information regarding sediment reduction credit costs have not been released as of this date.

If the Town selected this option, it would cost the Town approximately \$4.7 million (based on the market as of this date) for the required second permit cycle pollutant reductions for phosphorous and nitrogen only. This option is not recommended due to its high cost and the additional cost required to implement BMPs or purchase future credits for sediment removal. It is more cost-effective and efficient for the Town to implement BMPs that address the three POCs.

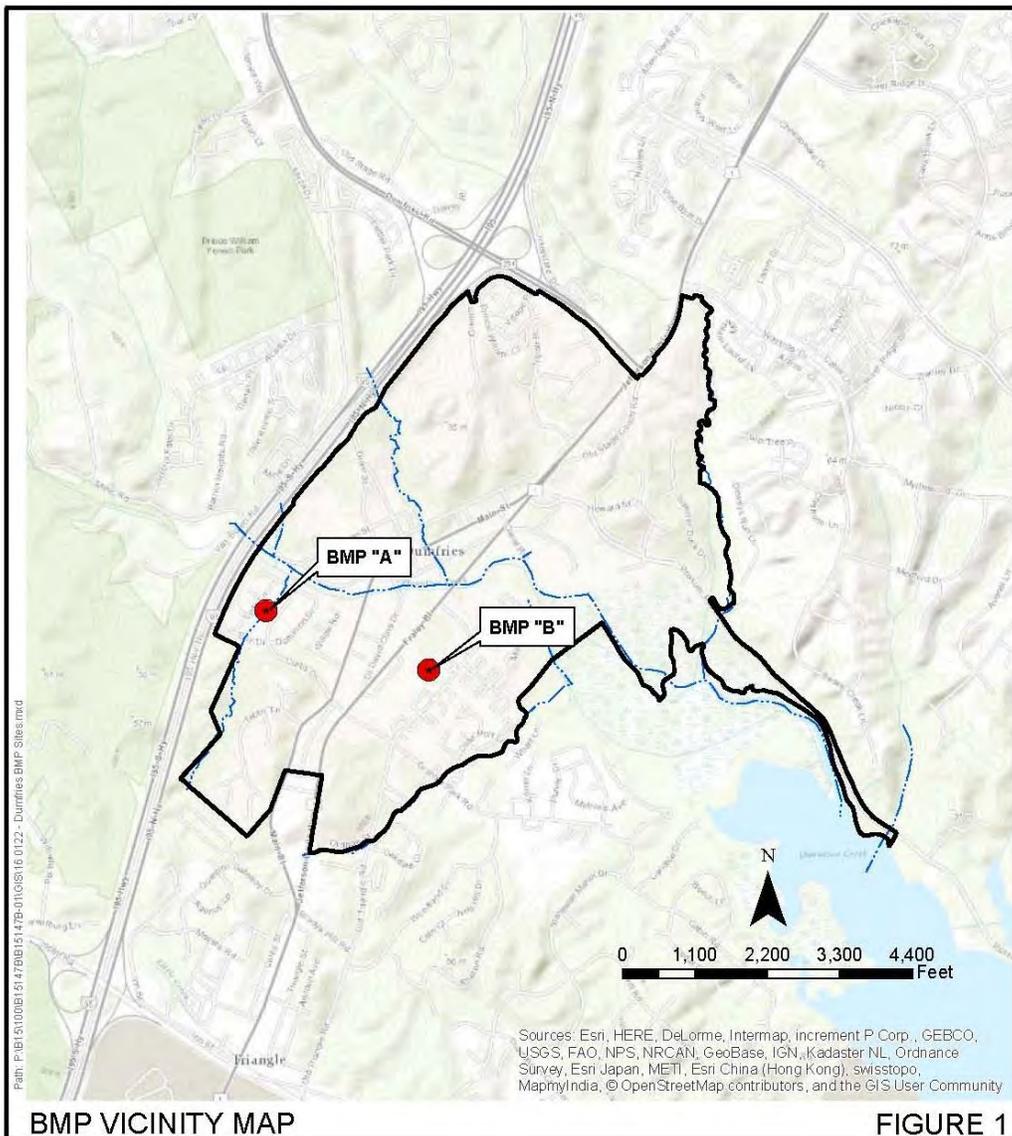
3.3 Recommended BMPs

The following are recommended BMPs based on a desktop review and our knowledge of the Town and its infrastructure; other BMP opportunities may be available in addition to those provided below to meet the required POC reductions for the second permit cycle. The BMPs suggested below will require easements and/or purchase of parcels, and perpetual maintenance of the BMPs.

The recommended BMPs are listed below; the location of each BMP is shown on Figure 1.

BMP A: Lyda Stream Restoration

BMP B: Old Triangle Road New Wet Pond



A summary of compliance with the second permit cycle anticipated requirements are shown in Table 3A.

		2nd Permit Cycle BMP Implementation			
		Estimated Reduction of POC (lbs/yr)			
Pollutant	2nd Permit Cycle Total Est. Reduction Required (lbs/yr)	A - Lyda Stream Restoration	B - Old Triangle Rd New Wet Pond	Total Est. Acheived	Required for 2nd Permit Cycle
Nitrogen	166.4955	66.65	131.80	198.45	-31.95
Phosphorous	19.2685	64.13	14.78	78.91	-59.64
Total Suspended Solids	10251.8115	42263.77	11179.30	53443.07	-43191.26

Table 3A: Summary of Estimated POC Achieved with Recommend 2nd Permit Cycle BMP Implementation

The nitrogen reduction requirements for the second permit cycle necessitated the recommendation for BMP B; BMP A exceeds requirements for P for both the second and third permit cycles, and TSS removal for the second cycle.

3.4 Lyda Stream Restoration & Outfall Regeneration

A stream lies southeast of Lyda Lane and northwest of Curtis Drive running parallel to both roads in the rear yards of a single-family residential subdivision. This channel is a tributary to Quantico Creek. The recommended limits of the restoration are from the edge of the forested area south of Eby Drive northeast parallel to Lyda Lane, to and including the outfall of culvert under Dominion for a distance of approximately 950 feet; refer to Figure 2.

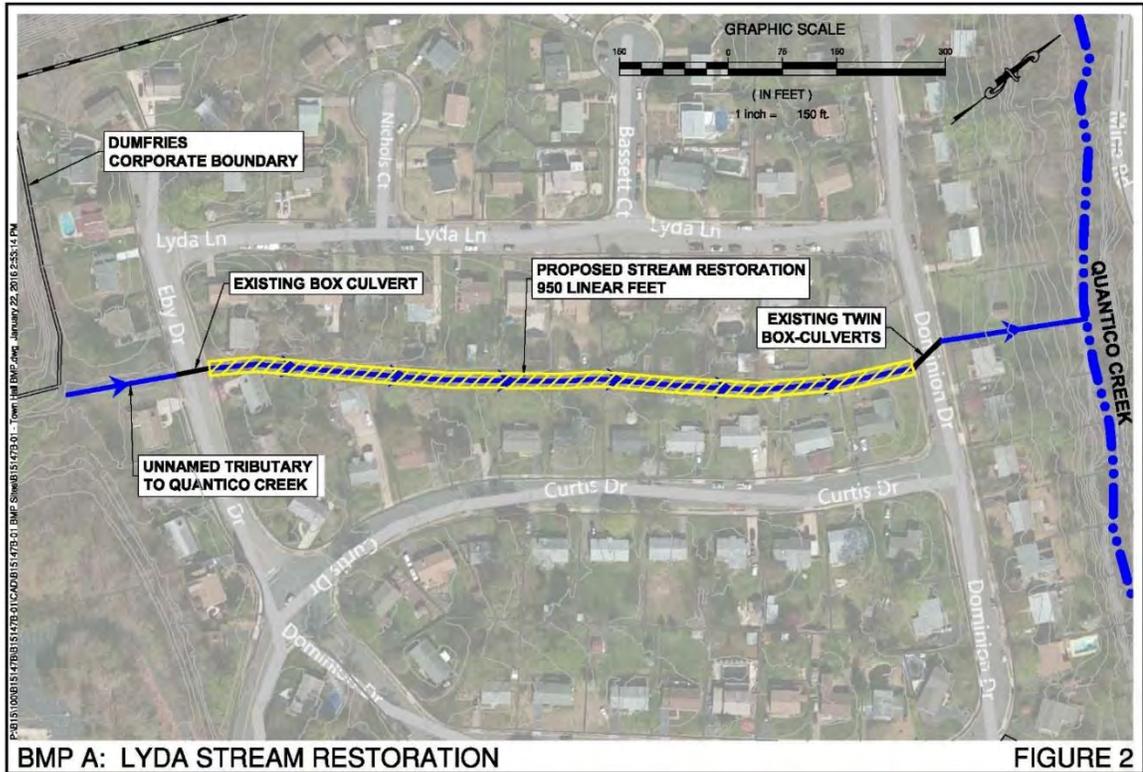


Table 3B summarizes the CDA characteristics to this portion of the stream.

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	Overall Total
Regulated Land	11.5	27.7	39.2	5.8	45.0
Unregulated Land	1.3	4.4	5.7	37.5	43.2
Total:	12.8	32.1	44.9	43.3	88.2

Table 3B: Contributing Drainage Area Characteristics

Using the protocols provided in the DEQ Guidance, Appendix V.J. – Urban Stream Restoration, the initial POC reductions are calculated by multiplying the length of the restoration by the interim approved removal rates for each POC, as provided in Table V.J.1 of the Guidance document, and by the ratio of the land type with the CDA. Table 3C summarizes the initial POC reductions from the proposed stream restoration.

Pollutant	Interim Approved Removal Rates (lbs/LF)	POC Reductions (lbs/yr)	Acreage Ratio	Initial Reductions (lbs/yr)
Nitrogen	0.075	71.25		
<i>Regulated Land</i>			0.4444444	31.667
<i>Unregulated Land</i>			0.0646259	4.605
<i>Forested</i>			0.4909297	34.979
Phosphorous	0.068	64.60		
<i>Regulated Land</i>			0.4444444	28.711
<i>Unregulated Land</i>			0.064626	4.175
<i>Forested</i>			0.490930	31.714
Total Suspended Solids	44.88	42636.00		
<i>Regulated Land</i>			0.4444444	18949.333
<i>Unregulated Land</i>			0.064626	2755.388
<i>Forested</i>			0.490930	20931.279

Table 3C: Initial POC Reductions from the Proposed Stream Restoration

The baseline POC loading for all three permit cycles from unregulated urban impervious and pervious areas within the CDA must be calculated; refer to Table 3D below.

Pollutant	1st Permit Cycle Loading Rate (lbs/ac/yr)	Total Baseline Loading Rate (lbs/ac/yr)	Area (acres)	Total Baseline Loading (lbs/yr)
Nitrogen				
<i>Unregulated Urban Impervious</i>	0.076	1.517	1.300	1.973
<i>Unregulated Urban Pervious</i>	0.030	0.604	4.400	2.658
Phosphorous				
<i>Unregulated Urban Impervious</i>	0.013	0.259	1.300	0.337
<i>Unregulated Urban Pervious</i>	0.001	0.030	4.400	0.131
Total Suspended Solids				
<i>Unregulated Urban Impervious</i>	11.713	234.264	1.300	304.543
<i>Unregulated Urban Pervious</i>	0.769	15.383	4.400	67.683

Table 3D: Total Baseline Reductions from the Proposed Stream Restoration

The total allowable reductions from unregulated urban areas is determined by subtracting the baseline loading from the initial reductions; refer to Table 3E below.

Pollutant	Initial Reductions (lbs/yr)	Total Baseline Loading (lbs/yr)	Total Allowable Reductions (lbs/yr)
Nitrogen			
<i>Unregulated Urban</i>	4.605	4.631	0.000
Phosphorous			
<i>Unregulated Urban</i>	4.175	0.468	3.707
Total Suspended Solids			
<i>Unregulated Urban</i>	2755.388	372.226	2383.162

Table 3E: Total Allowable Unregulated Area Reductions

The total POC reductions resulting from the stream restoration is the sum of the initial reductions from regulated and forested areas and the allowable unregulated reductions for the CDA; refer to Table 3F below.

Pollutant	Regulated Areas (lbs/yr)	Un-regulated Urban Areas (lbs/yr)	Forested Areas (lbs/yr)	Total Reductions (lbs/yr)
<i>Nitrogen</i>	31.667	0.000	34.979	66.645
<i>Phosphorous</i>	28.711	3.707	31.714	64.132
<i>Total Suspended Solids</i>	18949.333	2383.162	20931.279	42263.774

Table 3F: Total Allowable Reductions from CDA

3.5 Old Triangle Road New Wet Pond

There are two culverts that discharge into the Dominion Power right-of-way northeast of Kilpatrick Place and north of Old Triangle Road. If an easement could be negotiated with Dominion, a wet pond could be constructed to provide additional POC removal from the MS4 area. Refer to Figures 1 and 3. The wet pond (level 1 minimum) shall be designed and constructed as per the criteria found in the Virginia DEQ Stormwater Design Specification No. 14 – Wet Pond.

		Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	Overall Total
Regulated Land		12.5	22.7	35.2	15.3	50.5
Unregulated Land		0.0	0.0	0.0	0.0	0.0
Total:		12.5	22.7	35.2	15.3	50.5

Table 3G: Contributing Drainage Area Characteristics

	Total Existing (Est.) Acres Served by Basin	2009 EOS Loading Rate (lbs/ac/yr)	Estimated Total POC Load (lbs/yr)
Nitrogen			
Urban Impervious	12.50	16.86	210.75
Urban Pervious	22.70	10.07	228.59
Totals:	35.20	26.93	439.34
Phosphorous			
Urban Impervious	12.50	1.62	20.25
Urban Pervious	22.70	0.41	9.31
Totals:	35.20	2.03	29.56
Total Suspended Solids			
Urban Impervious	12.50	1171.32	14641.50
Urban Pervious	22.70	175.80	3990.66
Totals:	35.20	1347.12	18632.16

Table 3H: Estimated POC Load from CDA

Nutrient	Estimated Total POC Load (lbs/yr)	Efficiency Removal Rate	Estimated POC Reduction (lbs./yr.)
Nitrogen	439.34	30%	131.80
Phosphorus	29.56	50%	14.78
Sediment	18632.16	60%	11179.30

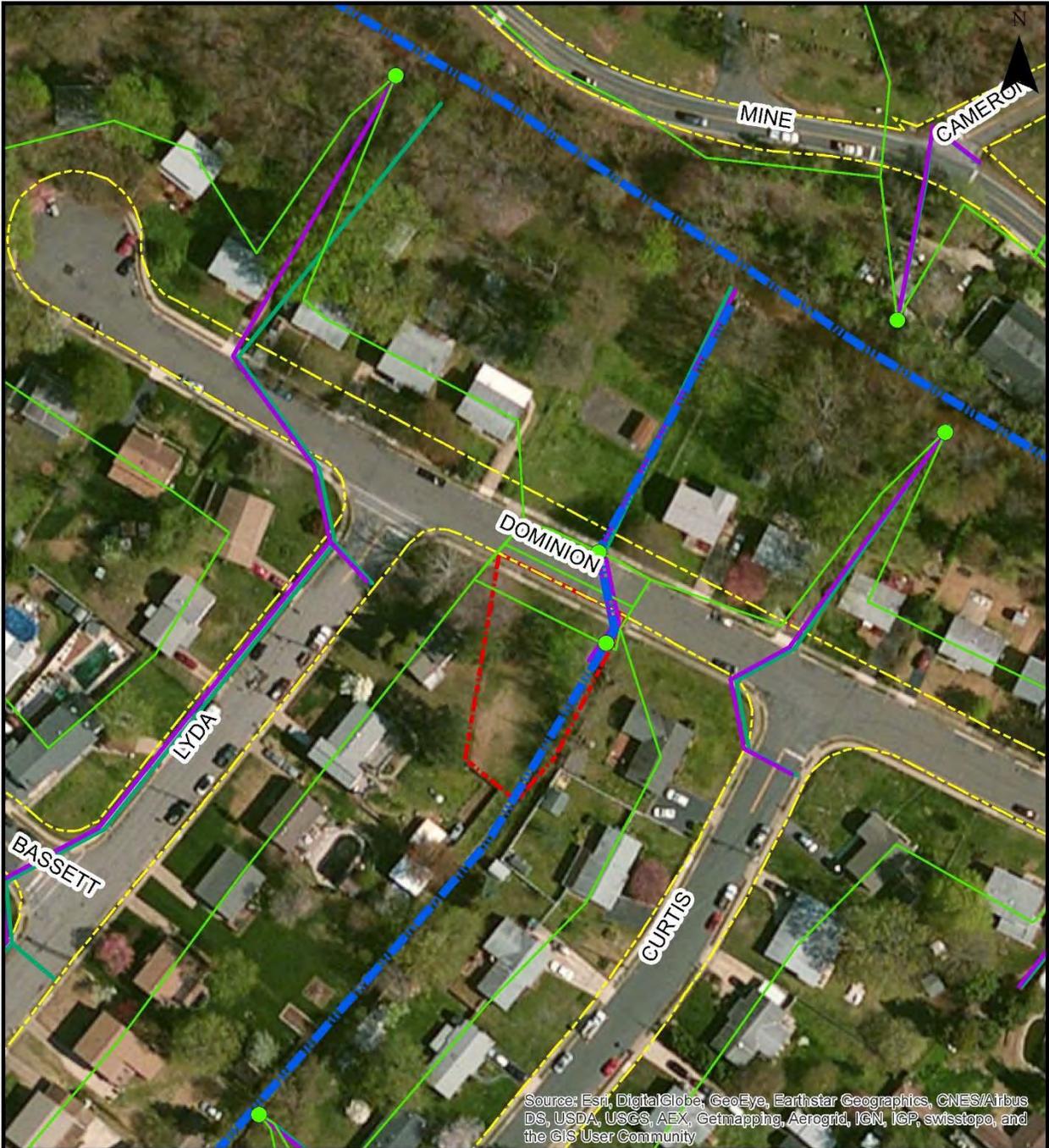
Table 3I: Estimated POC Reduction from Wet Pond (Level 1)

4.0 ESTIMATED COSTS FOR IMPLEMENTATION

Using best available information and recent bids for similar projects, the following estimated range of probable project costs, including design, permitting, easement / rights-of-way acquisition, and construction, are provided for each BMP.

- A. Lyda Stream Restoration and Outfall Regeneration\$ 400,000 – 520,000
- B. Old Triangle Road New Wet Pond\$ 760,000 – 900,000

APPENDIX A – EVALUATED BMPS



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Dominion Drive - 8189-61-4333

SCALE: 1" = 100'

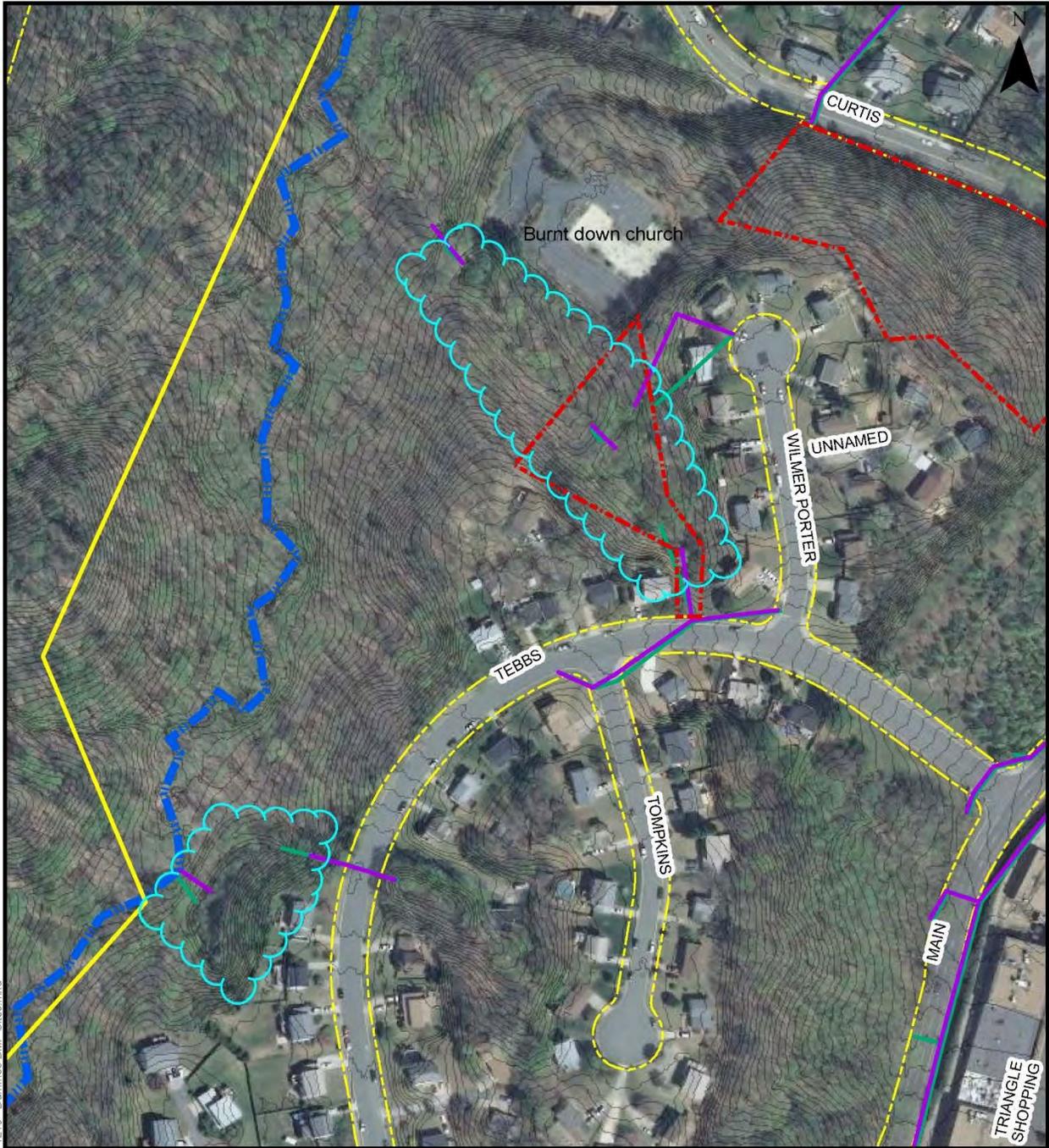
PLAN NO.: B15147B-01



Cameron Street - 8189-72-3626 and 8189-72-5227

SCALE: 1" = 100'

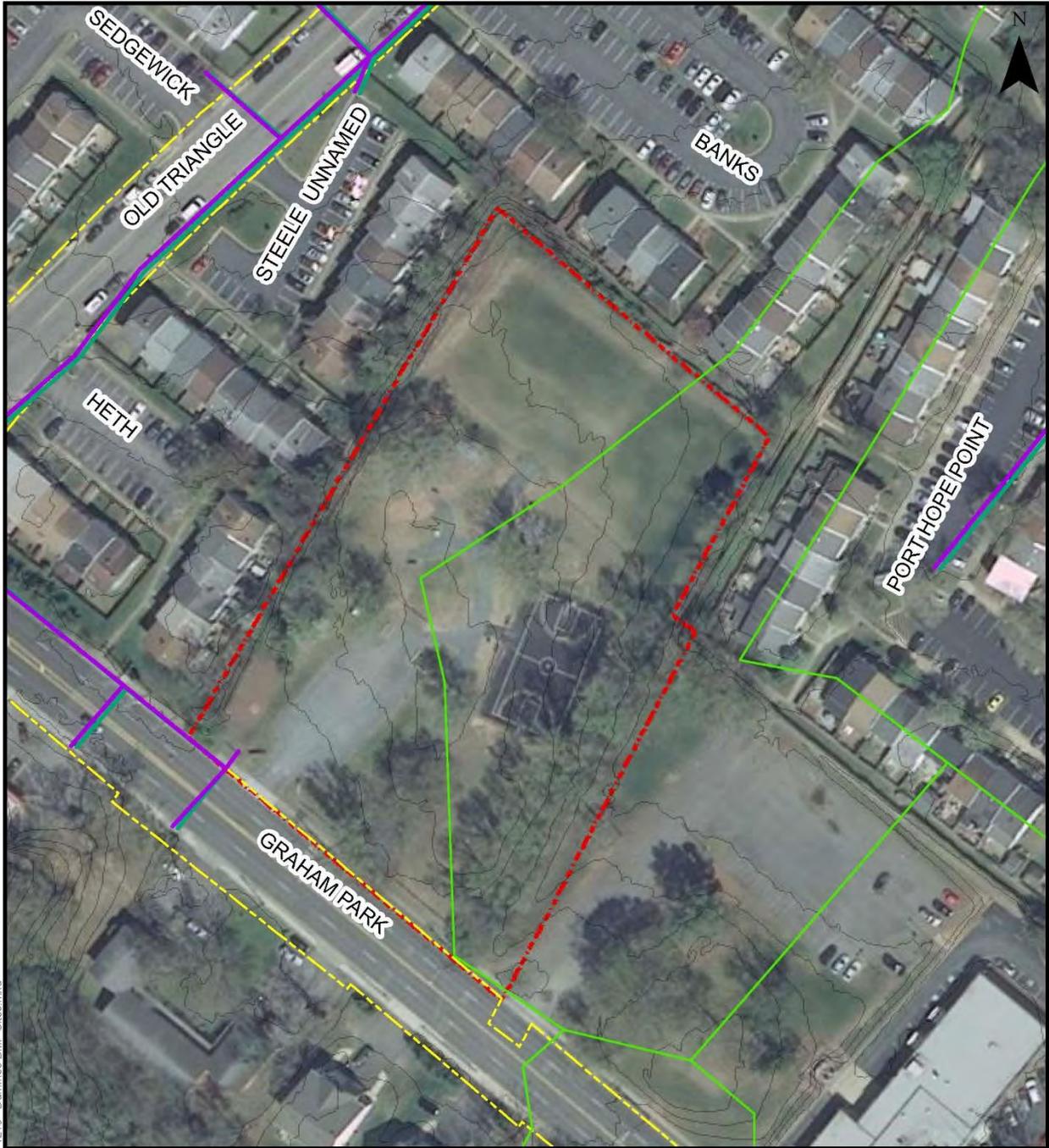
PLAN NO.: B15147B-01



**18086 Tebbs Ln - PIN 8188-69-1470 and
Behind church on Curtis Drive**

SCALE: 1" = 200'

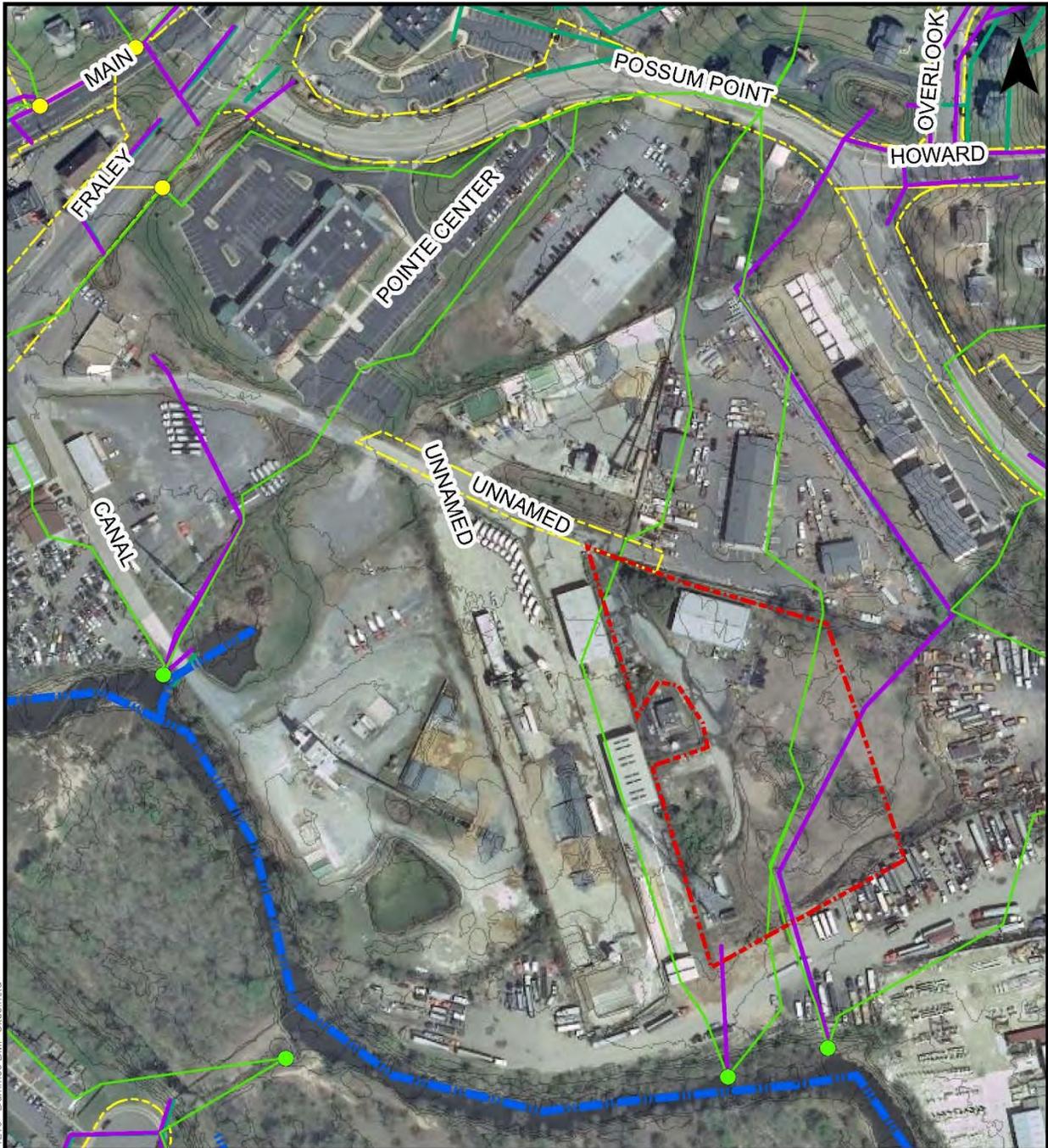
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Graham Park Rd - 8188-88-5393

SCALE: 1" = 100'

PLAN NO.: B15147B-01



Canal Street - 8289-01-9266

SCALE: 1" = 200'

PLAN NO.: B15147B-01

**APPENDIX B – VIRGINIA NONPOINT SOURCE
NUTRIENT CREDIT REGISTRY, 2/12/2016**

Virginia Nonpoint Source Nutrient Credit Registry

Nutrient Bank	Urban/ Ag BMPs	Bank Sponsor	Broker	Broker Contact	Phone No.	County	HUC Code	Certification No.	Credits Released		Credits Used/Retired		Credits Available	
									Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen
Wildwood Farm	Ag land conversion	Chesapeake Bay Nutrient Land Trust LLC	Chesapeake Bay Nutrient Land Trust, LLC	Casey Jensen	(804) 836-6636	Appomattox	02080203	James-001	101	376	60.78	222.60	40.22	153.4
Malvern Landbank	Ag land conversion	Le Moulin, LLC	Stadia Development	Ron Green	(804) 908-4171	Powhatan	02080205	James-002	62.04	278.66	50.03	222.3	12.01	56.36
Cranston Millpond	Urban BMP	Cranston Mill Pond, LLC	Chesapeake Bay Nutrient Land Trust, LLC	Casey Jensen	(804) 836-6636	James City	02080206	James-003	752	1655	155.43	342.83	596.57	1312.17
Swiss Dixie	Ag land conversion	R&J Investments, LC	Stadia Development	Ron Green	(804) 908-4171	Amelia	02080207	James-004	228.05	763.26	42.39	141.87	185.66	621.39
Eastern Henrico Nutrient Bank	Ag land conversion	Dominion Golf, LLC	Midview Management Corp.	Spud Mistr	(804) 387-7783	Henrico	02080206	James-005	98.10	365.52	27.03	100.46	71.07	265.06
Layne	Ag land conversion	Osborne Glenn, LLC	Wilton Family Investment Trust	Henry Wilton	(804) 285-2191	Henrico	02080206	James-006	66.65	573.32	23.44	201.31	43.21	372.01
Leinster	Ag land conversion	Leinster Nutrient Exchange, LLC	Leinster Nutrient Exchange, LLC	Herbert Fitzgerald	(804) 514-7551	Nottoway	02080207	James-007	23.06	103.57	23.03	103.50	0.03	0.07
Stone Tavern Nutrient Bank	Ag land conversion	Stone Tavern, LLC	Stone Tavern, LLC	David Whitmore	(540) 460-2944	Rockbridge	02080201	James-008	20.11	26.94	13.56	18.16	6.55	8.78
Dungeness Nutrient Bank	Ag land conversion	Sara M. Grattan	Sara M. Grattan	Sara M. Grattan	(804) 347-8755	Goochland	02080205	James-009	22.81	102.48	0.00	0.00	22.81	102.48
Shaefer Nutrient Bank	Ag land conversion	Joy P. Massie and James P. Massie, Jr. Irrevocable Trust u/a December 21, 2012	Alexander Massie	Alexander Massie	(804) 839-2065	Goochland	02080205	James-010	71	318.94	16.14	72.47	54.86	246.47
Buckingham Nutrient Bank	Ag land conversion	Overland VA, LLC	Overland VA, LLC	Harrison Hall	(804) 814-5299	Buckingham	02080203	James-011	36.29	121.46	20.24	67.73	16.05	53.73
Prince Edward	Ag land conversion	Leinster Nutrient Exchange, LLC	Leinster Nutrient Exchange, LLC	Herbert Fitzgerald	(804) 514-7551	Prince Edward	02080207	James-012	5.11	11.71	0.00	0.00	5.11	11.71
Greyfields	Ag land conversion	James K. Timmons Jr., Trustee and Marian Free Timmons	James K. Timmons Jr., Trustee and Marian Free Timmons	Ken Timmons Jr.	(804) 358-1150	Powhatan	02080205	James-13	13.37	60.06	0.00	0.00	13.37	60.06
Pamunkey Farms	Ag land conversion	Falling Springs, LLC	Falling Springs, LLC	James Parker	(804) 330-8092	New Kent	02080106	York-001	41.93	436.8	41.79	435.37	0.14	1.43
Healy's Pond	Ag land conversion	Healy's Pond Nutrient Offset and Trading Bank, LLC	Chesapeake Bay Nutrient Land Trust LLC	Casey Jensen	(804) 836-6636	Middlesex	02080102	York-002	31.52	212.76	0.93	4.72	30.59	208.04
York	Ag land conversion	CBAY-VA LLC	Resource Environmental Solutions, LLC	Cara Conder	(919) 209-1052	New Kent	02080107	York-003	37.62	391.91	0.00	0.00	37.62	391.91
Rappahannock Nutrient Bank	Ag land conversion	Perdue-Barboursville, LLC	Perdue-Barboursville, LLC	David Perdue	(804) 432-6805	Orange	02080103	Rappahannock-001	81.80	260.93	0.00	0.00	81.8	260.93
Culpeper	Ag land conversion	Overland VA, LLC	Overland VA, LLC	Harrison Hall	(804) 814-5299	Culpeper	02080103	Rappahannock-002	78.36	235.55	22.87	67.01	55.49	168.54
Pristine Waters	Ag land conversion	Pristine Waters Environmental Solutions, Inc.	Ecosystem Services, LLC	Jon Roller	(540) 578-4296	Orange	02080103	Rappahannock-004	106.67	419.07	0.00	0.00	106.67	419.07
Buena Vista	Ag land conversion	Falling Springs, LLC	Falling Springs, LLC	James Parker	(804) 330-8092	King George	02070011	Potomac-001	67.55	1057.14	34.52	541.31	33.03	515.83
Swinging Bridge	Ag land conversion	Paul J. Wright	P. J. Wright	P. J. Wright	(540) 430-3070	Augusta	02070005	Potomac-002	8.61	54.25	0 ¹	0 ¹	0 ¹	0 ¹
Elk Run	Ag land conversion	CBAY-VA LLC	Resource Environmental Solutions, LLC	Cara Conder	(919) 209-1052	Fauquier	02070010	Potomac-003	115.15	1550.97	115.01	1549.40	0.14	1.57
Wampler Road	Ag land conversion	NERD Farms, LLC	Virginia Nutrient Bank, LLC	Nathan Blackwell	(540) 908-1679	Rockingham	02070006	Potomac-004	33.51	341.83	31.66	320.28	1.85	21.55
Holy Cross Abbey	Ag land conversion	CBAY-VA LLC	Resource Environmental Solutions, LLC	Cara Conder	(919) 209-1052	Clarke	02070007	Potomac-005	65.78	396.93	53.99	310.20	11.79	86.73
Midland	Ag land conversion	CBAY-VA LLC	Resource Environmental Solutions, LLC	Cara Conder	(919) 209-1052	Fauquier	02070010	Potomac-006	167.96	2244.97	160.05	2141.02	7.91	103.95
South River	Ag land conversion	EBCO, LLC	EBCO, LLC	Eddie Burkholder	(540) 490-4001	Augusta	02070005	Potomac-007	17.37	148.1	0.00	0.00	17.37	148.10
Autumn Lane	Ag land conversion	TROBUDD, Inc.	Virginia Nutrient Bank, LLC	Nathan Blackwell	(540) 908-1679	Rockingham	02070005	Potomac-008	25.61	331.45	0.00	0.00	25.61	331.45
Owl Run	Ag land conversion	CBAY-VA LLC	Resource Environmental Solutions, LLC	Cara Conder	(919) 209-1052	Fauquier	02070010	Potomac-011	50.99	556.97	0.00	0.00	50.99	556.97
Totals									2,379	12,840	893	6,863	1,478	5,923

Notes: ¹ Credits have not been transferred but are reserved per 9/20/13 letter from bank sponsor