City of Alexandria, Virginia

Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan for 5% Compliance

June 30, 2015

For compliance with 9VAC25-890 et. seq., "General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems, Permit No. VAR040057

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Executive Summary

The purpose of this Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan is to comply with Section I C "Special condition for the Chesapeake Bay TMDL" of the 2013 – 2018 General Virginia Pollution Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4), No. VAR040057 issued to the City of Alexandria (City). This Action Plan has been developed to provide a review of the current MS4 program and demonstrate the City's ability to comply with the required 5% reductions for existing sources as of June 30, 2009, increased loads from 2009-2014 New Sources, and increased loads from Grandfathered projects (9VAC25-870-48). The Action Plan includes the requisite planning items found in permit Section I C.2., according to the procedures provided in the Virginia Department of Environmental Quality (DEQ) Guidance Memo No. 15-2005 dated May 18, 2015 (Guidance). The main focus of the Action Plan is to provide the means and methods and a general level of effort that will be needed for the City to meet the 5% Chesapeake Bay TMDL reduction targets in the MS4 permit for phosphorus, nitrogen, and sediment developed by the United States Environmental Protection Agency (EPA) in December 2010.

The TMDL contains aggregate wasteload allocations (WLAs) for regulated stormwater and no specific WLAs for the City's MS4. The Phase I Virginia Watershed Implementation Plan (WIP I) submitted to EPA on November 29, 2010 contains general requirements for permittees. The Phase II WIP that was submitted to EPA on March 20, 2012 builds on the Phase I WIP as the state's primary planning tool to establish strategies, targets, and expectations for different sectors; including urban stormwater for local governments. The Phase II WIP requires the implementation of urban stormwater controls to meet specific nutrient and sediment reductions – Level 2 (L2) scoping implementation – to address the TMDL. The WIPs identify the use of state-issued stormwater permits as the tool for compliance by requiring target reductions for the TMDL. The MS4 general permit reissued by DEQ and effective July 1, 2013 contains special conditions requiring the implementation of strategies to meet 5% reductions of the overall L2 scoping for nitrogen, phosphorus and sediment, along with offsets for new sources and grandfathered projects. The permit also requires the completion of a Chesapeake Bay TMDL Action Plan by June 30, 2015, which must contain the means and methods to meet the pollutant reduction targets. This 5% goal – or Phase I – must be implemented no later than the end of the current 5-year MS4 permit period (by June 30, 2018).

The following excerpt from the WIP II provides more information on the L2 scoping:

> The Commonwealth will utilize MS4 permits to ensure BMP implementation on existing developed lands achieves nutrient and sediment reductions equivalent to Level 2 (L2) scoping run reductions by 2025. Level 2 implementation equates to an average reduction of 9 percent of nitrogen loads, 16 percent of phosphorus loads, and 20 percent of sediment loads from impervious regulated acres and 6 percent of nitrogen loads, 7.25 percent of phosphorus loads and 8.75 percent sediment loads beyond 2009 progress loads for pervious regulated acreage. These reductions are beyond urban nutrient management reductions for pervious regulated acreage.

According to the WIP II and MS4 general permit, the City will have three full MS4 permit cycles to implement the required reductions (Phase I: 2013-2018; Phase II: 2018-2023; and Phase III: 2023-2028). During the first cycle (Phase I), the City will need to implement practices sufficient to achieve 5% of the reduction targets. During the second cycle (Phase II), the City will need to implement additional practices sufficient to achieve 35% reductions for a total of 40%. Finally, the remaining 60% for the total reduction target must be achieved by 2028 (Phase III). Pursuant to the permit, this Action Plan is only required to address the 5%, or Phase I, reductions required during the permit term. While the WIP II contains a range of strategies applicable to urban land uses, the City can only be required to implement strategies that are enforceable through the MS4 permit based on the City's regulated land contained in the MS4 service area.

The technical and fiscal challenges of meeting the Chesapeake Bay TMDL as required in the MS4 general permit will be significant. Since the development of the TMDL and WIPs, the City engaged internal and external support to assist in an analysis to meet the reduction requirements and to develop a better overall understanding of the potential cost and feasibility of different combinations of stormwater best management practices (BMPs). The Action Plan builds on the previous technical and planning-level work and refines previous analysis of the potential strategies discussed by the City's internal stakeholders – the Water Quality Steering Committee and Water Quality Work Group – and external stakeholders in order to meet the MS4 general permit target reductions.

A. MS4 Service Area

Calculation of phosphorus, nitrogen, and sediment existing source loads are based on impervious and pervious land uses regulated by the MS4 permit. The existing pollutant loads and the targeted reductions depend on the amount of pervious and impervious land cover in the City's MS4 service area. The area served by the MS4 includes those areas draining to a regulated stormwater outfall. Lands that are regulated under a separate VPDES stormwater permit, lands that sheet flow directly to waters of the state, wetlands and open waters, and forested areas are not considered part of the MS4 service area.

The City's ArcGIS impervious cover and storm sewer data were used to determine the estimated size and extent of the regulated MS4 service area for the June 30, 2009 baseline condition as the starting point for estimating existing loads towards meeting TMDL target reductions.

B. Existing Source Loads and Calculated Reductions

Following the determination of the MS4 service area and the breakdown of impervious and pervious land uses, the total baseline load from existing sources and the target reductions in pounds for phosphorus, nitrogen, and sediment was determined. MS4 general permit Table 2b assigns existing source loads for regulated impervious and regulated pervious land use in the Potomac River Basin. Permit Table 3b incorporates the required L2 reductions by discounting the overall loading rate for the Potomac River Basin. However, using the discounted loading rate in permit Table 3b yields a slightly different required reduction for the first permit cycle than calculating a 5% target reduction using the overall reductions and the L2 scoping. Part II 2 on page 7 of the Guidance provides the more accurate discounted loading rates for the Potomac River Basin than those in permit Table 3b. The Guidance allows either Table 3b or the Guidance; however, DEQ will need to address this discrepancy during subsequent MS4 permit cycles and guidance. This Action Plan addresses the required reductions presented in Table 6b using the Guidance 5% loading rates

Table E1 presents the total pollutant loads from existing sources using permit Table 2b. The 5% reduction requirements were calculated using permit Table 3b.

Table E1 – Total Pollutant Loads and Required Reductions

Subsource	Pollutant of Concern	Est. MS4 Service Area (ac)	Loading Rates (lbs/ac/yr)	Load per Land Cover (lbs/yr)	Total Exiting Load (lbs/yr)	Est. Total Required (lbs/yr)*	Required Phase I (lbs/yr)
Regulated Impervious	TN	3417.24	16.86	57,615	**97,809.78**	**7,597.03**	**379.85**
Regulated Pervious		3991.57	10.07	40,195			
Regulated Impervious	TP	3417.24	1.62	5,536	**7,172.47**	**1,004.40**	**50.22**
Regulated Pervious		3991.57	0.41	1,637			
Regulated Impervious	TSS	3417.24	1,171.32	4,002,682	**4,704,399.56**	**861,936.64**	**43,096.83**
Regulated Pervious		3991.57	175.8	701,718			

**Based on 100% of the L2 scoping loads.*

C. Increased Loads from 2009-2014 Sources

The MS4 general permit also requires the City to offset increases from development and redevelopment projects initiating construction between July 1, 2009 and June 30, 2014. During that period, post-development stormwater quality requirements were predicated on an average land cover condition of 41% imperviousness. This approach was consistent with the Chesapeake Bay Act of using 16% as the average land cover condition, or opting to use the average land cover condition of the City of 41% imperviousness. However, TMDL special conditions in the MS4 general permit require the City to offset any increased loads that may have occurred as a difference of using 41% instead of 16% land cover condition. The City is required to offset these differences at a rate of 5%, 35%, and 60% of the total offsets to coincide with the 2013-2018, 2018-2023, and 2023-2028 permit cycles, respectively. Due to the highly impervious nature of our urban landscape and the preponderance of urban infill redevelopment, the use of 41% imperviousness resulted in a minimal increase in load. Additionally beneficial was that the City's local stormwater quality requirements were more stringent during that period and required development and redevelopment to treat

the first ½" of stormwater over all impervious areas with the site, otherwise known as the water quality volume default. Due to these two factors, the amount of pollutant potential loading offsets is greatly reduced. However, Table E2 presents the total pollutant of concern (POC) loads from existing sources and the 5% required reductions for existing sources and 2009-2014 increased loads, but does not include credits from stormwater BMPs installed as part of the project. Those are captured in the "Post-2009 BMP" credits.

Table E2 – Existing Baseline Loads and Required 5% Reductions

Subsource	Pollutant	Land Change		Required Phase I (5%) Pollutant Reductions		
		Pre Site (ac)	Post Site (ac)	Loading Rates (lbs/ac/yr)	Est. Full Offset	2009 - 2014 Offsets
Regulated Impervious	Nitrogen	26.3	31.1	16.86	80.93	4.05
Regulated Pervious		27.3	22.5	10.07		
Regulated Impervious	Phosphorus	26.3	31.1	1.62	7.78	0.39
Regulated Pervious		27.3	22.5	0.41		
Regulated Impervious	Total Suspended Solids	26.3	31.1	1,171.32	5622.34	281.12
Regulated Pervious		27.3	22.5	175.80		

**Does not include credits from BMPs installed with the project.*

D. Grandfathered Projects

The State Stormwater Management Regulations provide the opportunity for qualifying development and redevelopment projects initiating construction after July 1, 2014 to design post-construction stormwater management controls in accordance with the old water quality technical criteria in effect prior to July 1, 2014. However, the MS4 general Permit requires the City to offset potential increased loads from grandfathered projects disturbing one acre or greater that initiate construction after July 1, 2014. Much like the 2009-2014 new sources, increased loads from grandfathered projects are somewhat compensated through most projects being redevelopment of existing project imperviousness, coupled with the more stringent water quality volume default, requiring projects to install BMPs. Unlike the 2009-2014 increased loads from new sources that must be offset by 5%, 35% and 60% through three successive MS4 permit cycles; any increased loads grandfathered projects must be offset prior to completion. Table E3 presents the increased loads from grandfathered projects.

Table E3 – Increased Loads from Grandfathered Projects

	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
Offset Loads to Reduce	73.12	504.56	34309.97
Loads Removed by BMPs*	69.79	475.22	32315.21
Total Load Remaining	**3.34**	**29.33**	**1994.76**

**Loads removed by project BMPs are subtracted from the offset to calculate the total.*

E. Means and Methods to Meet Target Reductions

The City has used an iterative approach in continually refining the list of potential pollutant reduction strategies through a series of planning level exercises to address meeting the TMDL target reductions. This includes the first "Chesapeake Bay TMDL Analysis and Options" (Final Draft August 2012), the City's February 1, 2012 response to the Virginia Department of Conservation and Recreation (DCR) "local letter" (November 9, 2011) and the "Draft Chesapeake Bay TMDL Phase I (5%) Action Plan" (June 26, 2014). This early draft action plan, which focused mainly on potential strategies and cost, was based on the draft action plan guidance provided by DEQ and built on the previous work and the continued input of internal stakeholder groups.

Since the target reduction requirements are greatly increased for the two subsequent permit cycles, the City has set an internal planning goal for the first permit cycle that extends beyond the 5% target to approximately 15-20% of the anticipated total reductions. This approach enables the City to ramp up planning and design to increase the likelihood of success in achieving reduction goals in the second and third permit cycles. The City is using an adaptive management approach that is based on an "all of the above" strategy for identifying likely candidate projects for implementation. This approach puts the greatest number of strategies on the table, and allows the City to consider any and all of the strategies based on existing site, economic and water quality conditions. This will allow the City to realize efficiencies through maximization of benefits and minimize of cost and external impacts. However, the means and methods implemented during this Action Plan are only required to meet the current 2013 – 2018 MS4 General Permit due by the end of this permit cycle on June 30, 2018. Based on the analysis to date, the following means and methods are proposed in the City's adaptive management approach.

Structural BMPs implemented prior to January 1, 2006 are included in the calibration and baseline conditions of the Bay Model and are not available for credit towards reductions. Credit for existing stormwater management BMPs are calculated according to the Guidance.

- ***Credits for 2006 – 2009 Stormwater BMPs.*** Structural BMPs implemented on or after January 1, 2006 and prior to July 1, 2009 will be credited.
- ***Credits for Post-2009 Stormwater BMPs.*** Structural BMPs implemented on or after July 1, 2009.

Structural BMPs are implemented to retrofit existing facilities and as new facilities to treat existing impervious areas. Redevelopment projects requiring the implementation of stormwater management BMPs to meet the new technical criteria for projects initiating construction after July 1, 2014 can be credited towards reductions.

- ***Projected Redevelopment.*** Stormwater quality BMPs implemented to meet the new VSMP regulations, effective July 1, 2014, and the City's more stringent ordinance. Note that new development also must comply with the more stringent water quality volume default.
- ***Regional Facilities.*** Retrofitting flood control facilities to provide water quality treatment and enhancing existing facilities to provide increase reductions.
- ***Public-Private Partnerships (P3).*** Informal arrangement for implementation of regional facilities during the development process that provide for treatment of impervious area beyond the required site area, in exchange for other onsite consideration as well as treating offsite stormwater.
- ***Retrofits on City Properties.*** Retrofitting City-owned properties that are not currently treated.

- ***Right-of-Way Retrofits.*** Retrofitting public streets, especially taking advantage of CIP road projects where implementation is deemed feasible.
- ***Urban Stream Restoration.*** Restoration of urban streams.

The following additional strategies may be pursued by the City to address the targeted reductions; however, these are currently not part of the core strategies being implemented.

- ***Street Sweeping.*** Removing nutrients and sediment from roadways before transported offsite in stormwater flows.
- ***Urban Nutrient Management.*** Pollutant reductions from nutrient management plans implemented beyond those required by law or statute.
- ***Land Use Change.*** Credit for lands converted to a land use with a lower associated pollutant load.
- ***Forest Buffers.*** Implementing buffers and enhancing Resource Protection Areas (RPAs) to protect local waterways and receive pollutant reduction credits.
- ***Public-Private Partnerships (P3).*** Consideration of more formal P3 arrangements such as the Community Based Public-Private Partnership (CBP3) approach.
- ***Nutrient Trading.*** Purchasing pollutant credits from the expanded nutrient credit exchange.
- ***Integrated Approach.*** Applying credits generated from controls implemented in the City's VPDES Combined Sewer System (CSS) permit to the MS4 service area.

F. Summary of Reductions

The above strategies or "means and methods" are based on projects that have been implemented, are in the design phase, or represent viable opportunities that may be implemented. Yet the list is not exhaustive and may be further refined given in depth onsite investigations and site-specific conditions. Full implementation of specific means and methods that have been implemented or are in the design phase will likely provide reductions beyond the 5% target requirements for nitrogen, phosphorus, and sediment. This action plan is only required to focus specifically on means and methods to meet the 5% reduction goals that must be implemented by June 30, 2018; however, the suite of strategies considered in the "all of the above" approach will provide approximately 20% of the total required reductions for nitrogen, phosphorus, and sediment. Since reduction requirements greatly increase beyond the initial 5% for the two subsequent permit cycles for an additional 35% and 60%, respectively, by 2028, the City's approach is to consider setting an internal goal for the first permit cycle that extends beyond the 5% target to ramp up planning and design and increase the likelihood of success. Table E4 presents a summary of the required total reductions from existing sources and 2009-2014 offsets, along with the required 5% reductions. Table E5 presents a summary of potential strategies, their potential pollutant reductions in pounds, and the potential percentage of the overall target reduction goals.

Table E4 – Summary of Required Reductions for Existing Sources

Subsource	POC	Total Exiting Load (lbs/yr)	Est. Total Required (lbs/yr)	2009 - 2014 Offsets	G.F. Offsets*	Required Phase I (lbs/yr)**
Regulated Impervious	TN	97,809.78	7,597.03	4.05	3.34	383.90
Regulated Pervious						
Regulated Impervious	TP	7,172.47	1,004.40	0.39	29.33	50.61
Regulated Pervious						
Regulated Impervious	TSS	4,704,399.56	861,936.64	281.12	1,944.76	43,377.95
Regulated Pervious						

**Must be offset prior to project completion, not on the 5% schedule.*
***Include 5% reductions from existing sources and 5% offsets for 2009-2014 increased loads; does not include grandfathered projects.*

G. Estimated Costs and Reductions per Strategy

The potential strategies outlined above will require significant additional resources beyond the City's current programs; however, funding for design and feasibility of some of these potential strategies was originally included in the CIP budget starting FY13. Further, as noted, full implementation of these potential strategies will meet greater than the 5% Chesapeake Bay TMDL compliance targets for reduction of nitrogen, phosphorus, and sediment. While this report focuses on potential strategies to meet the 5% reduction goals that must be implemented by June 30, 2018, reduction requirements are greatly increased for the two subsequent permit cycles. Yet by ramping up planning and design to increase the likelihood of success in achieving reduction goals in the second and third MS4 permit cycles, the City can also help spread the costs over time for full compliance.

Order of magnitude costs were developed in previous planning-level exercises to estimate the total cost of 100% compliance with the target loads in order to determine the impact on the CIP budget over the short and long terms. Cost assumptions were based on best engineering practices, local assumptions, discussions with regional partners, and a draft report researching the costs of various BMPs (King and Hagen, 2011) prepared for the Maryland Department of Environment. The analyses employed during the previous planning level exercise identified specific possible retrofit strategies that may be implemented based on assumptions about the type of retrofit most likely to be implemented for each specific strategy, and limitations associated with each strategy. A range of technologies were assumed applicable and an average removal efficiency and unit cost per acre treated were derived for each strategy. For instance, most Retrofits of City Rights-of-Way would likely involve manufactured BMPs (such as tree box filters) or similar structures with an average removal efficiency of approximately 45% at a unit cost of approximately $112,000 per acre treated. This and other assumptions for other types of strategies, along with the assumed long-term operations and maintenance costs, may or may not hold true. With regard to those strategies needed to fill the pollutant reduction gap (that is, those generic strategies needed to reach reduction targets after implementation of the specific strategies addressed in this report) no assumptions were made regarding whether these would be sited on public or private land. As a result, cost estimates do not include the cost of purchasing land or easements – which could be considerable.

The approximate cost to implement the potential means and methods to meet the total nitrogen, phosphorus and sediment reductions through FY2023 may range as high as $50M and depends of the type and mix of technologies implemented, whereas total compliance may reach as high as $100M. Table E5 presents the means and methods, the pounds of each pollutant of concern, percentage of the total L2 scoping targets and the estimated costs.

The approximate cost to implement the potential means and methods to meet the total nitrogen, phosphorus and sediment reductions by 2028 are estimated at $100M. Table E5 presents the means and methods, the pounds of each pollutant of concern, percentage of the total L2 scoping targets and the estimated costs.

Table E5 – Estimated Percent Reduction and Costs per Potential Strategy[1]

Reduction Strategies	N (lbs)	100% Goal[2]	P (lbs)	100% Goal	TSS (lbs/yr)	100% Goal	Est. Cost[3]
2006-2009 BMPs	1104.02	14.53	160.00	15.48	75,073.26	8.69	$0
Post-2009 BMPs	317.33	4.18	45.89	4.44	39,629.17	4.59	$0
Regional Facilities – Lake Cook	1,586.97	20.88	163.25	15.79	131,334.00	15.20	$2.7M[4]
Regional Facilities – Pond 19	159.21	2.09	15.68	1.52	11,262.74	1.35	$0
Retrofits on City Property	2.21	0.03	15.28	1.48	1,039.16	0.12	$1.0M[5]
Urban Stream Restoration – Four Mile Run	194.8	2.56	40	3.87	14,914.00	1.73	$1.8M[6]
Total	**3,364.54**	**44.26**	**280.10**	**42.57**	**273,612.33**	**31.67**	**$5.5M**

1. Assumes all grandfathered projects to be offset this permit cycle.
2. 100% goal is based on L2 scoping.
3. The City did not incur direct costs for BMPs implemented by developers.
4. Includes $1.2M SLAF grant.
5. Includes SLAG grant funding.
6. Includes grant funding. Individual project costs may be less.

1. Introduction

The purpose of this Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan is to comply with Section I C "Special condition for the Chesapeake Bay TMDL" of 9VAC25-890, the 2013 – 2018 General Virginia Pollution Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4), No. VAR040057 issued to the City of Alexandria (City) effective July 1, 2013. This Action Plan has been developed to provide a review of the current MS4 program and to demonstrate the City's ability to comply with the required target reductions during the first permit cycle. The Action Plan includes the requisite planning items found in permit Section I C.2., according to the procedures provided in the Virginia Department of Environmental Quality (DEQ) Guidance Memo No. 15-2005 dated May 18, 2015 (Guidance). The main focus of the Action Plan is to provide the means and methods and a general level of effort needed to meet the Chesapeake Bay TMDL 5% reduction targets and offsets for phosphorus, nitrogen, and sediment developed by the United States Environmental Protection Agency (EPA) in December 2010.

The TMDL contains aggregate wasteload allocations (WLAs) for regulated stormwater and no specific WLAs for the City's MS4. The Phase I Virginia Watershed Implementation Plan (WIP I) submitted to EPA on November 29, 2010 contains general requirements for permittees. The Phase II WIP that was submitted to EPA on March 20, 2012 builds on the Phase I WIP as the state's primary planning tool to establish strategies, targets, and expectations for different sectors; including urban stormwater for local governments. The Phase II WIP requires the implementation of urban stormwater controls to meet specific nitrogen, phosphorus and sediment reductions – Level 2 (L2) scoping implementation – to address the TMDL. The WIPs identify the use of state-issued stormwater permits as the tool for compliance by requiring target reductions for the TMDL.

The MS4 general permit contains special conditions requiring the implementation of strategies to meet 5% reductions of the overall L2 scoping for nitrogen, phosphorus and sediment, along with offsets for new sources and grandfathered projects. The permit also requires the completion of a Chesapeake Bay TMDL Action Plan by June 30, 2015, which must contain the means and methods to meet the pollutant reduction targets. This 5% goal – or Phase I – must be implemented no later than the end of the current 5-year MS4 permit period (by June 30, 2018).

According to the Phase II WIP the City will have three full MS4 permit cycles to implement the required reductions (2013-2018; 2018-2023; and 2023-2028). The percentage of the reduction targets are calculated as a percentage of the L2 implementation requirements in the Phase I WIP beyond the 2009 progress loads, which equates to an average reduction of 9% of nitrogen loads, 16% of phosphorus loads, and 20% of sediment loads from regulated impervious acreage; and 6% of nitrogen loads, 7.25% of phosphorus loads, and 8.75% sediment loads from regulated pervious acreage. According to the MS4 permit, the City will need to implement practices sufficient to achieve 5% of the reduction targets during the first permit. During the second cycle, the City will need to implement additional practices sufficient to achieve 35% of the reduction target, for a total of 40%. Finally, the City will need to achieve the remaining total reduction target by 2028.

The "means and methods" or reduction strategies discussed will require significant additional resources beyond the City's current programs; however, funding for some of these potential strategies has been included in the City's CIP budget as early as FY13. Further, as noted, implementation of practicable strategies will likely reach beyond the 5% of the City's total Chesapeake Bay TMDL compliance targets for nitrogen, phosphorus, and sediment based on the 5.3.2 Bay Model, which forms the basis of the requirements in the 2013 – 2018 MS4 General Permit. While this report focuses on potential strategies to meet the 5% reduction goals that must be implemented by June 30, 2018, reduction requirements are greatly increased for the two subsequent permit cycles. Therefore, the City has set an internal goal for the first permit cycle that extends beyond the 5% target, in order to achieve the escalating total reductions in the required timeframe towards meeting the overall total. The City's "all of the above" strategy is an iterative, adaptive approach that considers a range of potential strategies based on extant conditions, which enables the City to ramp up planning and design to increase the likelihood of success in achieving reduction goals in the second and third MS4 permit cycles.

Following development of the Bay TMDL and during the development of the WIPs, the City engaged in the process of planning and analyses of potential strategies, including the implementation of structural stormwater quality best management practices (BMPs), towards meeting the target pollutant reductions. The first official planning-level exercise began in fall 2011 with the first draft of the "Chesapeake Bay TMDL Analysis and Options" in February 2012 and the final draft in August of 2012. This planning effort focused first on the overall requirements by examining potential strategies, identifying potential gaps, and order of magnitude costs to implement the reductions.

This Action Plan is a refinement of the City's efforts to date and focus on meeting the 5% (Phase I) requirements in the current MS4 Permit. The Action Plan contains updated analyses that focus on high-priority projects that are currently in the planning and design phase, potential strategies that may be implemented during the permit cycle, credit for existing structural BMPs, and the cost to implement the required reductions that would be sufficient to meet the Chesapeake Bay TMDL special conditions in the current MS4 permit. The following steps are required per the MS4 permit and the Guidance:

- Current Program and Legal Authority
- Delineation of the MS4 Service Area
- Existing Source Loads and Calculating Target Reductions
- Increased Loads from 2009 – 2014 New Sources
- Increased Loads from Grandfathered Projects
- Estimated Future Grandfathered Projects
- Means and Methods to Meet Target Reductions
- Estimated Cost of Implementation

Since the reduction requirements are greatly increased for the two subsequent permit cycles (35% and 60%, respectively), the City has set an internal goal for the first permit cycle that extends beyond the 5% target in order to achieve the total reductions in the required timeframe. This approach will enable the City to ramp up planning and design to increase the likelihood of success in achieving reduction goals in the second

and third permit cycles. To this effect, the Action Plan contains concrete strategies to achieve the 5%, with the flexibility to choose from a menu of options as contingency measures and/or to begin addressing the future requirements. In all, the means and methods discussed in section 9 will achieve approximately 40% of the overall target reductions. However, implementation requirements in this Action Plan are limited to the target reductions embodied in the current MS4 General Permit target reductions for nitrogen, phosphorus and sediment calculated using permit Table 3b that are due by the end of this permit cycle on June 30, 2018.

2. Current Program and Legal Authority

The City takes pride in being a waterfront community on the Potomac River – the nation's river – and understands the integral part that our water resources play in our economy, our environment and the social well-being of our community. Being a waterfront community in the Chesapeake Bay, the City has long enacted local environmental ordinances to protect our water resources. In 1992 the City incorporated requirements of the Chesapeake Bay Act for protection of land in the watershed and stormwater quality into local ordinance through Article XIII of the Zoning Ordinance – the Environmental Management Ordinance. During the process of adopting Bay Act requirements, the City took a more conservative route and chose to be more protective by implementing 100' Resource Protection Area (RPA) requirements in the City, and designating all other non-RPA land acreage as Resource Management Areas (RMAs). The City even went a step further and implemented 50' buffers for intermittent streams and isolated wetlands. In addition to the minimum water quality requirements, the City also adopted a more stringent requirement for development and redevelopment to treat the first ½" of runoff from impervious surfaces, known as the water quality volume default. More recently, the City adopted amendments to the Environmental Management Ordinance that incorporate the Virginia Stormwater Management Regulations, while retaining the more stringent water quality volume default requirements, and currently operates a local Virginia Stormwater Management Program.

The City was initially issued an MS4 general permit in 2003 to regulate stormwater discharges. The permit was reissued in 2008, with the City currently regulated under the 2013-2018 MS4 general permit.

3. Delineation of the MS4 Service Area

The City's MS4 permit is the regulatory mechanism used to require implementation of stormwater quality BMPs or purchase of nutrient credits necessary to meet the Chesapeake Bay TMDL. The MS4 permit requires the City to define the size and extent of the existing impervious and pervious area within the MS4 service area. Areas of the City that sheet flow directly to waters of the state, or otherwise drain to waters of the state through means other than a regulated outfall, are not considered part of the MS4 service area. Properties within the jurisdictional boundary that are regulated under a separate VPDES stormwater permit, forested areas, wetlands, and open waters are also not considered part of the MS4 service area.

The first step in the analysis involved distinguishing between regulated and unregulated land areas to define the MS4 service area. To perform this analysis, the City utilized local ArcGIS data and tools, a review of other state stormwater permits under the VPDES program, and discussions with regulating agencies. A digital elevation model (DEM) for the entire City was built using two-foot contour data. Storm sewer pipes, represented as lines, were burned into the DEM. MS4 outfall locations, stored as points in ArcGIS, were treated as small watershed outlets and the ArcGIS Desktop Hydrology toolset was utilized to generate small

watersheds draining to each MS4 outfall. These small watersheds were manually reviewed and edited for greater accuracy. Finally, the breakdown of impervious and pervious area was determined by clipping the impervious surface cover to the MS4 service area, with the assumption that all non-impervious areas were pervious.

The above approach coupled with GIS impervious surface data rendered a delineation of impervious versus pervious areas within the regulated and unregulated areas. Unregulated areas include land with direct drainage to surface waters with no connection to the MS4, stream corridors, and areas covered under separate MS4 or VPDES industrial stormwater permits. The exclusion of these categories from the MS4 regulated area was initially confirmed by the Virginia Department of Conservation and Recreation (DCR) during their previous administration of the MS4 program. Additional confirmation of this approach is provided in the Chesapeake Bay TMDL Action Plan guidance and current MS4 general permit. Federal lands not covered under a separate stormwater permit were not simply excluded, but were categorized as regulated or unregulated based on this above approach. The Combined Sewer System (CSS) in the Old Town area is covered under a separate non-stormwater-related VPDES permit and is considered independently of the MS4 in the Chesapeake Bay TMDL.

Lands associated with separate individual or general MS4 or industrial stormwater permits were removed from the Alexandria MS4 service area totals and are listed in Table 1.

Table 1 – Permit Holders Excluded from MS4 Service Area

Permit Holder	Permit
George Washington Parkway	MS4
Northern Virginia Community College	MS4
VDOT	MS4
United Parcel Service - Alexandria	Industrial
US Postal Service - Alexandria Vehicle Maintenance Facility	Industrial
Covanta Alexandria Arlington Incorporated	Industrial
WMATA - Alexandria Metro Rail Yard	Industrial
Virginia Paving Company Alexandria Plant	Industrial
Alexandria Renew Enterprises Wastewater Treatment Plant	Industrial
Gordon Recycling Limited Liability Corporation	Industrial

Based on the above analysis, the estimated land areas draining to the Alexandria MS4 service area, non-Alexandria MS4, and CSS is presented in Table 2. Figure 1 shows the size and extent of the delineated pervious and impervious land uses for the MS4 service area in green.

Table 2 – Alexandria MS4, Non-Alexandria MS4, and CSS Land Area[1]

Land Area	Impervious (ac)	Pervious (ac)	Totals (ac)
Alexandria MS4 Service Area (regulated)	3417.24	3991.57	7408.81
CSS (regulated)	398.75	177.85	576.6
Non-Alexandria MS4 (unregulated)	452.17	1387.68	1839.85

1. Approximate acreage in Old Town – the historic portion of the City.

Figure 1 – Regulated City of Alexandria MS4 (in Green)

4. Existing Source Loads and Calculating 5% Compliance Reductions

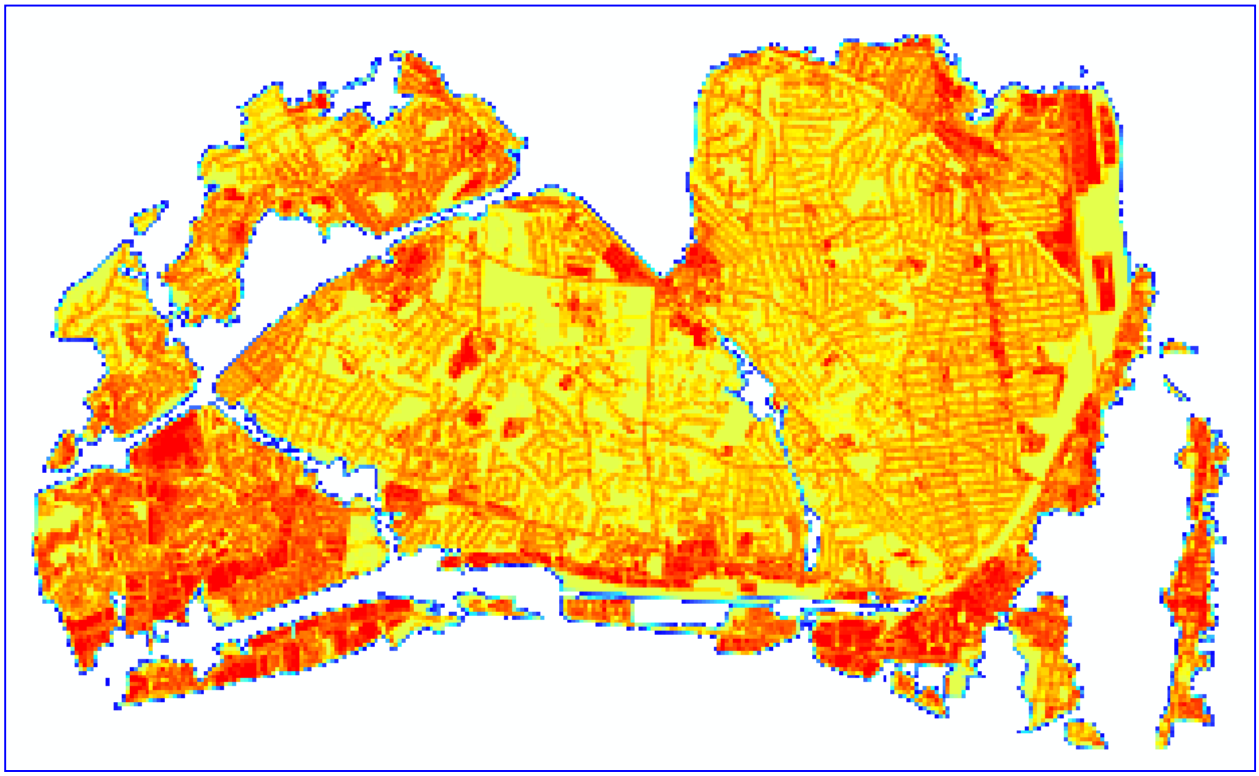
Baseline loads for nitrogen, phosphorus, and sediment were established using the City's impervious surface GIS data that represent the best available data for total existing acres served by the MS4 as of June 30, 2009, along with loading rate data for each pollutant of concern found in Table 2b (Potomac River Basin) of the MS4 general permit. In working with our consultant, AMEC Environment and Infrastructure, ALERT (AMEC Loading Estimation and Reduction Tool) was used to calculate total loads from the MS4 service area and generate spatial data to help visualize areas of higher and lower loading rates.

Total loads from existing impervious and pervious sources are presented below in Table 3. Figure 2 is a "heat map" that presents existing nitrogen loads in a graphic format that was generated using ALERT. Existing loads for phosphorus and sediment will generally show similar intensity differentials.

Table 3 – Existing Source Loading Rates for Nitrogen, Phosphorus, and Sediment

Subsource	Pollutant of Concern	Est. MS4 Service Area (ac)	Loading Rates (lbs./ac)	Load per Land Cover (lbs.)	Total Exiting Load (lbs.)
Regulated Impervious	Nitrogen	3417.24	16.86	57,614.67	**97,809.78**
Regulated Pervious		3991.57	10.07	40,195.11	
Regulated Impervious	Phosphorus	3417.24	1.62	5,535.93	**7,172.47**
Regulated Pervious		3991.57	0.41	1,636.54	
Regulated Impervious	Total Suspended Solids	3417.24	1,171.32	4,002,681.56	**4,704,399.56**
Regulated Pervious		3991.57	175.8	701,718.01	

Figure 2 – Graphic Representation of Existing Nitrogen Loads



The Phase I WIP and MS4 General Permit special conditions state that MS4 permittees will need to meet L2 scoping reduction requirements for existing sources. During the first MS4 permit cycle (2013-2018), the City will need to implement practices sufficient to achieve 5% of the L2 reduction target. This report focuses on these 5%, or Phase I, reductions; however, potential strategies considered may achieve reductions beyond the 5%, given the need to comply with increasing reduction requirements in successive

permit cycles. During the second permit cycle (2018-2023), the City will need to implement additional practices sufficient to achieve 35% of the L2 reduction target, for a total of 40%. Finally, the City will need to achieve the remaining 60% or total reduction targets by 2028. The L2 reductions for total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) applied to the regulated MS4 service area are presented in Table 4.

Table 4 – Level 2 Reduction Requirements

Land Cover Type	Required Reduction		
	TN	TP	TSS
Regulated Impervious	9.00%	16.00%	20.00%
Regulated Pervious	6.00%	7.25%	8.75%

Table 5 presents the total required reductions through three permit cycles. The total loads were calculated using MS4 general permit Table 2b loading rates for the Potomac River Basin and the impervious and pervious areas within the MS4 service area. Estimated total required reductions were calculated using the total L2 scoping requirements in the Phase I WIP (Table 4 above). These represent the estimated 100% target reductions to be met by the end of the third MS4 general permit cycle (by June 30, 2028).

Table 5 – Existing Source Loads and Total L2 Pollutant Reductions[1]

Land Cover Type	Pollutant	Total Existing Loads (lbs)	Estimated Total Required Reductions (lbs/yr)
Regulated Impervious	TN	97,810.78	**7,597.03**
Regulated Pervious			
Regulated Impervious	TP	7,172.47	**1,004.40**
Regulated Pervious			
Regulated Impervious	TSS	4,704,400.56	**861,937.64**
Regulated Pervious			

1. Approximate L2 scoping total reductions.

Table 6a presents the final estimated pollutant reductions broken out by MS4 general permit cycle based strictly on meeting 5%, 35%, and 60% (or total) of the L2 scoping requirements.

Table 6a – Estimated Pollutant Reductions Broken Out by MS4 Permit Cycle[1]

Permit Cycle	N (lbs/yr)	P (lbs/yr)	S (lbs/yr)
First MS4 Cycle Target (5%)	379.85	50.21	43,096.83
Second MS4 Cycle Target (35%)	2,658.96	351.54	301,677.82
Third MS4 Cycle Target (60%)	4,558.22	602.64	517,161.98
TOTAL REDUCTION (100%)	**7,597.03**	**1,004.40**	**861,936.64**

1. These estimates are based on percentages of the L2 requirements.

The MS4 General Permit requires the City to use permit Table 3b to determine the 5% reductions required by the end of the current permit cycle (June 30, 2018). Table 6b presents the 5% reduction requirements for existing sources by multiplying the general permit discounted loading rates (permit Table 3b) by impervious and pervious MS4 service area. The table incorporates the required L2 reductions by discounting the overall loading rate for the Potomac River Basin. However, using the discounted loading rate in permit Table 3b yields a slightly different required reduction for the first permit cycle than calculating a 5% target reduction using the overall reductions and the L2 scoping. Part II 2 on page 7 of the Guidance provides the more accurate discounted loading rates for the Potomac River Basin than those in permit Table 3b. The Guidance allows the use of either approach; however, DEQ may need to address this discrepancy during subsequent MS4 permit cycles. This Action Plan addresses the required reductions presented in Table 6b using the Guidance 5% loading rates.

Table 6b – First Permit Cycle Pollutant Reductions Calculated per the MS4 Permit[1]

Subsource	Pollutant	Existing MS4 Service area in acres (as of 6/30/2009)	5% Loading Rate from Guidance (lbs/ac/yr)	Total Reduction Required First Permit Cycle (lbs/yr)	Required Phase I Reductions (lbs/yr)
Regulated Impervious	TN	3,417	0.07587	259.27	**379.85**
Regulated Pervious		3,992	0.03021	120.59	
Regulated Impervious	TP	3,417	0.01296	44.29	**50.22**
Regulated Pervious		3,992	0.00148625	5.93	
Regulated Impervious	TSS	3,417	11.7132	40026.82	**43,096.83**
Regulated Pervious		3,992	0.769125	3070.02	

1. These reduction estimates are calculated using Guidance page 7 table for Potomac River Basin.

5. Increased Loads from 2009 – 2014 New Sources

The City first adopted the Chesapeake Bay Act requirements into local ordinance in 1992. This included land protection and water quality requirements being adopted locally. The Bay Act required that post-construction stormwater quality requirements be calculated based on an average land cover condition. While localities were required to adopt the new stormwater quality requirements, they were given the option of setting the average land cover condition at 16% impervious – the calculated average for the Bay watershed – or using the existing average impervious area for a local watershed. Using the average impervious land cover condition existing in the City at that time was the most feasible alternative for urbanized communities like the City. Requiring development to go back to 16% impervious cover would be overly restrictive given the existing urbanized conditions. Consistent with the Act, the City adopted a local average land cover condition of 41% impervious for post-construction stormwater quality design and required development to meet this criteria. This represented the existing condition, so that new development and redevelopment projects could not increase the pollutant load above this average. In addition, the City went a step further and adopted the more stringent "water quality volume default" requirements to treat the first ½" over the site impervious surface – or first flush – for post-construction stormwater design. More recently, the City has amended Article XIII of the Zoning Ordinance (the Environmental Management Ordinance) effective July 1, 2014 to incorporate the water quality technical criteria in the Virginia Stormwater Management Regulations (9VAC25-870). However, the MS4 General

Permit Section 1.C.2.a.(7) requires the City to offset increased loads from new sources initiating construction between July 1, 2009 and June 30, 2014 that disturb one acre or greater, which use the 41% average impervious cover for calculating post-construction water quality requirements. Please note that the majority of land-disturbing activities in the City do not reach the one acre or greater threshold.

The City used the aggregate approach discussed in the Guidance to determine the increased loads from projects disturbing greater than one acre that initiated construction within this time period. Loading rates in permit Table 2b were used to calculate the existing (pre-site) and resultant (post-site) loads for changes in impervious and pervious area as a result of these projects. The estimated full offset was calculated by subtracting the pre-site from the post-site, with the current required offsets calculated as 5% of the total. Table 7 provides the changes in land use for qualifying projects, the associated increased load, and the 5% offset required during this permit cycle. Please note that credits from BMPs installed as part of the 2009-2014 projects are included in the Post-2009 BMPs in Section 9.2 and are not reflected in Table 7.

Table 7 – Increased Loads and Pollutant Reductions 2009-2014 New Sources

Subsource	Pollutant	Land Change		Required Pollutant Reductions		
		Pre-Site Impervious (ac)	Post-Site Impervious (ac)	Loading Rates (lbs/ac/yr)	Est. Full Offset	2009 - 2014 Offsets
Regulated Impervious	Nitrogen	26.3	31.1	16.86	80.93	4.05
Regulated Pervious		27.3	22.5	10.07		
Regulated Impervious	Phosphorus	26.3	31.1	1.62	7.78	0.39
Regulated Pervious		27.3	22.5	0.41		
Regulated Impervious	Total Suspended Solids	26.3	31.1	1,171.32	5622.34	281.12
Regulated Pervious		27.3	22.5	175.80		

6. Increased Loads from Grandfathered Projects

The Virginia Stormwater Management Regulations (9VAC25-870-48) provide the opportunity for qualifying development and redevelopment projects to calculate post-construction stormwater quality requirements in accordance with the old water quality technical criteria in place in the City prior to the implementation of the new state stormwater requirements effective July 1, 2014. However, MS4 general permit Section I.C.2.a.(8) requires the City to offset increased loads from grandfathered projects disturbing one acre or greater that initiate construction after July 1, 2014.

As discussed in the previous section, the City implemented the Chesapeake Bay Act stormwater quality requirements utilizing an average land cover condition of 41% impervious. Additionally, the City continues to retain the more stringent requirement for projects to treat the first ½" of runoff associated with impervious surfaces – the water quality volume default. The permit requires that the City to offset the difference between the existing impervious condition of the project and the final impervious condition when applying the 41% land cover condition requirement. The City maintains a BMP database in a Microsoft Access format. Required BMP information and additional pertinent information is added to the database during

the plan and construction record drawings review and approval processes. Projects where post-construction stormwater quality requirements were calculated using the old technical criteria and have not commenced construction, but are fairly certain to initiate construction during this MS4 permit term, are labeled in the database as "planned." Increased loads associated with planned projects disturbing equal to or greater than one acre must be offset by the City prior to completion of the grandfathered project. Given that the permit and Guidance are silent on what constitutes completion, this plan assumes that approval of as-built plans and certification by a professional engineer that the stormwater management BMP is functioning properly is a reasonable measure of completion for each project.

Appendix II of the Guidance was followed to calculate the offsets. The simple method was used to determine the loading rate from the existing pre-site impervious cover. The simple method was also used to determine the loading rate from the final or post-site impervious cover condition. The pre-site loading rate (lb/ac/yr) was subtracted from the post site loading rate (lb/ac/yr), and the difference was multiplied by the post site area (ac) to yield the increased load (lb/yr). This is the amount that must be offset prior to applying the credit received for BMPs implemented for these projects. The credits for installed BMPs were calculated according to Part III of the Guidance using the Chesapeake Bay Program BMP efficiencies in Table V.C.1.

Since these Grandfathered projects generate minimal offsets, due in large part to the existing impervious cover of the site and the more stringent requirements to treat water quality volume default. Considering the most aggressive scenario that all of the projects were completed before June 2018, the minimal loads requiring offsetting would be in place through other strategies such as credit generated from 2006-2009 BMPs or Post-2009 BMPs discussed in Section 9. The City identified 13 projects implementing 26 BMPs to meet the old water quality technical criteria and the more stringent Alexandria water quality volume default. Summary calculations are presented in Table 8.

Table 8 – Summary of Remaining Offset Loads from Grandfathered Projects

	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
Offset Loads to Reduce	73.12	504.56	34309.97
Loads Removed by BMPs*	69.79	475.22	32315.21
Total Load Remaining	**3.34**	**29.33**	**1994.76**

**These BMP reductions are not included in Post-2009 BMP credits.*

7. Estimated Future Grandfathered Projects

Estimated future grandfathered projects may disturb greater than one acre and qualify as future grandfathered in accordance with 9VAC25-870-48. These projects have been approved or have an obligation of funding prior to July 1, 2012, but have not received coverage under the VPDES Construction General Permit prior to July 1, 2014. Given that these are either projected or in the early planning stages, project data has not been captured in the BMP database as "planned" for this list of projects, and it is uncertain when these projects may initiate construction. Approximately 428 acres of projects are estimated to be grandfathered; however, that estimate is likely high given that stormwater quality has been provided for some of the common plan of development projects that have stormwater BMPs in place, while others will likely only be changes to the previously approved floor area ratios. The list of future grandfathered projects is provided in Appendix A.

8. Means and Methods to Meet Target Reductions

The City has used an iterative approach in continually refining the list of potential pollutant reduction strategies through a series of planning level exercises to address meeting the TMDL target reductions. This includes the first "Chesapeake Bay TMDL Analysis and Options" (Final Draft August 2012), the City's February 1, 2012 response to the Virginia Department of Conservation and Recreation (DCR) "local letter" (November 9, 2011) and the "Draft Chesapeake Bay TMDL Phase I (5%) Action Plan" (June 26, 2014). The early draft action plan, which focused mainly on potential strategies and cost, was based on draft action plan guidance provided by DEQ, and built on the previous work through continued input of internal stakeholder groups.

The City will employ the following potential strategies described in the preceding sections as the toolbox of means and methods to meet the required target pollutant for reductions total nitrogen, total phosphorus and total suspended solids. This includes reductions for 1) Existing Sources 2) New Sources, 3) Increased Loads from 2009 – 2014 New Sources, and 4) Increased Loads from Grandfathered Projects. The Guidance stipulates BMPs implemented for credit should be in the Virginia Stormwater BMP Clearinghouse or be approved by the Chesapeake Bay Program. The City is using a menu of means and methods that fit this stipulation to meet the reduction requirements for each of the categories listed above. This type of adaptive management approach is an iterative "all of the above" strategy to identify likely candidate projects for implementation. This approach puts the greatest number of strategies on the table, and allows the City to consider any and all of the strategies based on conditions present at the time.

The means and methods in this Action Plan represent the synthesis of the analysis and options reports and the planning-level exercises, and the feasibility study to address pollutant target reductions by June 30, 2018. In considering an iterative approach that employs adaptive management principles and retains maximum flexibility in choosing the appropriate means and methods, the City has identified a number of potential strategies to reach target reduction goas. A mix of the following strategies will be implemented, where practicable, to address the reductions due by June 30, 2018; while additionally working towards meeting anticipated reductions required during the next permit cycle.

Structural stormwater BMPs implemented prior to January 1, 2006 are included in the calibration and baseline conditions of the Bay Model and are not available for credit towards reductions. Credit for existing stormwater management BMPs are calculated according to the Guidance.

- ***Credits for 2006 – 2009 Stormwater BMPs.*** Structural BMPs implemented on or after January 1, 2006 and prior to July 1, 2009 will be credited.
- ***Credits for Post-2009 Stormwater BMPs.*** Structural BMPs implemented on or after July 1, 2009 providing treatment for previously uncontrolled.

Projected redevelopment requiring the implementation of stormwater management BMPs meeting the new technical criteria for projects initiating construction after July 1, 2014 can be credited towards reductions and reported as credits following implementation. Structural BMPs such as retrofitting existing facilities and implementing new facilities to retrofit existing impervious areas are included in the means and methods to meet reductions. The City's "all of the above" approach is focused on strategies that are complete, under construction, or in the design phase are listed below. However, other strategies listed below may also be implemented.

- ***Projected Redevelopment.*** Stormwater quality BMPs implemented to meet the new VSMP regulations, as adopted into the City's Environmental Management Ordinance effective July 1, 2014 and the City's more stringent ordinance. Note that new development also must comply with the more stringent water quality volume default.
- ***Regional Facilities.*** Retrofitting flood control facilities to provide water quality treatment and enhancing existing facilities to provide increase reductions.
- ***Public Private Partnerships (P3).*** Informal arrangement for implementation of regional facilities during the development process that provide for treatment of impervious area beyond the required site area, in exchange for other onsite consideration as well as treating offsite stormwater.
- ***Retrofits on City Properties.*** Retrofitting City-owned properties that are not currently treated by stormwater quality BMPs.
- ***Right-of-Way Retrofits.*** Retrofitting public streets, especially in conjunction with CIP road projects where implementation is deemed feasible.
- ***Urban Stream Restoration.*** Urban streams restored using one of the five expert panel report methodologies, as adjusted to account for the unregulated baseline load.

The following additional strategies may be pursued by the City to address the targeted reductions; however, these are currently not part of the core strategies being implemented.

- ***Street Sweeping.*** Removing nutrients and sediment from roadways by mechanical means before pollutants may be transported offsite in stormwater flows.
- ***Urban Nutrient Management.*** Pollutant reductions from nutrient management plans implemented beyond those required by law or statute.
- ***Land Use Change.*** Credit for converted lands to a land use with a lower associated pollutant load.
- ***Forest Buffers.*** Implementing buffers and enhancing RPAs to protect local waterways and receive pollutant reduction credits.
- ***Public-Private Partnerships (P3).*** Consideration of more formal P3 arrangements such as the Community Based Public-Private Partnership (CBP3) approach.
- ***Nutrient Trading.*** Purchasing pollutant credits through the expanded nutrient credit exchange.
- ***Integrated Approach.*** Applying credits generated from controls implemented in the City's VPDES Combined Sewer System (CSS) permit to the MS4 service area.

Since the target reduction requirements are greatly increased for the two subsequent permit cycles, the City believes it prudent to set an internal planning goal for the first permit cycle that extends beyond the 5% target. This approach will enable the City to ramp up planning and design to increase the likelihood of success in achieving reduction goals in the second and third permit cycles. However, implementation requirements in this Action Plan relate only to reductions required in the current 2013 – 2018 MS4 general permit due by the end of this permit cycle on June 30, 2018. The mix of potential strategies presented above are discussed in further detail in the following sections.

8.1 Credits for 2006 – 2009 Unreported Stormwater BMPs

DEQ strongly encourages permittees to submit historical data for stormwater management BMP installed on regulated and unregulated lands prior to June 30, 2013 to be used as an input for the next run of the Bay Model. Per Part IV 2, of the Guidance, the City is affirming that the complete list of historical BMPs will

be submitted to DEQ by September 1, 2015 as part of the "Historical Data Clean-Up" effort as DEQ has requested. By affirming that the City will provide the complete historical list, and submitting historical BMPs installed between January 1, 2006 and June 30, 2009, DEQ Guidance states that this list of BMPs will be credited towards TMDL target reductions.

The City BMP database was queried for BMPs installed during this timeframe. Pollutant loads associated with the impervious and pervious area draining to project BMPs were calculated using the Potomac River Basin loading rates permit Table 2b loading rates. Removal efficiencies for the BMPs were assigned using the Chesapeake Bay Program Efficiencies found in Guidance Table V.C.2. A full list of BMPs per project with all pertinent data and calculations can be found in Appendix B. The summary of the 2006 – 2009 BMP reductions for nitrogen, phosphorus and sediment are presented in Table 9.

Table 9 – Reductions Achieved for 2006 – 2009 BMPs

Number of Projects	Total Number of BMPs	TN Removed (lbs/yr)	TP Removed (lbs/yr)	TSS Removed (lbs/yr)	Approx. Cost
19	63	1,104.02	160.00	75,073.26	$0[1]

1. Developer bears installation and long-term operation and maintenance costs.

8.2 Credits for Post-2009 Stormwater BMPs

The City maintains a current digital inventory of stormwater management BMPs that are required as part of the development process or that have been implemented as retrofits on City properties. This database was used to identify and gather data on BMPs for projects initiating construction on or after July 1, 2009, which qualify for water quality treatment credit according to Part III 3 of the Guidance. In addition to the Chesapeake Bay ordinance water quality requirements, the City implemented the water quality volume default requirement for development and redevelopment during this time period. BMPs installed prior to January 1, 2006 are included in the baseline existing conditions in the Bay Model and not given credit towards treatment. (Credit for BMPs installed on or after January 1, 2006 and before July 1, 2009 are discussed in 9.1.) An analysis was conducted to determine the total load reductions achieved by post-June 30, 2009 BMPs within the MS4 service area.

The BMP database was used to determine the acres treated per type of BMP installed after the 2009 baseline. Pollutant loads for impervious and pervious areas draining to each BMP were calculated using the Potomac River Basin loading rates from permit Table 2b. Specific BMP types and associated pollutant removal efficiencies were based on the Chesapeake Bay Program Efficiencies and Retrofit Curves data, as applicable. These credits are associated with the 2009 – 2014 projects that generated some minor increased loads and offsets to be applied towards required reductions discussed in Section 6.0. The resulting reductions in nitrogen, phosphorus, and sediment for these projects are presented in Table 10.

Table 10 – Reductions Achieved Through Post-June 30, 2009 BMPs

BMP Status	Total Acres Treated	Impervious Acres Treated	Estimated Pollutant Reductions (lbs/yr)			Approx. Cost[1]
			TN	TP	TSS	
Constructed	44.89	33.62	92.93	12.71	10,551.71	$0
Planned - Under Construction	100.07	72.95	225.40	33.17	29,077.46	$0
Total	**144.96**	**106.58**	**317.33**	**45.89**	**39,629.17**	**$0**

1. Developer bears the cost of installation and long-term operation and maintenance.

8.3 Projected Redevelopment

Redevelopment over time is a significant opportunity for the City to achieve pollutant reductions, since corresponding pollutant reductions will be credited towards Bay TMDL targeted reductions. The City is almost completely built out and was done so largely prior to stormwater quality regulations adopted in 1992. The Virginia Stormwater Management Regulations, implemented by the City on July 1, 2014 through the updated Environmental Management Ordinance, require that all redevelopment greater than or equal to one acre must achieve a 20% reduction in phosphorus from existing site conditions. Redevelopment less than an acre must reduce phosphorus 10% from existing conditions. New development that is subject to the new stormwater management regulations will have to meet nitrogen, phosphorus and sediment loading rates associated with pervious area, or a 0.41 lbs/ac/yr TP loading rate. This equates to no net increase and is therefore considered neutral with respect to loads. However, in addition to the state water quality standards, the City has retained the more stringent requirement of treating the first ½" of runoff associated with all the impervious area of the site – the water quality volume default. This more stringent requirement will continue to translate to increased reductions beyond the state minimum water quality requirements for both development and redevelopment projects.

While future redevelopment projects will provide nutrient and sediment credits, given the highly speculative nature of potential credits generated from projected development from now until 2018, there is no guarantee that these projects will occur to be credited towards the 5% reductions required in the first permit cycle. For this reason, credits associated with projected redevelopment are not presented here. However, the City will include reductions from development and redevelopment projects in the required reporting on progress towards achieving the overall targets.

8.4 Regional Facilities

A number of existing and potential stormwater pond sites were considered to evaluate planning-level retrofit feasibility for new or enhanced water quality benefits. The viability of retrofitting existing regional ponds and potential construction of new stormwater management ponds was addressed through a multi-year "Feasibility Study for Retrofit of Existing Ponds and Construction of New Stormwater Management Ponds" that was finalized December 2014. That report represents a refinement from the previous planning-level exercise for large regional projects, and provides more specificity based on the City's Water Quality Steering Committee and Water Quality Work Group internal stakeholder discussions about viability and

potential for these projects to go forward. Some barriers to implementation included minimal water quality benefits and site-specific restraints which included lack of available area, ownership and competing interests, among others. The potential strategy involves the retrofit of existing water quantity-only facilities (detention ponds) to provide water quality benefits by, enhancing the pollutant removal of an existing pond, or increasing the amount of treated impervious area draining to the facility.

For regional facilities that provide no effective water quality benefit, the improved stormwater treatment would provide a removal efficiency and the entire associated pollutant reduction will be credited. For existing regional BMPs that are enhanced to provide an extra water quality benefit, the increased pollutant reductions will be credited. Through refinement of the initial lists of potential sites, the City has identified the following large-scale regional facilities. Figure 3 presents the location and drainage areas for the first three of these facilities discussed below.

- Lake Cook,
- Eisenhower Block 19 Pond (Pond 19),
- Cameron Station Pond, and
- Lucky Run Pond

Lake Cook

Funding for the feasibility and design of Lake Cook were included in the City's FY2013 CIP. This existing fishing pond was identified in early planning-level exercises initiated in late 2011 as a retrofit candidate, included in the City's Response to DCR's November 2011 Information Request, and was considered in a subsequent feasibility study initiated in March 2013. Lake Cook is an existing facility that is currently used as a fishing pond that provides water quantity only (detention). Lake Cook will be retrofitted to provide enhanced pollutant removal or to increase the capture volume and level of treatment. In December 2013, the City received a Stormwater Local Assistance Fund (SLAF) 50% matching grant from DEQ to help fund the conversions of Lake Cook from a recreational fishing lake to a stormwater management BMP. Lake Cook drains approximately 390 acres of urban land, with approximately 127 acres of the drainage area being impervious. The lake's primary use is recreational and it is regularly stocked with fish by the Virginia Department of Game and Inland Fisheries.

Pollutant loads for lands draining to Lake Cook were computed using the MS4 General Permit Table 2b loading rates. Removal efficiencies were calculated using the Bay Program Curves according to "Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Projects" dated January 20, 2015" and the associated Guidance section. Pollutant loads removed are based on these calculated loads and efficiencies. The Technical Memorandum in Appendix C provides a detailed approach of the planned retrofit, the calculated pollutant removal efficiencies, and the associated pollutant removal credits. Lake Cook is considered the City's main retrofit strategy towards meeting initial Bay TMDL reduction goals for the current and next permit cycle. This project is currently in the design phase and is scheduled to begin construction in fall 2016, with project completion late 2017 or early 2018. Table 11a provides a summary of acres treated, pollutant reductions, and costs for this retrofit project. The total estimated CIP cost of the projects is approximately $2.7M.

Table 11a: Lake Cook Existing Loads and Pollutant Removal

Pollutant	Drainage Area Load (lbs/yr)	Removal Efficiency	Annual Pollutant Removal (lbs/yr)
Nitrogen	4,599.20	35%	1,586.97
Phosphorus	302.80	55%	163.25
Sediment	191,628.70	70%	131,334

Eisenhower Pond 19

This regional facility is being constructed by the private developer of the property; however, the impervious area treated was negotiated by City staff to be greater than that required during the development review process. Any pollutant reductions beyond those required are credited towards the City's Bay TMDL reduction requirements. Since this practice goes well beyond the reductions required for development and redevelopment, this pond is not included in the previous section as a "Credit for Post-2009 BMPs". The pond assumes efficiencies based on 17% TP removal based on design and treatment considerations. Removal efficiencies of 15% for TN and 18% for TSS were subsequently derived using the Chesapeake Bay stormwater treatment curves. Table 11c presents data for this regional facility.

Table 11b: Block 19 Pond Treatment[1]

Total Treated (ac)	Impervious Treated (ac)	Pervious Treated (ac)	Estimated Pollutant Reductions (lbs/yr)			Approximate Total Cost
			TN	TP	TSS	
70.00	52.50	17.50	159.21	15.68	11,622.74	$0[2]

1. Assumes efficiencies based on 17% TP, 15% TN, and 18% TSS from Chesapeake Bay curves.

2. Developer bears the cost of installation and long-term operation and maintenance. Opportunity costs for alternate uses of the land are considered inconsequential given the current use and therefore not factored into the costs.

Cameron Station Pond

This City-owned and maintained facility drains over 240 acres of mostly private land, but currently provides water quality treatment for only approximately 94 acres. A proposed retrofit of the pond assumes 215 acres of treatment and a conversion from a Level 1 Wet Pond to a Level 2 Wet Pond. This would create additional water quality volume to provide treatment for nearly the entire drainage area of the pond. This project received a SLAF 50% matching grant in December 2014, and is likely slated for completion beyond the scope of this Action Plan and permit cycle. It is included here for reference and to highlight the City's iterative approach and internal planning goal of exceeding current regulatory requirements to begin the process of addressing anticipated requirements in the next permit cycle. Table 11b presents the estimation of pollutant removal and the approximate total CIP cost. However, retrofitting this pond is not included in the final summary of reductions for this Action Plan.

Table 11c: Cameron Station Pond Treatment

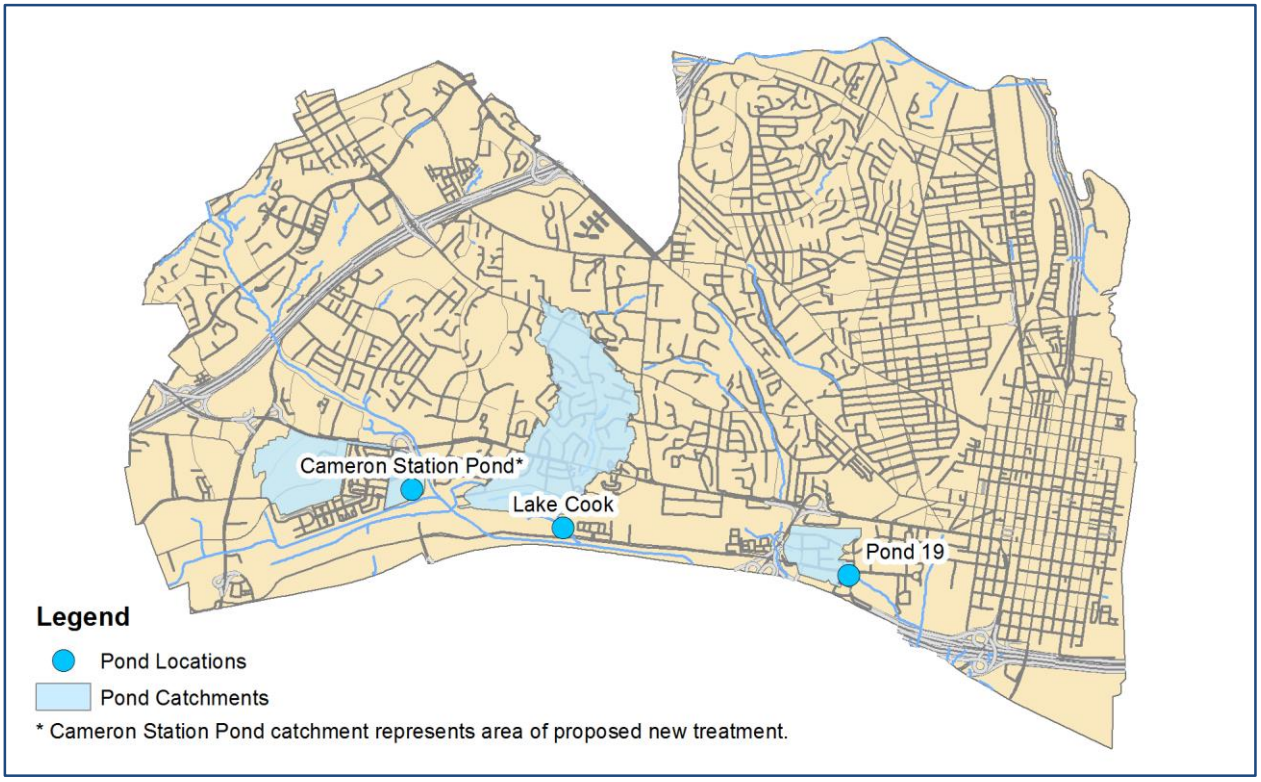
Total Treated (ac)	Impervious Treated (ac)	Pervious Treated (ac)	Estimated Pollutant Reductions (lbs/yr)			Approximate Total CIP Cost[1]
			TN	TP	TSS	
248.10	159.80	88.30	496.93	92.08	31,071.94	$3.5M

1. Opportunity costs for alternate uses of the land are considered inconsequential given the current use and therefore not factored into the costs.

Lucky Run Pond

Lucky Run Wet Pond is located in the northwest portion of the City, northeast of the intersection of Interstate 395 and West Braddock Road adjacent to the Stonegate Scenic Easement. The Lucky Run Pond drainage area is a mixture of urban residential and commercial land uses. The total treated drainage area of the pond is 225 acres, with 133 acres of impervious area.

Figure 3 – Potential Large-Scale Regional Facilities Locations



8.5 Retrofits on City Property

This strategy involves retrofits on City properties to treat existing impervious areas that are not currently treated by stormwater quality BMP. Even prior to the Bay TMDL reduction requirements, the City actively sought opportunities to retrofit existing impervious areas on City properties to provide water quality benefits for local streams, the Potomac River, and the Chesapeake Bay. A number of these retrofits were implemented prior to June 30, 2009 and cannot be credited towards the current reduction targets. However, the City continues to look for opportunities to retrofit City properties. Treatment of these previously untreated areas are strictly retrofits and generate credits towards meeting the required reductions. During earlier planning exercises, the City refined a list of existing properties as candidates for BMP retrofits. This list of potential projects was based on the following criteria:

1) ≥ 1 acre of untreated impervious area, and
2) The property not being slated for redevelopment in the near term.

For planning purposes, the list of potential City properties was assumed to be retrofitted with an average type of technology for the range of BMPs that may be installed to generate pollutant reductions. For planning purposes, it is assumed that approximately 50% of existing untreated impervious area could be treated by retrofits. Also, for planning and discussion purposes, a range of technologies was assumed for implementation. Pollutant removal efficiencies for this range of technologies were derived by averaging the efficiencies for several types of BMPs that would be likely candidates for this application on City properties: Filtering Practices, Bioretention, Dry Swale and Grass Channel. The resulting average efficiencies assigned to this range of technologies is: 30% TN, 50% TP, and 60% TSS. These were used to generate possible pollutant reductions for this range of technologies that may be implemented. The identification of specific practices can then be refined during subsequent onsite planning and design when the project becomes feasible. Final retrofits implemented and the associated removal efficiencies will determine the reductions achieved.

The City will continue to use the above criteria to identify other likely candidates for retrofit opportunities. Table 12 presents the retrofits that have been implemented on City properties after June 30, 2009 and the related pollutant reductions.

Table 12 – Retrofits on City Property

Project	Total Treated (ac)	Impervious Treated (ac)	Bay Program Efficiency	TP Removed (lbs/yr)	TN Removed (lbs/yr)	TSS Removed (lbs/yr)	Approximate Total Cost
Fire Station #206	0.55	0.55	60%	0.53	3.69	250.85	$252,240[1]
Burke Library	0.98	0.92	50%	0.76	0.38	2.61	$143,372
Charles Barrett Elementary	0.73	0.62	60%	0.63	4.34	295.47	$252,240[1]
Charles Barrett Elementary	1.62	1.38	45%	1.05	7.25	492.83	$252,240[1]
			Totals	**2.22**	**15.31**	**1,041.34**	**$900,092**

1. The total cost was evenly divided, however actual costs varied for each.

8.6 Retrofits of City Rights-of-Way

City right-of-way retrofits is a potential strategy for treating smaller areas with each practice, but collectively may net large areas of impervious surface cover being treated. This approach has the benefit of using public property, which avoids the cost of land acquisition. These retrofits treat public spaces such as public streets and medians. Retrofits may include low impact development (LID) such as bioretention for the medians and sidewalks, inlet tree box filters or various manufactured BMPs such as hydrodynamic or filters to treat roadways. These retrofits tend to treat relatively small areas due to size constraints and gradient changes. As a result, a large number of facilities are required to achieve meaningful reductions. Considering median retrofits in conjunction with inlet retrofits generally provides for the treatment of a greater contiguous area.

The City has identified possible medians and nearby stormwater inlets as retrofit candidates. Potential medians considered as likely candidates for retrofit were wide enough to accommodate the typical dimensions of a bioretention facility. Inlets considered were located in the vicinity of the potential median

projects. The location of utilities and mature street trees were not considered and must be taken into consideration when performing more in depth onsite investigations.

For planning purposes, acres treated and the impervious acres treated may vary since it may not be practical that the entire median area can be directed to a BMP and treated. Average efficiencies assigned to this range of technologies is: 30% TN, 50% TP, and 60% TSS. These efficiencies consider a range of technologies that may be implemented. The identification of specific practices and the target locations will be further refined during subsequent onsite planning and design. The most advantageous time to implement such practices is during planned transportation improvements. The City continues to look for ways to implement these types of retrofits through coordination with other departments and divisions during the internal planning and review process for CIP transportation projects. Implementation of retrofit practices will determine the actual pollutant loads removed to be reported.

8.7 Urban Stream Restoration

According to Appendix V.I of the Guidance, urban stream restoration projects initiating construction on or after January 1, 2006 and those not conforming to any of the four expert panel protocols must use the interim approved removal rates developed by the Bay Program. (Expert Panel, September 2014) Projects initiating construction after January 1, 2006 may use one of the four applicable protocols to determine removal rates.

Following years of design, public outreach and inter-jurisdictional collaboration, the Four Mile Run Stream Restoration began construction in May 2015. The project includes a tidal wetland restoration that the City assessed using Protocol 3 – Credit for Floodplain Reconnection Volume. The protocol provides mass sediment and nutrient reduction credit since the project will provide a reconnection of the Four Mile Run main stream channel to the floodplain over a wide range of storm events. The pollutant removal capability of the wetland will be a function of sediment deposition, plant pollutant uptake, denitrification, and other biological and physical processes. The approach and the determination of pollutant removal credits is discussed in the Technical Memorandum in Appendix D. Please note that although the memo references an older version of the expert panel report, staff has reviewed the memo against the most recent expert panel report and deemed that the approach remains valid and the calculated credits are consistent with the latest expert panel recommendations. The project is scheduled to be completed by spring/summer 2016. Table 13 presents the reductions for each pollutant of concern and the approximate project cost.

Table 13 - Four Mile Run Stream Restoration Pollutant Reductions

TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)	Approximate Cost*
194.8	40.0	14,914	$1.8M

**Estimate from the total costs of multiple projects in one package.*

The City initiated a restoration of a segment of Holmes Run that was completed in 2011. Dubbed "Chambliss Crossing" this restoration used natural channel techniques to provide water quality credits and to mitigate flooding in the vicinity. The City is working with the project engineer to determine what

removal credits can be assigned to the project. Since the project pre-dated the Expert Panel report, the City will provide the calculated credits and approach at a later date.

8.8 Street Sweeping

Street sweeping is an effective strategy of removing nutrient and sediment loads prior to them being transported in stormwater runoff. Frequent sweeping of prioritized areas is an effective strategy to receive pollutant reduction credits to meet Bay TMDL targets. There are two approaches for calculating pollutant removal, these include the mass loading approach and the qualifying street lanes method. The Chesapeake Bay BMP Expert Panel approved this credit in March 2011. Methods and efficiencies are still pending approval, to include the possible frequency requirement that must be met prior to receiving credit. (Bay Program Memo, March 2011)

Street sweeping must be credited annually using one of the two approved methods reductions, with the pounds of pollutants reduced included in each MS4 annual report.

8.9 Urban Nutrient Management

According to Section II.B.6.c of the MS4 general permit, the City is required to develop and implement nutrient management plans (NMPs) for lands owned and operated by the City which receive nutrients and are greater than one contiguous acre. The Commonwealth has also implemented the ban of use phosphorus-containing fertilizers during routine applications. The City does not receive pollutant reduction credits for reductions required by Virginia statute or law. However, the City can receive pollution reduction credits for the development and implementation of NMPs for unregulated lands outside the MS4 service area, on public lands less than one contiguous acre, and on private lands, other than golf courses, where nutrients are applied. (Expert Panel, March 2013)

The City continues to develop and implement NMPs according to applicability and schedule found in the MS4 general permit. The City is considering the feasibility for the implementation of NMPs on unregulated lands and private lands, following the Guidance and the Expert Panel report. The City can receive credit for these other NMPs and the associated pollutant reductions, and will include these in the City's annual report, as applicable.

8.10 Land Use Change

As part of the "all of the above" approach, the City will look for opportunities to receive credit for land use change conversions and apply the appropriate credit per Appendix V.G of the Guidance. This may include converting impervious to forest, impervious to grass, impervious to pervious, pervious to forest, or pervious to grass. Upon completion of a land use change BMP, the City will use the Table V.G.1 Land Use Change Conversion Efficiency table found in the Guidance to calculate the reductions. Pollutant reductions credited will be reported in the annual report for the appropriate period.

8.11 Forest Buffers

This BMP is another tool in the "all of the above" approach and similar to the previous BMP. The City will look for opportunities to protect local waterways and create credits by implementing forest buffer BMPs and/or providing enhancements to RPAs. Credits will be calculated using the efficiencies found in Table V.H.1 of the Guidance, and will be reported with the appropriate annual report.

8.12 Public-Private Partnerships

The use of public-private partnerships (P3) can optimize all available technical and financial resources to reduce the cost burden borne by the City. These partnerships are often used as a means to provide more cost effective financial strategy to build and manage public infrastructure that can carry huge financial obligations. Examples include toll roads, military housing, and wastewater and recycling services. Historically, wastewater has been the leader in this arena related to water quality. Today, governments at all levels are considering public-private partnerships to address fiscal challenges related to the construction, operation, and maintenance of infrastructure, expansion of services, and repair of aging infrastructure. However, stormwater retrofits to meet the Bay TMDL has provided a new set of financial concerns.

Municipalities are considering this approach to help reduce costs and risks related to retrofits. Prince George's County, Maryland is pioneering this P3 effort in the region to address Bay TMDL requirements. The County has established an innovative P3 pilot program to help fund projects to retrofit of about 8,000 acres of existing impervious surfaces at an estimated cost of $1.2B. The private partners will get paid from stormwater utility fees collected by the County that are based on impervious area, while the County may reduce its costs of the retrofit program by 40%.

While the P3 for stormwater retrofits and infrastructure is modeled on past approaches, a related but somewhat different approach being promoted by EPA through their Green Infrastructure initiative is Community Based Public-Private Partnerships (CBP3s). While a CBP3 uses many of the same financial and procurement arrangements as a traditional P3, there are differences as well. The nature of the contract, wider range of retrofit opportunities and the flexibility of the adaptive management approach are a few of the key differences. The biggest difference is the optimization of equity and the focus on the community inherent in the approach. In a CBP3, conditions must be appropriate for the community and the contractor so that both receive equitable benefits for all actions and gains from efficiencies. (EPA Region 3, April 2015)

The Prince George's P3 pilot program and the CBP3 may prove to be the most efficient and equitable models for localities trying to meet the overwhelming cost of the retrofits required by the Bay TMDL. But this program is complicated and the data points are just now being generated, therefore; these are not viable as a solution to meet the 5% reductions due by June 30, 2018. However, the P3 and CBP3 strategies are being considered to help achieve reductions required in Phase II and III for a total of 40% and 100%, respectively. Additionally, the City has set aside funding for the study of a local stormwater utility. The City will continue to monitor the effectiveness of Prince George's P3 program and stay abreast of other cases that may materialize.

Until further consideration provides for information on the suitable of a P3 or CBP3 approach, the City has taken a less formal collaborative approach. Negotiations between the City and the developer may produce reduction credits beyond those required in local ordinance. This strategy may include the implementation of regional facilities during the development process that provide for treatment of impervious area beyond the required site area in exchange for other onsite considerations as well as treating offsite water. Credits generated under this strategy would be negotiated during construction and be the property of the City. Based on desktop analyses and current conditions, it was concluded that private parcels with greater than five acres of untreated impervious area could be potential candidates for the program. This threshold was

chosen because the level of effort would outpace the return on investment for parcels with smaller untreated areas. The following criteria were then applied and three categories emerged from this group of properties: 1) parcels that may be redeveloped before 2018 can be negotiated at the project level with project-specific innovations that go beyond reductions required per the City's stormwater ordinance, while the creation of a larger P3 program is under consideration, 2) parcels that may redevelop after 2018 but before 2028 should be considered during the Phase 2 and 3 planning effort under a new P3 program, 3) parcels not likely to be developed before the TMDL implementation deadline of 2028 cannot be counted credited toward reductions.

8.13 Nutrient Trading

The Commonwealth of Virginia is expanding the current program to allow urban stormwater to be included in the sectors that may trade nutrient credits to meet reduction requirements. The City has identified nutrient trading as a potential strategy to meet target reductions. Nutrient credits to meet overall stormwater reductions must be kept in perpetuity to meet final goals. However, wastewater dischargers currently use the program to trade credits annually. This annual trading can also be a valuable tool to assist localities in complying with their MS4 permits while working to implement the required reductions.

The City also strongly encourages DEQ to allow "annual" credit trading for the implementation of urban stormwater practices that exceed the requirements set out in the MS4 permits for each permit cycle and beyond. This would work much the same way that the current program works for permitted wastewater discharges, but would be based on a five-year permit period. In the wastewater sector annual credits are available for nutrient trading when a facility demonstrates discharges below permitted levels. These credits are traded to other wastewater facilities that are still working to complete scheduled upgrades on their facilities to meet requirements. This annual trading incentivizes discharges below permitted limits for some and allows other permittees to remain in compliance while working to upgrade their facilities.

Likewise, urban stormwater pollutant reduction practices functioning beyond the pollutant reductions required in each MS4 permit cycle generate credits in advance of permitted requirements. These credits should be available for "annual" trading in the expanded nutrient credit exchange. For instance, if the City exceeds the 5% pollutant reduction requirements for 2018, these credits should be available for the City to trade in 2018 to other permittees that may need more time to reach the required June 30, 2018 pollutant reductions. The pollutant credits would be purchased by another MS4 permittee until the City is required to use the credits per the MS4 general permit. This approach protects water quality by incentivizing early implementation of urban stormwater reduction practices and helping to ensure that the largest number of MS4 permittees are in compliance. This expansion of the program would complement the current nutrient trading program allows for annual trading, and provide sediment credits for trading.

8.14 Integrated Approach

The City operates a VPDES-permitted Combined Sewer System (CSS) located in the older historic district. The Bay TMDL assigns a wasteload allocation (WLA) to the CSS for nutrients and sediment. Additionally, the Hunting Creek/Cameron Run TMDL assigns a WLA to three of the four CSS outfalls and requires substantial reductions that are enforced through the VPDES CSS permit. Taken separately, the CSS and MS4 permits require infrastructure investments on the order of $100-200M each. By integrating these efforts to help identify efficiencies in how to best prioritize capital investments and facilitate the use of sustainable and comprehensive solutions, the City can minimize the overall additive cost while maximizing

economic and water quality benefits. (EPA Memo, June 2012) CSS controls implemented as the result of the Long-Term Control Plan Update (LTCPU) will likely achieve substantial nitrogen, phosphorus and sediment reductions below the assigned WLA for the CSS. Pollution reduction credits generated from these controls will be applied towards MS4 target reductions.

The City is currently considering a number of CSS overflow control alternatives to reduce discharges. While some of the smaller, green infrastructure practices may be implemented prior to June 30, 2018, the larger grey alternatives will likely be available in subsequent permit cycles when pollutant reductions are greatly increased through the MS4 permit. The City is currently carefully considering and planning for the long term with this integrated approach in mind.

9. Summary of Required Reductions

The BMP strategies discussed in this action plan as part of the City's "means and methods" to meet target pollutant reductions. It is noted that the reduction strategies listed below are either implemented, under construction or in the design phases, other potential strategies discussed above are for planning purposes. However, the list is not exhaustive and may be further refined given in-depth onsite investigations and site-specific conditions. Further, as noted, full implementation of the specific BMPs discussed as identified means and methods are being pursued for reductions beyond the 5% requirement in this action plan in order to meet TMDL compliance targets for nitrogen, phosphorus, and sediment anticipated in subsequent permit cycles. While the WIP II contains a range of strategies applicable to urban land uses, the City can only be required to implement strategies that are enforceable through the MS4 permit based on the City's regulated land contained in the MS4 service area. This action plan is only required to focus specifically on means and methods to meet the 5% reduction goals that must be implemented by June 30, 2018. The suite of strategies presented below and those considered in the "all of the above" approach will provide reductions above the total required reductions for nitrogen, phosphorus, and sediment. However, since reduction requirements greatly increase beyond the initial 5% for the two subsequent permit cycles that span the additional 35% and 100% implementation by 2028, the City's approach is to consider setting an internal goal for the first permit cycle that extends beyond the 5% target, in order to achieve the total reductions in the required timeframe to maintain permit compliance. This approach enables the City to ramp up planning and design to increase the likelihood of success. Table 14 presents a summary of the required total reductions for each pollutant of concern (POC), 2009-2014 offsets, grandfathered projects, and 5% required reductions.

Table 14 – Summary of Required Reductions for Existing Sources

Subsource	POC	Total Exiting Load (lbs/yr)	Est. Total Required (lbs/yr)	2009 - 2014 Offsets (lbs/yr)	G.F. Offsets (lbs/yr)*	Required Phase I (lbs/yr)*
Regulated Impervious	TN	**97,809.78**	**7,597.03**	**4.05**	**3.34**	**383.90**
Regulated Pervious						
Regulated Impervious	TP	**7,172.47**	**1,004.40**	**0.39**	**29.33**	**50.61**
Regulated Pervious						
Regulated Impervious	TSS	**4,704,399.56**	**861,936.64**	**281.12**	**1,944.76**	**43,377.95**
Regulated Pervious						

**Must be offset prior to project completion, not on the 5% schedule.*

***Include 5% reductions from existing sources and 5% offsets for 2009-2014 increased loads; does not include grandfathered projects.*

10. Estimated Costs and Reductions per Strategy

The cost for credits for BMPs implemented during development and redevelopment are borne by the developer. But the majority of the cost to implement the strategies outlined in this study will largely fall to the City. While small amounts of grant funding may be available from state and federal agencies, Virginia has acknowledged that the planning, implementation, operation, and maintenance of BMPs "will be costly and likely borne by local government." (Virginia Senate Finance Committee, November 2011)

Order of magnitude costs were developed in previous planning-level exercises to estimate the total cost of 100% compliance with the target loads in order to determine the impact on the CIP budget over the short and long terms. Cost assumptions were based on best engineering practices, local assumptions, discussions with regional partners, and a draft report researching the costs of various BMPs (King and Hagen, 2011) prepared for the Maryland Department of Environment. The analyses employed during the previous planning level exercise identified specific possible retrofit strategies that may be implemented based on assumptions about the type of retrofit most likely to be implemented for each specific strategy, and limitations associated with each strategy. A range of technologies were assumed applicable and an average removal efficiency and unit cost per acre treated were derived for each strategy. For instance, most Retrofits of City Rights-of-Way would likely involve manufactured BMPs (such as tree box filters) or similar structures with an average removal efficiency of approximately 45% at a unit cost of approximately $112,000 per acre treated. This and other assumptions for other types of strategies, along with the assumed long-term operations and maintenance costs, may or may not hold true. With regard to those strategies needed to fill the pollutant reduction gap (that is, those generic strategies needed to reach reduction targets after implementation of the specific strategies addressed in this report) no assumptions were made regarding whether these would be sited on public or private land. As a result, cost estimates do not include the cost of purchasing land or easements – which could be considerable.

The approximate cost to implement the potential means and methods to meet the total nitrogen, phosphorus and sediment reductions through FY2023 may range as high as $50M and depends of the type and mix of technologies implemented, whereas total compliance may reach as high as $100M. Table E5 presents the means and methods, the pounds of each pollutant of concern, percentage of the total L2 scoping targets and the estimated costs.

To meet these increased costs, funding for specific regional opportunities was first included in the FY2013 CIP. While the City dedicates a portion of the property tax towards funding the stormwater program, increased costs has outpaced these revenues. To meet these increasing costs, the City has earmarked FY16 funds to study the feasibility of a stormwater utility to create a more equitable funding strategy and increase the level of funding.

Table 15 presents a summary of potential strategies, their potential pollutant reductions in pounds and the potential percentage of the overall target reduction goals.

Table 15 – Estimated Percent Reduction and Costs per Potential Strategy[1]

Reduction Strategies	N (lbs)	100% Goal[2]	P (lbs)	100% Goal	TSS (lbs/yr)	100% Goal	Est. Cost[3]
2006-2009 BMPs	1104.02	14.53	160.00	15.48	75,073.26	8.69	$0
Post-2009 BMPs	317.33	4.18	45.89	4.44	39,629.17	4.59	$0
Regional Facilities – Lake Cook	1,586.97	20.88	163.25	15.79	131,334.00	15.20	$2.7M[4]
Regional Facilities – Pond 19	159.21	2.09	15.68	1.52	11,262.74	1.35	$0
Retrofits on City Property	2.21	0.03	15.28	1.48	1,039.16	0.12	$1.0M[5]
Urban Stream Restoration – Four Mile Run	194.8	2.56	40	3.87	14,914.00	1.73	$1.8M[6]
Total	**3,364.54**	**44.26**	**280.10**	**42.57**	**273,612.33**	**31.67**	**$5.5M**

1. Assumes all grandfathered projects to be offset this permit cycle.
2. 100% goal is based on L2 scoping.
3. The City did not incur direct costs for BMPs implemented by developers.
4. Includes $1.2M SLAF grant.
5. Includes SLAG grant funding.
6. Includes grant funding. Individual project costs may be less.

11. Public Comment

A more streamlined version of the Action Plan dated June 2014 was posted on the City's website for public review and comment. This version focused on costs and percent reductions and was used as a tool for internal stakeholder groups and budgeting purposes. This Action Plan incorporates required elements found in Part I C of the MS4 general permit and DEQ's Guidance. The following outreach activities are part of the public comment approach:

- A public notice was placed in the Alexandria Times/Gazette inviting the public to learn about and comment on the draft by attending the May 18, 2015 Environmental Policy Commission (EPC) Public Meeting.

- A presentation based on this draft will be provided during the May 18, 2015 EPC Public Meeting, inviting the EPC and members of the community to comment on the draft.

- Posting the draft on the City website with contact information for receipt of comment.

- Including in the June City Manager's Report online.

- Sending an electronic notice via eNews directing subscribers to the online draft and contact for receipt of comment.

12. References

Expert Panel Reports

Guidance Memo No. 15-2005, Virginia Department of Environmental Quality, May 18, 2015

Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Projects, January 20, 2015

Recommendation of the Expert Panel to Define Removal Rates for Urban Nutrient Management, March 2013

Recommendation of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects, September 2014

Community Based Public-Private Partnerships (CBP3s) and Alternative Market-Based Tools for Integrating Green Stormwater Infrastructure; EPA Region 3; Water Protection Division, April 2015

March 2011 Memo from the Bay Program to the Urban Stormwater Workgroup, Street Sweeping/BMP Era Recommendations

Chesapeake Stormwater Network Technical Bulletin No. 9, Stormwater Nutrient Accounting.

June 5, 2012 Memo form EPA Regional Administrators to Acting Assistant Administrator for the Office of Water, Integrated Municipal Stormwater and Wastewater Planning Approach Framework

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Appendix A

Future Grandfathered Projects

City of Alexandria, Virginia
Chesapeake Bay TMDL Action Plan
Phase I for 5% Compliance

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Appendix A

Estimated Future Grandfathered Projects

Project Name	Address	Approx.
Potomac Yard Landbay I & J East	2301 Main Line Boulevard	12.31
Potomac Yard Landbay G (Infrastructure)	2801 Main Line Boulevard	15.66
Potomac Yard Partial I & J West, L	2501 Jefferson Davis Highway	20.16
The Calvert	3110 Mount Vernon Avenue	6.77
Mount Vernon Village Shopping Center	3809 Mount Vernon Avenue	14.61
Charles Barrett Modular Addition	1115 Martha Custis Drive	1.89
James Polk Elementary	5000 Polk Avenue	1.36
Patrick Henry Modular Addition	4643 Taney Avenue	1.98
Harris Teeter Old Town	735 North Saint Asaph Street	5.33
The Madison	800 North Henry Street	8.29
Landbay L – Multifamily	1400 South Main Line	7.04
Braddock Gateway – Phase I	1219 First Street	6.39
Edmonson Plaza	1701 Duke Street	2.94
Safeway on King Street	3526 King Street	2.90
James Bland – Phase V - Block F	998 North Alfred Street	1.91
Braddock Metro Place	1261 Madison	3.43
Potomac Yard – Landbay G – Building C	2801 Main Line Boulevard	7.73
Potomac Yard – Landbay G – Building F	2801 Main Line Boulevard	4.33
East Reed AHC Multifamily	118 East Reed Avenue	2.31
Landmark Gateway (Phase I)	631 South Pickett Street	12.62
James Bland Phase III – Block D	918 North Columbus Street	2.06
Stevenson Ave Residences Extension	6125 Stevenson Avenue	4.22
ATA Development Extension Block 20	2200 Mill Road	13.43
Braddock Gateway Phase II	1100 North Fayette Street	4.20
Jefferson Houston School	1501 Cameron Street	3.52
Potomac Yard Landbay J Multifamily	1800 Main Line Boulevard	6.88
Potomac Yard Landbay G, Block H	2900 Main Line Boulevard	11.26
EESAP Block 19 Residential Building	2250 Mill Road	11.68
Washington Suites Residences	100 South Reynolds Street	5.14
Hunting Terrace	1199 South Washington Street	10.88
Hoffman Blocks 11 and 12	2210 Eisenhower Avenue	26.91
Victory Center Extension	5001 Eisenhower Avenue	24.00
Mercedes Benz	200 South Pickett Street	1.53
Enterprise Rent-a-car	4700 Eisenhower Avenue	1.30
Potomac Yard Landbay G - Block D	701 East Glebe Road	9.15
Alexandria Assisted Living	2805 King Street	1.84
Cummings Hotel	220 South Union Street	2.32

The Gateway at King & Beauregard	4600 King Street	15.97
Cameron Park	450 South Pickett Street	15.57
Landmark Mall	5801 Duke Street	15.59
Southern Towers	5055 Seminary Road	9.18
King Street Condos	1604 King Street	2.04
Block 8 - Hoffman Town Center	2401 Eisenhower Avnue	16.01
Alexandria Renew Administration Building	340 Hooffs Run Drive	1.65
Carlyle Plaza Two (Amendments)	760 John Carlyle Street	53.88
Seminary Overlook	4800 Kenmore Avenue	17.72
	Total	**427.91**

Appendix B

2006 – 2009 BMPs Per Project

City of Alexandria, Virginia
Chesapeake Bay TMDL Action Plan
Phase I for 5% Compliance

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Appendix B: Alexandria 2006 - 2009 BMPs

BMP ID	BMP_Type_Full	Plan Name	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	Area Treated (ac)	Impervious Treated (ac)	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	BMP Efficiency
1995-0019 01	D.C. Sand Filter	Bishop Ireton High School	11.05	76.23	5183.91	1.65	0.95	1.10	7.56	514.06	0.6
1995-0019 02	D.C. Sand Filter	Bishop Ireton High School	0.00	0.00	0.00	1.05	0.86	0.88	6.09	414.14	0.6
1998-0015 01	Stormceptor® Stormwater Treatment System	Dartmouth Place	2.34	16.16	1098.73	5.40	0.93	0.33	2.30	156.68	0.1
1998-0015 02	Vegetated Buffer	Dartmouth Place	0.00	0.00	0.00	0.95	0.05	0.05	0.31	21.11	0.1
2000-0009 01	Bioretention Filter	Mount Vernon Village Center	6.92	47.75	3246.86	2.11	1.69	1.31	9.03	613.91	0.45
2001-0003 01	Alexandria Compound Sand Filter	Carlyle - Block L - Post at Carlyle [Post Carlyle Square]	4.61	31.82	2164.02	1.15	1.15	1.12	7.71	524.47	0.6
2001-0003 02	Alexandria Compound Sand Filter	Carlyle - Block L - Post at Carlyle [Post Carlyle Square]	0.00	0.00	0.00	1.20	1.20	1.17	8.05	547.27	0.6
2001-0014 01	StormFilter™ Stormwater Treatment System	Northampton Place Apartments - Phase I [Northampton Place Condominiums]	2.62	18.08	1229.26	1.00	1.00	0.97	6.71	456.06	0.6
2001-0014 03	StormFilter™ Stormwater Treatment System	Northampton Place Apartments - Phase II [The Alexander Apartments]	1.52	10.47	711.87	1.11	0.78	0.84	5.79	393.48	0.6
2001-0014-A 01	Regional Wet Pond	Park Center Pond Retro-Fit [Lucky Run Pond]	253.18	1746.94	118792.06	225.00	133.00	113.93	786.12	53456.43	0.45
2002-0001 01	Stormceptor® Stormwater Treatment System	The Preston Condominium and Townhomes	1.65	11.35	771.93	1.05	0.83	0.14	0.99	67.32	0.1
2002-0022 01	StormFilter™ Stormwater Treatment System	Tuscany at Landmark	2.95	20.39	1386.44	2.02	1.37	1.49	10.29	699.83	0.6
2002-0048 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Quaker Ridge	2.27	15.63	1062.98	1.06	0.42	0.09	0.65	43.95	0.1
2002-0048 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Quaker Ridge	0.00	0.00	0.00	1.24	0.67	0.13	0.91	61.61	0.1
2003-0010 01	Alexandria Compound Sand Filter	Carlyle - Block G - Lot 711 - Office / Retail Building	1.58	10.93	743.54	0.96	0.96	0.93	6.45	438.28	0.6
2003-0016 01	StormFilter™ Stormwater Treatment System	Duncan Library	0.32	2.19	148.83	0.28	0.19	0.21	1.43	97.04	0.6
2003-0016 02	Green Roof	Duncan Library	0.00	0.00	0.00	0.07	0.07	0.06	0.39	26.19	0.53
2003-0035 01	StormFilter™ Stormwater Treatment System	Park Tower Condominium [Halstead Tower Apartments]	1.86	12.85	873.70	1.56	0.99	1.10	7.61	517.29	0.6
2003-0039 01	Dry Vault Sand Filter	Pentagon Federal Credit Union Headquarters (Alexandria Tech Center - Phase V)	1.72	11.88	808.12	0.81	0.81	0.79	5.43	369.41	0.6
2003-0041 01	Alexandria Compound Sand Filter	Carlyle - Block F - Mixed-Use	2.08	14.32	973.70	1.32	1.22	1.21	8.33	566.58	0.6
2003-0042 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Wiecking Property [Lots 701 & 702]	1.47	10.17	691.69	1.20	0.12	0.06	0.44	29.90	0.1
2003-0042 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Wiecking Property [Lots 704 & 705]	0.00	0.00	0.00	0.13	0.13	0.02	0.15	9.88	0.1
2004-0014 01	StormFilter™ Stormwater Treatment System	Jamestown Village Apartments [Parkside @ Alexandria]	0.19	1.29	87.90	0.15	0.10	0.11	0.78	52.74	0.6
2004-0014 02	StormFilter™ Stormwater Treatment System	Jamestown Village Apartments [Parkside @ Alexandria]	0.31	2.12	144.13	0.28	0.16	0.18	1.27	86.48	0.6
2004-0019 01	D.C. Sand Filter	Fairchild Property	0.72	4.95	336.74	0.38	0.38	0.37	2.55	173.30	0.6
2004-0020 01	Delaware Sand Filter	ARHA Scattered - W. Braddock Rd.	0.39	2.69	182.99	0.35	0.28	0.29	2.00	135.78	0.6
2004-0021 01	Delaware Sand Filter	ARHA Scattered - S. Reynolds St.	0.84	5.82	395.91	0.57	0.45	0.47	3.22	219.08	0.6
2004-0022 01	D.C. Sand Filter	ARHA Scattered - S. Whiting St.	1.16	8.03	546.29	0.75	0.62	0.63	4.38	297.76	0.6
2004-0025 01	D.C. Sand Filter	Foxchase Shopping Center - UNKNOWN PLAN	15.73	108.53	7380.28	1.40	1.05	1.11	7.64	519.26	0.6

Appendix B: Alexandria 2006 - 2009 BMPs

BMP ID	BMP_Type_Full	Plan Name	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	Area Treated (ac)	Impervious Treated (ac)	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	BMP Efficiency
2004-0025 02	CDS® Stormwater Treatment System	Foxchase Shopping Center	0.00	0.00	0.00	7.83	7.57	1.24	8.54	580.40	0.1
2004-0025 03	CDS® Stormwater Treatment System	Foxchase Shopping Center	0.00	0.00	0.00	1.77	1.29	0.23	1.58	107.29	0.1
2004-0041 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Eisenhower Center III	2.10	14.47	984.21	1.73	1.59	0.26	1.81	123.25	0.1
2005-0005 01	D.C. Sand Filter	Mill Race - Building One	8.06	55.63	3782.50	2.99	2.82	2.78	19.20	1305.72	0.6
2005-0011 01	StormFilter™ Stormwater Treatment System	Marriott Residence Inn @ Mill Road	1.06	7.33	498.34	0.25	0.18	0.19	1.34	91.19	0.6
2005-0011 02	StormFilter™ Stormwater Treatment System	Marriott Residence Inn @ Mill Road	0.00	0.00	0.00	0.44	0.42	0.41	2.86	194.42	0.6
2005-0015 01	Alexandria Compound Sand Filter	Carlyle - Block J - Lot 712 - Retail / Office Building	1.11	7.69	522.99	0.48	0.45	0.44	3.04	206.87	0.6
2005-0019 PLT 01	Vegetated Filter Strip	Episcopal High School - Proposed Faculty Homes	1.05	7.23	491.44	1.02	0.52	0.10	0.72	49.14	0.1
2005-0019 PLT 02	Permeable Pavement	Episcopal High School - Proposed Faculty Homes	0.00	0.00	0.00	0.01	0.01	0.00	0.02	1.37	0.2
2005-0019 PLT 03	Permeable Pavement	Episcopal High School - Proposed Faculty Homes	0.00	0.00	0.00	0.01	0.01	0.00	0.02	1.37	0.2
2005-0020 01	D.C. Sand Filter	Mill Race - Building Two	8.06	55.63	3782.50	1.34	1.27	1.25	8.64	587.28	0.6
2005-0028 01	Alexandria Compound Sand Filter	Carlyle - Block K - Lot 715 - Retail / Office Building	1.20	8.27	562.48	0.57	0.57	0.55	3.82	259.96	0.6
2005-0810 BLD 01	Green Roof	City of Alexandria - Health Department	1.29	8.93	607.32	0.15	0.15	0.13	0.89	60.43	0.53
2006-0009 PLT 01	Infiltration System	Episcopal High School - Hummel Bowl and Greenway Field Renovation	1.22	8.39	570.73	2.10	0.00	0.73	5.05	343.38	0.85
2006-0009 PLT 02	Infiltration System	Episcopal High School - Hummel Bowl and Greenway Field Renovation	1.68	11.56	786.07	4.09	0.00	1.42	9.83	668.16	0.85
2006-0018 PLT 01	StormFilter™ Stormwater Treatment System	Virginia Paving Company	6.17	42.58	2895.31	2.26	1.60	1.72	11.87	806.90	0.6
2006-0018 PLT 02	StormFilter™ Stormwater Treatment System	Virginia Paving Company	0.00	0.00	0.00	10.18	10.18	9.89	68.28	4642.72	0.6
2006-0018 PLT 03	Stream Buffer Restoration	Virginia Paving Company	0.00	0.00	0.00	11.27	1.28	3.09	21.29	1447.65	0.5
2006-0036 PLT 01	Vortechs® Stormwater Treatment System	Jiffy Lube - Stormwater Runoff Collection & Water Quality Inlet Installation Plan	0.66	4.54	309.04	0.68	0.34	0.07	0.48	32.67	0.1
2006-0101 01	Tree Box Filter	Duke Street Bridge Pedestrian Access Improvements at Ben Brenman Park	0.41	2.79	190.03	0.25	0.25	0.18	1.26	85.51	0.45
2006-0101 02	Tree Box Filter	Duke Street Bridge Pedestrian Access Improvements at Ben Brenman Park	0.00	0.00	0.00	0.25	0.25	0.18	1.26	85.51	0.45
2006-0101 03	Tree Box Filter	Duke Street Bridge Pedestrian Access Improvements at Ben Brenman Park	0.00	0.00	0.00	0.25	0.25	0.18	1.26	85.51	0.45
2007-0004 PLT 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Hoffman Properties - Additions to the Existing Warehouse Shops @ Eisenhower Ave. East	2.82	19.44	1321.92	0.59	0.59	0.10	0.66	44.69	0.1
2007-0004 PLT 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Hoffman Properties - Additions to the Existing Warehouse Shops @ Eisenhower Ave. East	0.00	0.00	0.00	0.67	0.67	0.11	0.75	50.93	0.1
2007-0004 PLT 03	Aqua-Swirl® Stormwater Hydrodynamic Separator	Hoffman Properties - Additions to the Existing Warehouse Shops @ Eisenhower Ave. East	0.00	0.00	0.00	0.52	0.46	0.08	0.53	36.06	0.1
2007-0010 PLT 01	Vegetated Filter Strip	Episcopal High School - Proposed North Quaker Lane Entrance Renovation	0.18	1.26	85.82	0.48	0.42	0.07	0.49	33.08	0.1
2007-0016 PLT 01	StormFilter™ Stormwater Treatment System	Fort Ward Replacement Field	4.75	32.76	2227.90	2.13	1.71	1.77	12.18	828.34	0.6
2007-0101 01	Tree Box Filter	Valley Drive Traffic Calming Design	0.81	5.59	380.05	0.50	0.50	0.36	2.52	171.02	0.45
2007-0101 02	Tree Box Filter	Valley Drive Traffic Calming Design	0.00	0.00	0.00	0.50	0.50	0.36	2.52	171.02	0.45
2007-0102 01	Green Roof	Fire Station 202	0.00	0.00	0.00	0.01	0.01	0.01	0.05	3.22	0.53
2008-0018 PLT 01	StormFilter™ Stormwater Treatment System	Alexandria Firearms Training Facility	1.09	7.49	509.46	0.73	0.65	0.65	4.50	305.67	0.6
2008-0101 01	Tree Box Filter	Pegram St. & Pickett St. Sidewalk & Traffic Calming	0.35	2.41	163.56	0.26	0.20	0.16	1.08	73.60	0.45
2008-0101 02	Tree Box Filter	Pegram St. & Pickett St. Sidewalk & Traffic Calming	0.38	2.60	176.94	0.30	0.21	0.17	1.17	79.62	0.45
		Totals	362	2,497	169,810	313	189	160.00	1,104.02	75,073.26	

Appendix C

Lake Cook Technical Memorandum

City of Alexandria, Virginia
Chesapeake Bay TMDL Action Plan
Phase I for 5% Compliance

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Technical Memorandum

Date: April 23, 2015

To: City of Alexandria
Department of Transportation and Environmental Services
2900-B Business Center Drive
Alexandria, VA 22314

From: URS Corporation
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

RE: City of Alexandria- Lake Cook Retrofit Design
Draft Technical Memorandum- Chesapeake Bay TMDL Water Quality Credits
URS No. 15304189

Executive Summary

The City of Alexandria has identified retrofitting existing ponds as an initial step in meeting the Chesapeake Bay Total Maximum Daily Load TMDL reductions specified in its Municipal Separate Storm Sewer System (MS4) permit. A study commissioned by the City in March 2013 identified Lake Cook as a candidate for water quality retrofits. In December 2013, the City received a Stormwater Local Assistance Fund (SLAF) Grant from the Virginia Department of Environmental Quality (VA DEQ) to help fund the conversion of Lake Cook from a recreational fishing lake to a stormwater best management practice (BMP). The purpose of this technical memorandum is to describe the proposed BMPs for Lake Cook and summarize the water quality benefits in terms of pounds of nitrogen, phosphorus, and total suspended solids that will be removed annually by Lake Cook after retrofits are made.

With the exception of treatment volume storage, proposed retrofits to Lake Cook will meet the criteria for a Level 1 Design Wet Pond, as listed in the *Virginia DEQ Stormwater Design Specification No. 14 – Wet Pond, Version 1.9*, dated March 1, 2011. The design specification can be found on the Virginia Stormwater Management BMP Clearinghouse website (http://www.vwrrc.vt.edu/swc/). As a retrofitted wet pond with an upflow filter, Lake Cook will remove approximately 1,610 pounds of nitrogen, 167 pounds of phosphorus, and 134,140 pounds of total suspended solids annually.

While Lake Cook is considered to be a recreational lake in its existing state, it appears on the City's BMP inventory with a credit for the treatment of 15 acres draining to it from the adjacent Animal Welfare League property and a portion of Cameron Run Regional Park. According to DEQ's Draft Revised Guidance Memo No. 14-2012, and the SLAF Program Guidelines, if an existing BMP is retrofitted, nutrient removal credit will be allowed for the differences between the reported annual pollutant removals of the BMP before retrofits were made (existing condition) and the calculated removals after

retrofitting. The existing pollutant removal rates for Lake Cook were calculated using the methods outlined in VA DEQ's Draft Revised Guidance Memo No. 14-2012 for the 15 acres draining from the Animal Welfare League property and Cameron Run Regional Park. The annual removal rates for Lake Cook in its existing condition are 23, 3, and 2,806 pounds of nitrogen, phosphorus, and total solids, respectively. Since the 15 acres the City is taking credit for treating represents less than four percent of the total watershed actually draining to Lake Cook, the City will get credit for the annual removal of approximately 1,587 pounds of nitrogen, 163 pounds of phosphorus, and 131,334 pounds of total solids after completing retrofit improvements. The methods used to calculate the existing and post-retrofit annual pollutant removal rates are discussed below as well as design criteria that will be met as part of the Lake Cook retrofit.

Other design elements such as floating wetlands were included as additional features in the feasibility study, which may be incorporated into the overall project. However, this memorandum addresses only those water quality retrofits approved for nutrient removal credit by the Virginia Stormwater Management BMP Clearinghouse.

Background

Located in the Cameron Run watershed, Lake Cook was originally constructed in the 1970s, and drains approximately 390 acres of urban land in Alexandria. Approximately 127 acres, or 33 percent, of the area draining to Lake Cook, is impervious. The lake has a surface area of approximately 3 acres, and receives stormwater inflows primarily from Strawberry Run. As part of Cameron Run Regional Park, the lake's primary use is recreational and it is regularly stocked by the Virginia Department of Game and Inland Fisheries.

Description of Proposed Retrofits

Improvements to Lake Cook include retrofitting the lake to meet the criteria for a Level 1 Wet Pond, with the exception of treatment volume storage, as outlined by VA DEQ's Stormwater Design Specification No. 14, and the installation of an upflow filter. Some design elements, such as multiple storage cells meet the criteria for a Level 2 Wet Pond design. The following is a description of the required retrofits:

Treatment Volume – A treatment volume of approximately 14.8 acre-feet is required for a Level 1 design, based on the Virginia Runoff Reduction Methodology spreadsheets. This treatment volume may consist of storage entirely below the normal pool elevation, or a combination of extended detention storage above the normal pool elevation plus the storage volume below the normal pool elevation. Because Lake Cook is located within a

Federal Emergency Management Agency (FEMA) regulated floodplain, URS recommends that extended detention storage not be used to achieve the required treatment volume, and that treatment volume storage be contained below the normal pool elevation. Due to site constraints and conditions within the existing pond, the City believes that providing a storage volume of 14.8 acre-feet below the normal pool elevation is not feasible. The City would like to propose creating a storage volume that correlates to a runoff treatment depth of 1 inch over the impervious area within the Lake Cook watershed. With approximately 127.5 impervious acres in the watershed, that volume is approximately 10.6 acre-feet.

Single Pond Cell – Currently, storage in the lake is provided within a single area. The proposed design calls for a two-cell design. Multiple pond cells meet the criteria for a Level 2 Wet Pond design.

Sediment Forebay – A significant amount of accumulated sediment can be seen in aerial photographs at the mouth of Strawberry Run. Two sediment forebays will be incorporated into the proposed design. Each pond cell will have a separate sediment forebay.

Aquatic Benches – Aquatic benches will be provided according to the Level 1 Design criteria. The location of the benches is yet to be determined.

Upflow Filter – Additional water quality improvements will be provided by the construction of an upflow filter. While not a requirement for a Level 1 Design, it will provide additional water quality benefits within the lake.

The proposed upflow filter design does not meet the Virginia Stormwater Management BMP Clearinghouse criteria and has not been approved by VA DEQ as a water quality BMP; therefore, the City will not get any additional nutrient removal credit.

The use of an upflow filter meeting the Virginia Stormwater Management BMP Clearinghouse criteria would provide an additional 40-percent reduction in phosphorus. When applied to the remaining phosphorus load untreated by the wet pond itself, an additional 65 pounds of phosphorus could be removed annually.

Nutrient Removal Credit for Design Retrofits.

In order to calculate the pounds of nutrients removed by Lake Cook after retrofits are completed, the pollutant loads of nitrogen, phosphorus, and total suspended solids generated by the Lake Cook watershed were calculated first. The pollutant loading rates for the three pollutants were taken from Table 2b: *Calculation Sheet for Estimating Existing Source Loads for the Potomac River Basin,* found in Alexandria's 2013-2018 MS4 permit for Regulated Urban Impervious and Regulated Urban Pervious land uses. The pollutant loading rates for forested land were taken from Table III.1 *Forested loading rates by basin:* from DEQ's Draft Revised Guidance Memo 14-2012. Table 1 shows the land use acres served by Lake Cook, the pollutant loads for each nutrient by land use, and the total pollutant loads generated by the Lake Cook watershed.

Table 1. Lake Cook Watershed Pollutant Loads

Land Use	Pollutant	Total Acres Served	Loading Rate (lbs/ac/yr)	Pollutant Load (lbs/yr)	Total Load (lbs/yr)
Regulated Urban Impervious	Nitrogen	127.54	16.86	2,150.32	**4,599.20**
Regulated Urban Pervious	Nitrogen	221.51	10.07	2,230.61	
Forest	Nitrogen	41.26	5.29	218.27	
Regulated Urban Impervious	Phosphorus	127.54	1.62	206.61	**302.80**
Regulated Urban Pervious	Phosphorus	221.51	0.41	90.82	
Forest	Phosphorus	41.26	0.13	5.36	
Regulated Urban Impervious	Total Suspended Solids	127.54	1,171.32	149,390.15	**191,628.70**
Regulated Urban Pervious	Total Suspended Solids	221.51	175.80	38,941.46	
Forest	Total Suspended Solids	41.26	79.91	3,297.09	

Because the proposed wet pond design does not strictly meet all of the Virginia Stormwater BMP Clearinghouse standards for a Level 1 Wet Pond, the Clearinghouse removal efficiencies, strictly speaking, cannot be used to calculate the annual pollutant removals for the pond. Virginia DEQ's Draft Revised Guidance Memo No. 14-2012 (dated March 19, 2015) states that the Chesapeake Bay Program Retrofit Curves should be used to determine pollutant removal efficiencies when a BMP cannot meet the Virginia Stormwater BMP Clearinghouse criteria. Based on a treatment depth of 1 inch over the impervious acres in the Lake Cook watershed, the Chesapeake Bay Program Retrofit Curves give removal efficiencies of 35% for nitrogen, 55% for phosphorus and 70% for sediment for Stormwater Treatment Practices (ST) such as wet ponds. Table 2 shows the annual pollutant removal rates based on the Lake Cook watershed pollutant loads and nutrient removal efficiencies from the Bay Program Retrofit Curves (without the benefit of an approved upflow filter). The City would like to use the removal efficiencies from Bay Program Retrofit Curves to calculate the nutrient reduction credit

for the proposed retrofit design for three reasons. First, recent correspondence with DEQ confirmed that the Bay Program Retrofit curves must be used to calculate nutrient reduction efficiencies for BMPs that do not meet the BMP Clearinghouse criteria, and given a lack of other methods to compute efficiencies, permittees may use those efficiencies calculated by the curves. Secondly, the proposed retrofit design meets all other criteria for a Level 1 Wet Pond design, and even meets the criteria for a Level 2 Wet Pond design by providing multiple cells, each having its own sediment forebay.

Thirdly, the proposed retrofit design still provides storage for a runoff treatment depth of 1 inch over the impervious acreage within the watershed.

Table 2. Annual Nutrient Removal by Lake Cook After Retrofitting

Pollutant	Annual Pollutant Load Input from Watershed (lbs/yr)	Removal Efficiency (%)	Annual Pollutant Removal (lbs/yr)
Nitrogen	4,599.20	35	**1,609.72**
Phosphorus	302.80	55	**166.54**
Total Suspended Solids	191,628.70	70	**134,140.09**

The conversion of Lake Cook to a Level 1 Design Wet Pond through retrofitting will result in the removal of approximately 1,610 pounds of nitrogen, 167 pounds of phosphorus, and 134,140 pounds of total suspended solids.

Existing BMP Nutrient Removal

Per DEQ's Draft Revised Guidance Memo No. 14-2012 and the SLAF Program Guidelines, pollutant removal rates for an existing BMP must be calculated and subtracted from the removal rates for the BMP after upgrades and retrofitting are complete. In the case of Lake Cook, the nutrient removal provided by the lake in its existing state was calculated for the 15-acre Animal Welfare League that drains to the lake, which is the reported acreage serviced by Lake Cook in the City's BMP inventory. Since the lake does not meet the Virginia Stormwater Management BMP Clearinghouse standards for a wet pond in its existing state, the Chesapeake Bay Program BMP removal efficiencies for a wet pond (nitrogen – 20 percent, phosphorus – 45 percent, and total suspended solids – 60 percent) were used as a starting point for the calculations, per Example V.D.2 in the Draft Revised Guidance Memo 14-2012.

Due to the age of the lake and the lack of original design criteria, downward modifications were made to the Chesapeake Bay Program's removal efficiencies. Specifically, 10-percent reductions in efficiency were taken for age since the lake was constructed in the 1970s. The age of the lake combined with the lack of a sediment forebay and the lack of aquatic benches resulted in a total downward reduction of 30 percent. The resulting pollutant removal efficiencies used for calculating the existing pollutant removal rates are: 14 percent, 31.5 percent, and 42 percent for nitrogen, phosphorus, and sediment, respectively.

Tables 3 and 4 show the existing pollutant loads and the pollutant removal rates credited to Lake Cook for treatment of the 15-acre Animal Welfare League site. The pollutant

loads were based on 4.44 acres of urban impervious, 6.64 acres of urban pervious, and 3.92 acres of forested land.

Table 3. Existing Pollutant Loads from the Animal Welfare League/Cameron Run Regional Park

Land Use	Pollutant	Total Acres Served	Loading Rate (lbs/ac/yr)	Pollutant Load (lbs/yr)	Total Load (lbs/yr)
Regulated Urban Impervious	Nitrogen	4.44	16.86	74.86	**162.46**
Regulated Urban Pervious	Nitrogen	6.64	10.07	66.86	
Forest	Nitrogen	3.92	5.29	20.74	
Regulated Urban Impervious	Phosphorus	4.44	1.62	7.19	**10.42**
Regulated Urban Pervious	Phosphorus	6.64	0.41	2.72	
Forest	Phosphorus	3.92	0.13	0.51	
Regulated Urban Impervious	Total Suspended Solids	4.44	1,171.32	5,200.66	**6,681.22**
Regulated Urban Pervious	Total Suspended Solids	6.64	175.80	1,167.31	
Forest	Total Suspended Solids	3.92	79.91	313.25	

Table 4. Pollutant Removals for Existing Lake Cook

Pollutant	Annual Pollutant Load Input from Watershed (lbs/yr)	Removal Efficiency (%)	Annual Pollutant Removal (lbs/yr)
Nitrogen	162.46	14	**22.74**
Phosphorus	10.42	31.5	**3.28**
Total Suspended Solids	6,681.22	42	**2,806.11**

Based on the differences between the annual pollutant removal rates calculated for Lake Cook as an existing BMP treating 15 acres of the Lake Cook watershed (as reported by

the City) and the pollutant removal rates that will be provided by the new water quality retrofits, the City of Alexandria should be allowed to take credit for an incremental increase of 1,587 pounds of nitrogen, 163 pounds of phosphorus, and 131,334 pounds of total suspended solids towards meeting its Chesapeake TMDL reductions. Table 5 summarizes the existing and future pollutant removals, and incremental increase in nutrient removal credit.

Table 5. Existing, Future, and Incremental Pollutant Load Reductions

Pollutant	Existing Annual Pollutant Load Reductions (lbs/yr)	Annual Pollutant Removal Rates After Retrofitting (lbs/yr)	Incremental Difference Between Annual Pollutant Removal Rates (lbs/yr)
Nitrogen	22.74	1,609.72	**1,586.97**
Phosphorus	3.28	166.54	**163.25**
Total Suspended Solids	2,806.11	134,140.09	**131,334**

Appendix D

Four Mile Run Stream Restoration Technical Memorandum

City of Alexandria, Virginia
Chesapeake Bay TMDL Action Plan
Phase I for 5% Compliance

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Technical Memorandum

To: City of Alexandria

From: Brian Finerfrock, Eliana Rios

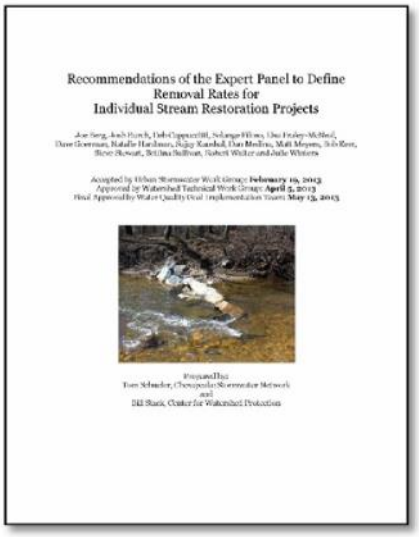
Rummel, Klepper & Kahl, LLP

Date: September 11, 2014

Subject: Four Mile Run Stream Restoration – Tidal Wetland Pollutant Removal – Protocol 3

The following memorandum documents the use of the "Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects" prepared by Tom Schueler (Chesapeake Stormwater Network) and Bill Stack (Center for Watershed Protection) to determine the pollutant removal amount for the proposed tidal wetland restoration site associated with the Four Mile Run Tidal Restoration project.

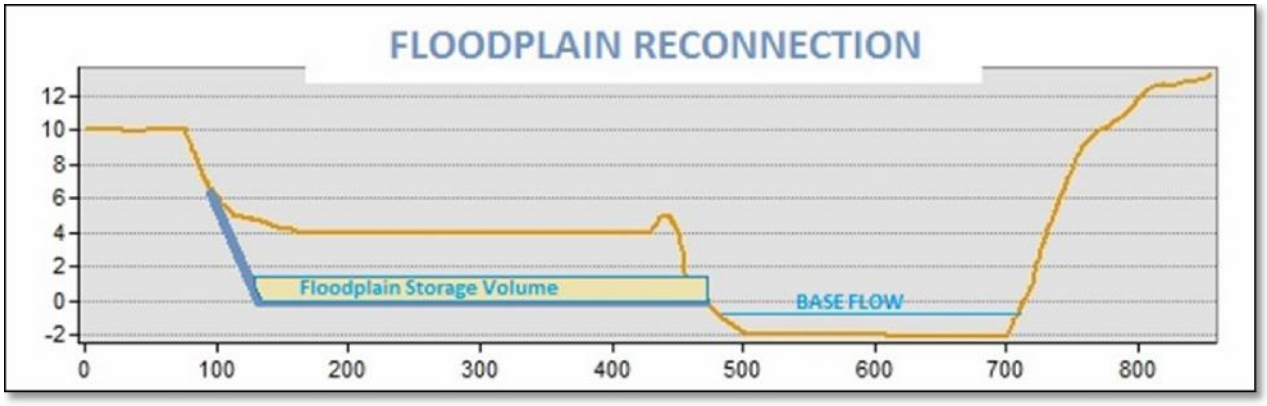
Introduction


Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects

The tidal wetland restoration site will be assessed using Protocol 3- Credit for Floodplain Reconnection Volume. The intent of this protocol is to provide mass sediment and nutrient reduction credit for projects which provide a reconnection of stream channels to their flood plains over a wide range of storm events. This criteria matches the intended function of the proposed wetland by providing a floodplain connection to the main channel (Four Mile Run). It should be noted that the Virginia Runoff Reduction Methodology Standard Constructed Wetland, is not an appropriate assessment of the pollutant removal conditions of the proposed wetland because the Constructed Wetland design and function relies on the long term storage of water over a wetland vegetation which is a function of a stand riser. Whereas the pollutant removal capability of the proposed wetland will be a function of the sediment deposition, plant pollutant uptake, denitrification, and other biological and physical processes.

METHOD AND QUALIFYING CONDITIONS

The applicable mass sediment and nutrient reduction credit is limited to the volume of water, up to 1 foot, captured by the wetland (floodplain reconnection).



A few criteria are required to be evaluated to determine applicability:

1. Is the project primarily designed to protect public infrastructure by bank armoring or riprap?- NO

2. Is the stream reach greater than 100 feet in length and still actively enlarging or grading in response to upstream development or adjustment to previous disturbances in the watershed? Yes

3. Does the project utilize a comprehensive approach to the stream/wetland restoration design? Yes

4. Will the project comply with state and federal permitting?- Yes

5. Are activities being proposed in a high function portion of the urban stream corridor?- No

Site Conditions

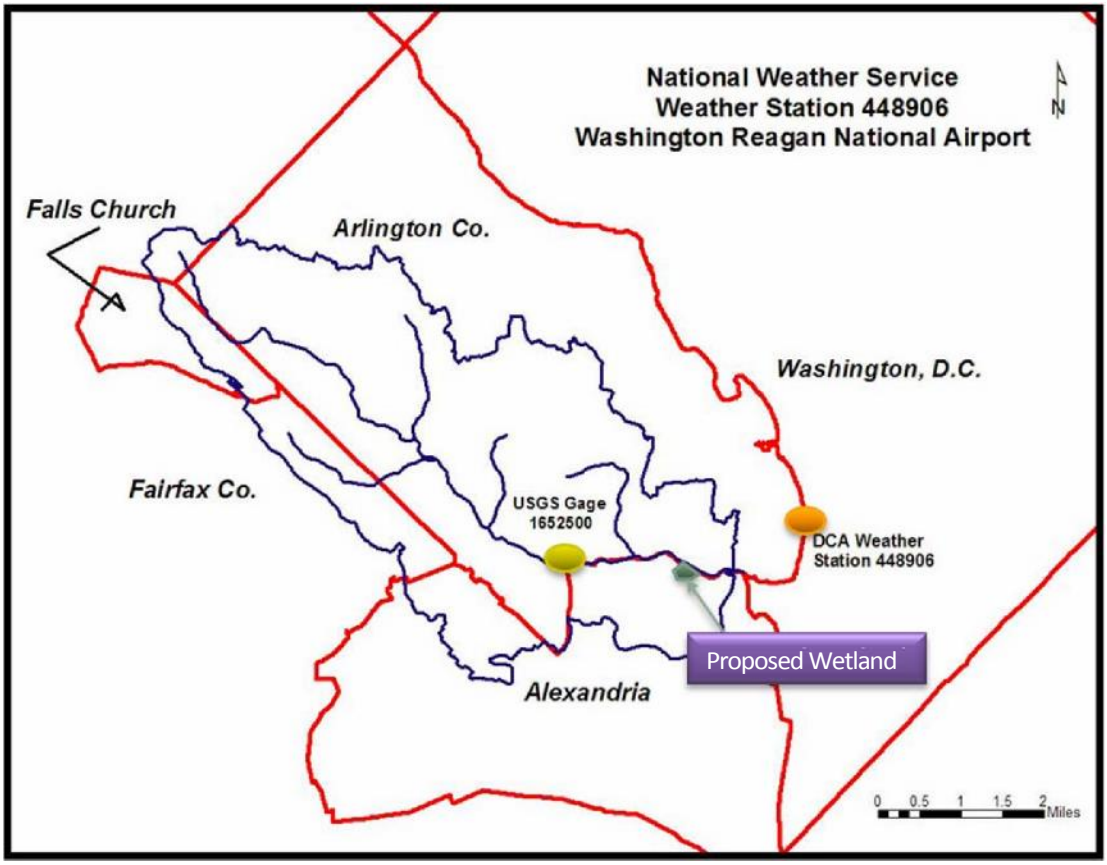
The proposed wetland is a tidally influenced wetland, located in the Four Mile Run Park, in the City of Alexandria. The proposed wetland is planned to be 2 acres in size, with a design intended to minimize phragmite colonization.

Site Computations:

Step 1: Estimate Floodplain Connection Volume

The proposed wetland is tidally influenced, therefore there is a baseflow condition. For pollutant removal efficiencies we determined which portion of the 1-inch storm event (Water Quality Volume event) will be available to the wetland for potential treatment. We determined the full range of 1-inch watershed inches if available to the wetland for potential treatment.

It should be noted that determination of the use of 1-inch storm events for purposes of treatment volume for the runoff reduction methodology was based an analysis of rainfall data at Reagan National Airport, which is very close to the project site and applicable for use in determining rainfall-runoff



characteristics of Four Mile Run.

Step 2: Estimate Phosphorus, Nitrogen and Total Suspended Solids (TSS) Removal Rate Available to Floodplain Reconnection

Under the guidance of the protocols, the maximum removal efficiency for wetland/floodplain reconnection is 30%. Based on the available volume in the proposed wetland with a maximum depth of 1.0 feet, we conclude that for treatment purposes, storm events up to the 0.5 inch storm event with a floodplain storage volume (watershed inches) of 1-inch, will allow for our wetland to achieve a

phosphorus (P), nitrogen (N) and total suspended solids (TSS) removal efficiency of 10%, 6.8% and 6.8% respectively.

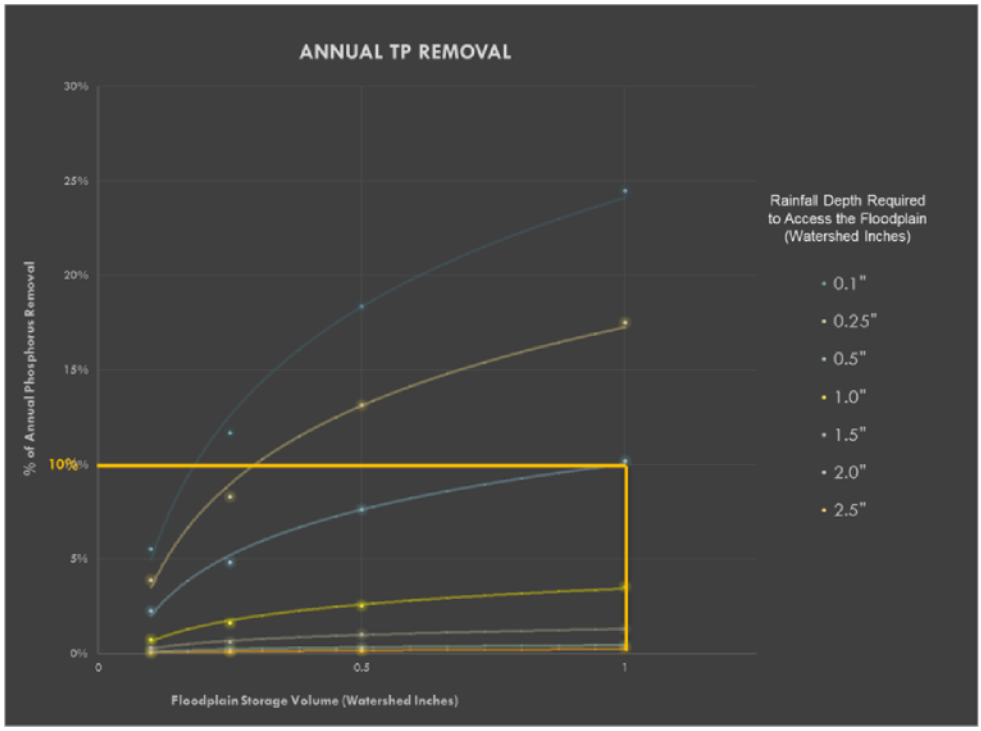
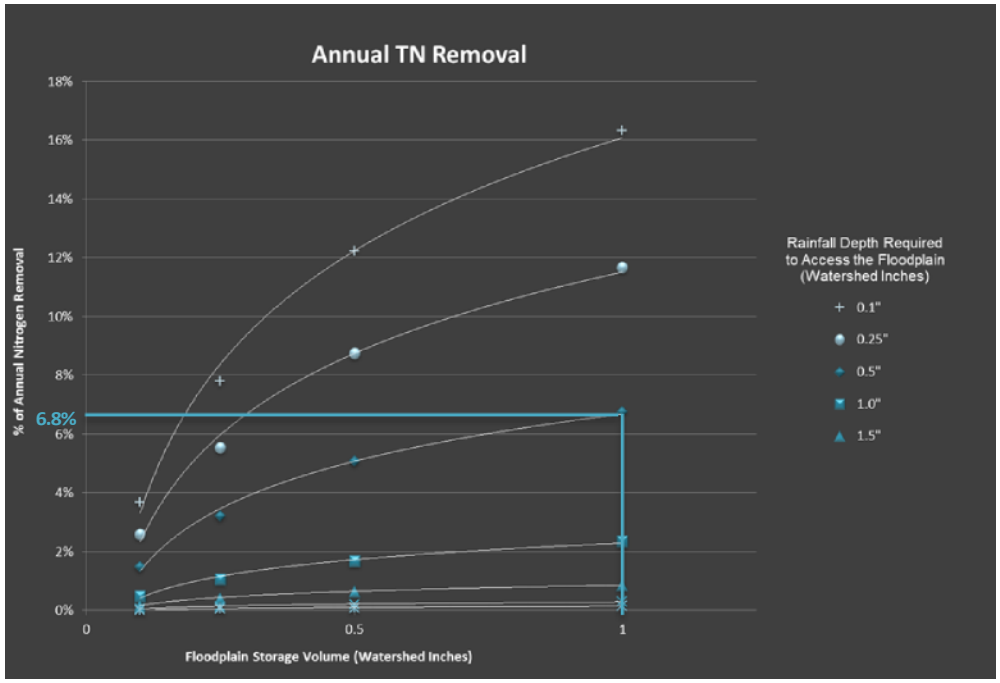


Figure 1-Annual Total Phoshorus (TN) removal as afunction offloodplain storage volume for several rainfall thresholds that allow runoff to access the floodplain.



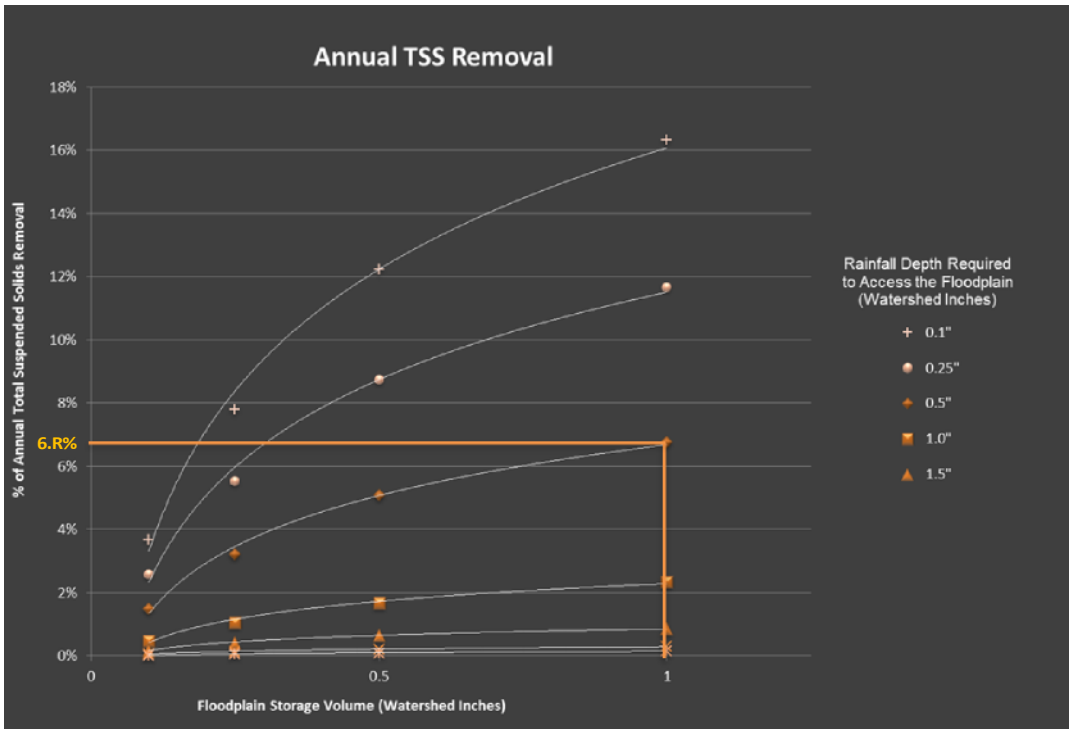
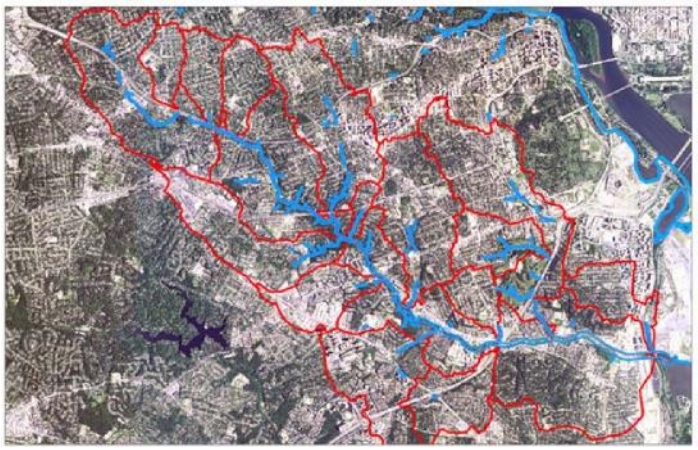


Figure 3-Annual Total Suspended Solids (TSS) removal as a function offloodplain storage volume for several rainfall thresholds that allow runoff to access the floodplain

Step 3: Compute Annual Phosphorus, Nitrogen and Total Suspended Solids Load



Our analysis performed a watershed analysis of the watershed to determine the potential phosphorus loading for Four Mile Run. Four Mile Run watershed drainage area to the wetland is approximately 10,560 acres, comprised of a highly urbanized watershed, with 10% B soils and 90% D soils in average.

Our analysis utilized two methodologies of determining the potential phosphorus and nitrogen loads: Virginia Runoff Reduction Methodologies and Chesapeake Bay Watershed Model projections (CBWM). The later methodology was also used for computing TSS loads. Using these two methods, the results for phosphorus and nitrogen loads were comparable:

- ***Runoff Reduction Methodology:*** *21,074 lbs/yr for Phosphorus and 150,759 lbs/yr for Nitrogen.*
- ***Chesapeake Bay Watershed Model (CBWM):*** *21,648 lbs/yr (using 2.21 lbs/acre/yr of impervious cover & 0.6 lbs/acre/yr for pervious cover)for Phosphorus, 142,879 lbs/yr (using 13.9 lbs/acre/yr of impervious cover & 10.2 lbs/acre/yr for pervious cover) for Nitrogen and*

11,355,168 lb/yr (using 1,175 lbs/acre/yr of impervious cover & 178 lbs/acre/yr for pervious cover)for Total Suspended Solids.

Due to the wide acceptance of Runoff Reduction, we chose to utilize the Runoff Reduction Methodology Loadings: 21,074 lbs/yr for Phosphorus and 150,759 lbs/yr for Nitrogen. As only one methodology was evaluated for Total Suspended Solid the Chesapeake Bay model loadings will be utilized: *11,355,168 lb/yr.*

Step 4: Compute Annual Pollutant Reduction Credit

From step 2, we determined the wetland will have a phosphorus removal rate of approximately 10%. With an estimated pollutant loading of 21,074 lbs/year the total potential phosphorus removal would be 2,107.4 lbs/year. But, due to the wetland area being less than 1% of the watershed area, we cannot take full credit for the load reduction, but rather a portion of the removal (0.019%), this yields a phosphorus credit of **40.0 lbs/year of removal.**

Again, from step 2, we determined the wetland will have a nitrogen removal rate of approximately 6.8%. With an estimated pollutant loading of 150,759 lbs/year the total potential nitrogen removal would be 10,252 lbs/year. But, due to the wetland area being less than 1% of the watershed area, we cannot take full credit for the load reduction, but rather a portion of the removal (0.019%), this yields a nitrogen credit of **194.8 lbs/year of removal.**

Lastly, from step 2, we determined the wetland will have a Total Suspended Solids (TSS) removal rate of approximately 6.8%. With an estimated pollutant loading of 11,355,168 lbs/year the total potential TSS removal would be 784,933 lbs/year. But, due to the wetland area being less than 1% of the watershed area, we cannot take full credit for the load reduction, but rather a portion of the removal (0.019%), this yields a TSS credit of **14,914 lbs/year of removal.**

Appendix A:

Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (May 2013)

Appendix E

DEQ Correspondence and Action Plan Approval

DEQ Additional Data Request 11/30/2015

City Response to Additional Data Request 12/14/2015

DEQ Provisionally Approval Letter and Data Request 12/29/2015

City Response to Provisionally Approved Letter 1/7/2016

DEQ Action Plan Approval Letter 1/12/2016

City Response to Approval Letter 2/11/2016

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From: Brooks, Kelsey (DEQ) <Kelsey.Brooks@deq.virginia.gov>
Sent: Monday, November 30, 2015 11:43 AM
To: Jesse Maines
Subject: VAR040057 Chesapeake Bay TMDL Action Plan - Additional Info Required

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Hello Jesse,

The Chesapeake Bay TMDL Action Plan for the City of Alexandria is currently under review. However, the following supplemental and/or clarifying information is necessary before the review of the Action Plan can be completed:

1. **Current Program and Legal Authority –** Please provide an affirmative statement that the permittee has sufficient legal authorities in place to meet the requirements of the TMDL.
2. **Service Area Delineation –** Please provide additional information on the method the permittee used to verify the forested acres that were excluded from the service area are greater than or equal to 900m^2 contiguous and are otherwise undeveloped.
3. **Gordon Recycling Limited Liability Corporation** – Our records indicate this facility is no longer active. The permittee should not exclude the lands draining from this site from its service area. Please revise the loading calculations appropriately.
4. **Historical BMPs –** Please provide the list of Historical BMPs that are being submitted for credit towards the TMDL. The list should include the following for each BMP:
    1. The date the BMP was installed
    2. The BMP type
    3. The method that was used to determine the BMP efficiency for each POC
    4. The BMP efficiency for each POC
    5. The reductions for each POC
5. **Lake Cook –** Please clarify if the lake is being expanded – it is unclear from the information provided how the lake is treating 15 acres in its present condition, but will treat 390 acres once it is upgraded.
6. **Eisenhower Pond 19 –** The method the permittee used to determine the efficiencies used to determine the reductions for this pond is unclear from the information provided. Please provide the following information:
    1. The project's required reductions (total acres, percent impervious)
    2. The pond's total reductions
    3. The RD value that was used to determine the BMP's efficiencies
    4. The date the BMP was implemented.

    In addition the TSS value provided in the description does not appear to match the value for TSS provided in Table 15. Please verify which value is correct.
7. **Cameron Station Pond –** Similarly to the Lake Cook project it is unclear to the Department why the pond is treating 94 acres prior to the ponds upgrade and 248.1 acres after the ponds upgrade if the facility's footprint is not increasing. Please provide additional information concerning the change in the pond's drainage area.
8. **Section 8.5 –** Please provide the following information for each BMP summarized in Table 12:
    1. The date the BMP was installed
    2. The BMP type

3. The BMP efficiency for each POC

Please note the values in Table 12 do not appear to match the values in Table 15. Please verify which of the reported values are correct.

9. **Four Mile Run Stream Restoration –** Please note that it is not appropriate to apply the stream restoration protocols to streams that are tidally influenced. Based on the information provided in this section, it does not appear that the application of Protocol 3 is appropriate.
10. **Aggregate Method Applications –** Please note that the calculations the permittee provided in Table 7 do not appear to match the method provided in Guidance Memo 15-2005. The permittee should also take in to account the change in pervious acres when applying the aggregate accounting method. Please revise the provided calculations.
11. **Grandfathered Projects –** Please provide the list of grandfathered projects summarized in Table 8. Also, please provide the same information as requested in comment 3 for the BMPs that were included in Table 8.
12. **Public Comment Period –** This process should have been completed prior to the Action Plan submittal. If the permittee has posted the plan and solicited comments, please let us know. If not, this process should be undertaken as soon as possible.

Please provide the above information no later than **December 14, 2015**. If there is information in the Action Plan that explains these issues that has been overlooked, please let me know.

If you have any questions, please contact me at **804-698-4321** or **kelsey.brooks@deq.virginia.gov**.

Thank you,
Kelsey Brooks

MS4 Stormwater Specialist
Department of Environmental Quality
629 E Main St, Richmond, VA 23219
P: (804) 698-4321
E: kelsey.brooks@deq.virginia.gov

DEPARTMENT OF TRANSPORTATION
AND ENVIRONMENTAL SERVICES
P.O. Box 178 - City Hall
Alexandria, Virginia 22313
703-746-4025
www.alexandriava.gov

December 14, 2015

Via Email: kelsey.brooks@deq.virginia.gov

Kelsey Brooks
MS4 Stormwater Specialist
Department of Environmental Quality
629 E Main St, Richmond, VA 23219

RE: City of Alexandria Response to DEQ Additional Information Request: MS4 VAR040057 Chesapeake Bay TMDL 5% Action Plan

Ms. Brooks:

The City received the electronic correspondence entitled "VAR040057 Chesapeake Bay TMDL Action Plan – Additional Info Request" on November 30, 2015 in response to the City's June 30, 2015 "Chesapeake Bay TMDL Action Plan for 5% Compliance" submitted to the Virginia Department of Environmental Quality (DEQ) on October 1, 2015 in compliance with the MS4 permit. The responses below are provided to address the additional information and/or clarifications requested to aid in review of the submitted action plan and will be considered as an addendum to the action plan.

Your request is provided in italics below in its entirety, along with the City's responses in non-italics.

Hi Jesse,

The Chesapeake Bay TMDL Action Plan for the City of Alexandria is currently under review. However, the following supplemental and/or clarifying information is necessary before the review of the Action Plan can be completed:

1. ***Current Program and Legal Authority** – Please provide an affirmative statement that the permittee has sufficient legal authorities in place to meet the requirements of the TMDL.*

   Response: Please note that Section 2 of the action plan contains detailed information illustrating the City's ability to meet the requirements of the TMDL. The City affirms that it has sufficient legal authorities in place to meet the requirements of the TMDL.

2. ***Service Area Delineation** – Please provide additional information on the method the permittee used to verify the forested acres that were excluded from the service area are greater than or equal to 900m^2 contiguous and are otherwise undeveloped.*

Response: The City took a conservative approach to forested acres in delineating the MS4 service area. Forested areas located in Resource Protection Areas that are undeveloped and/or greater than 900 square meters were excluded. Forested areas draining to a regulated outfall that are not associated with an undeveloped RPA were considered as pervious, regardless of size.

3. ***Gordon Recycling Limited Liability Corporation*** *– Our records indicate this facility is no longer active. The permittee should not exclude the lands draining from this site from its service area. Please revise the loading calculations appropriately.*

Response: This property was previously not included in the service area and loading calculations due to the active VPDES permit and that the property does not drain to the delineated service area. In the absence of an active permit, the property continues to be excluded from the service area and loading calculations since it is not within the delineated service area.

4. **Historical BMPs –** Please provide the list of Historical BMPs that are being submitted for credit towards the TMDL. The list should include the following for each BMP:
    1. The date the BMP was installed
    2. The BMP type
    3. The method that was used to determine the BMP efficiency for each POC
    4. The BMP efficiency for each POC
    5. The reductions for each POC

Response: Historical BMP data was included in Appendix B of the Chesapeake Bay TMDL Action Plan dated June 30, 2015 that included #2 (VA Clearinghouse name), #4 (TP only) and #5 above. The table did not contain the date installed since it was given that the BMPs presented were indeed installed between January 1, 2006 and June 30, 2009. The table has been revised to include the requested information. 2006 – 2009 BMPs are presented here in Attachment 1A, and 2009 – 2014 BMP credits (see below for offsets) are presented in Attachment 1B

5. ***Lake Cook –*** *Please clarify if the lake is being expanded – it is unclear from the information provided how the lake is treating 15 acres in its present condition, but will treat 390 acres once it is upgraded.*

Response: Lake Cook is a fishing pond created prior to 1992 that was not built for water quality and quantity purposes and does not conform to any standard. As such, the pond provides no water quality benefit. The 15 acres assigned to the pond is associated with a water park that was constructed on City property. The Lake Cook Retrofit Project was awarded a Stormwater Local Assistance Fund (SLAF) grant in FY2014, and includes the installation of a sediment forebay, aquatic bench and capture volume to treat approximately 390 acres to the 1" water quality standard.

6. ***Eisenhower Pond 19 –*** *The method the permittee used to determine the efficiencies used to determine the reductions for this pond is unclear from the information provided. Please provide the following information:*
    1. *The project's required reductions (total acres, percent impervious)*
    2. *The pond's total reductions*
    3. *The RD value that was used to determine the BMP's efficiencies*
    4. *The date the BMP was implemented.*

In addition the TSS value provided in the description does not appear to match the value for TSS provided in Table 15. Please verify which value is correct.

Response: This regional wet pond implemented in "Eisenhower Block 19" treats additional acreage than required to meet the project's water quality requirements. The project is currently under construction (Site Plan DSP2012-00028) by a private developer and slated for completion Spring 2016, so the date of installation requested per #4 is not yet applicable. City staff negotiated with the developer to provide reductions beyond those required for the development project. The following provides project information:

- The RD value is 0.40" based on RD = (1.81 ac-ft.)(12) / 53.68 Ia, using the Bay Curves for a Stormwater Treatment (ST) practice since this is a wet pond.
- Bay Curve efficiencies: TP = 38%, TN = 22.5%, TSS = 45%
- Pond drains a total of 67.1 acres (53.68 impervious aces)
- Project considered new development with 0% impervious existing and about 50% proposed. (see lines #3 and #4 below)
- Reductions required to meet the 16% land cover condition was calculated by subtracting #5 from #3.
- Total reductions in #2 minus the required reductions for the project #6 (old technical criteria requirements and offset to 16%) equals the additional credits in #7 beyond those required by the development and credited towards Bay TMDL reductions.

The following table provides the requested information summarized for Pond 19.

		Total Area (ac)	Ia (ac)	TP (lbs/yr)	TN (lbs/yr)	TSS (lbs/yr)
1.	Total Drainage Area	67.1	53.68	117.80	812.83	55272.12
2.	Total Reductions Provided (TP=38%, TN=22.5%, TSS=45%)			44.8	182.9	24,872.5
3.	Development Site Post Conditions	2.88	1.45	3.30	22.80	1550.11
4.	Existing Site Conditions	2.88	0	0.33	2.27	154.05
5.	16% Land Cover Condition	2.88	0.46	1.27	8.78	596.94
6.	Total Required Reductions to Meet 16% Land cover			2.03	14.02	953.17
7.	**Additional Credits Reductions (#2 - #6)**			**42.7**	**168.9**	**23,919.3**

7. ***Cameron Station Pond*** *– Similarly to the Lake Cook project it is unclear to the Department why the pond is treating 94 acres prior to the ponds upgrade and 248.1 acres after the ponds upgrade if the facility's footprint is not increasing. Please provide additional information concerning the change in the pond's drainage area.*

Response: The Cameron Station Pond was originally designed in the 1990's as a Level 1 pond to the ½" standard for the Cameron Station project, which drained approximately 100 acres from the project and an additional 119.4 acres draining to the pond, equaling a total of 219.4 acres draining to the pond in this configuration. The proposed retrofit will enhance the pond to a Level 2 design standard, which will include increasing the size of the forebay, create two cells, and enhance the aquatic bench. Additionally, the project includes diverting an additional 33ac to the pond for treatment.

As stated in the action plan, this project will not likely be constructed before June 30, 2018 and were not included in summarized strategies to comply with the 5% target reductions of the current MS4 permit cycle. The information in the action plan was based on an outdated approach. The table below presents current information on this retrofit.

Cameron Pond Specification (Note: Proposed conditions includes 33- acres of offsite area to be treated)	**TP (lbs/yr)**	**TN (lbs/yr)**	**TSS (lbs/yr)**
Existing Level I Wet Pond, collects 137.3 acres impervious and 82.1 acres turf (total 219 acres)	169	727	79,294.8
Proposed Level II Wet Pond, which will collect 160.9 acres impervious and 91.9 acres turf (total 252.8 acres)	296	1,129	138,833.2
Water Quality Treatment Achieved through this Retrofit (Proposed minus Existing Conditions)	**127**	**402**	**59,588.4**

8. ***Section 8.5*** *– Please provide the following information for each BMP summarized in Table 12:*
    1. *The date the BMP was installed*
    2. *The BMP type*
    3. *The BMP efficiency for each POC*

   Please note the values in Table 12 do not appear to match the values in Table 15. Please verify which of the reported values are correct.

   Response: The Table in question is related to the Retrofits on City Property that have already been implemented towards the target reductions. The requested information is included in Attachment 2. The revised Table 15 is provided below.

9. ***Four Mile Run Stream Restoration*** *– Please note that it is not appropriate to apply the stream restoration protocols to streams that are tidally influenced. Based on the information provided in this section, it does not appear that the application of Protocol 3 is appropriate.*

   Response: The Four Mile Run Stream Restoration is a floodplain reconnection project that closely aligns with the goals of the Expert Panel's protocol 3 for floodplain reconnection. This project meets all of the basic qualifying criteria and protocol-specific criteria set forth in the Expert Panel report. The tidal limit for Four Mile Run is approximately at the Mount Vernon Bridge, which is only about 500 feet upstream of this project. Because the primary goal of the project was floodplain reconnection and the project meets all of the basic and protocol specific qualifying conditions, we believe that protocol 3 does apply to this stream restoration project.

10. ***Aggregate Method Applications –*** *Please note that the calculations the permittee provided in Table 7 do not appear to match the method provided in Guidance Memo 15-2005. The permittee should also take in to account the change in pervious acres when applying the aggregate accounting method. Please revise the provided calculations.*

    Response: The revised information is provided in Attachment 3.

11. ***Grandfathered Projects –*** *Please provide the list of grandfathered projects summarized in Table 8. Also, please provide the same information as requested in comment 3 for the BMPs that were included in Table 8.*

    Response: The list of Grandfathered BMP Credits is proved in Attachment 4A and Grandfather Project Offsets is provided in Attachment 4B.

12. ***Public Comment Period –*** *This process should have been completed prior to the Action Plan submittal. If the permittee has posted the plan and solicited comments, please let us know. If not, this process should be undertaken as soon as possible.*

    Response: The City provided for a public comment period on the draft Action Plan prior to finalizing on June 30, 2015. The below provides additional information on the process:

    - A public notice was placed in the Alexandria Times/Gazette inviting the public to learn about and comment on the draft by attending the May 18, 2015 Environmental Policy Commission (EPC) Public Meeting.
    - A presentation based on this draft will be provided during the May 18, 2015 EPC Public Meeting, inviting the EPC and members of the community to comment on the draft.
    - Solicitation of public comment by posting the draft action plan on the City website with contact information for receipt of comment.
    - Solicitation of public comment through posting in the June 5, 2015 City Manager's Report on the City's website online.
    - Public comment period was picked up by AlexandriaNews.org (a very well-read online news source) and circulated on June 5, 2015 email alert and online posting.
    - Finally, the Final action plan was placed on the City Council docket for September 8, 2015; where the recommendation to submit the June 30, 2015 action plan to DEQ was passed by consensus.

Please provide the above information no later than ***December 14, 2015****. If there is information in the Action Plan that explains these issues that has been overlooked, please let me know.*

Thanks for this opportunity to provide clarifying information for the action plan to facilitate your review. As presented in the action plan and here in this response to your request, the 5% goal of the action plan – including 2009-2014 offsets and grandfathered projects – is nearly achieved through credits from Post-2009 BMPs from redevelopment. Factoring in the reductions for 2006-2009 Historical BMPs exceeds the requirement by nearly 200%. Based on the above clarifications, the following table (revised from Table 15 in the action plan) summarizes the City's requirements and reductions:

Reduction Strategies	N (lbs)	100% Goal[2]	P (lbs)	100% Goal[2]	TSS (lbs/yr)	100% Goal[2]
2006-2009 BMPs	1305.10	17.2	158.00	15.48	150,452.00	8.69
Post-2009 BMPs	110.24	1.5	14.88	4.44	17,051.59	4.59
Regional Facilities – Lake Cook	1586.97	20.9	163.25	15.79	131,334.00	15.2
Regional Facilities – Pond 19	168.90	2.2	42.70	1.52	23,919.30	1.35
Retrofits on City Property	17.57	0.2	2.67	1.48	2,804.69	0.12
Urban Stream Restoration – Four Mile Run	194.80	2.6	40.00	3.87	14,914.00	1.73
Total Proposed Reductions	**3364.54**	**44.5**	**280.10**	**42.58**	**273,612.33**	**31.68**
Total Required Reductions (3 permit cycles)	*7,597.00*	*100%*	*1,004.40*	*100%*	*861,936.64*	*100%*

1. Assumes all grandfathered projects to be offset this permit cycle.
2. 100% goal is based on L2 scoping.

Please note that the City will provide annual compliance reporting on the implementation of strategies to meet the City's Bay TMDL targets per the requirements of the MS4 general permit and DEQ's Guidance. Please feel free to contact me at jesse.maines@alexandriava.gov or 703-746-4643 should you have any additional questions.

Sincerely,

Jesse E. Maines, MPA, CPESC
Watershed Management Planner
Transportation and Environmental Services
Stormwater & Sanitary Infrastructure Division

Cc: William J. Skrabak, Deputy Director, T&ES Infrastructure and Environment
Lalit K. Sharma, PE, Division Chief, T&ES, Stormwater & Sanitary Infrastructure Division
Brian Rahal, PE, T&ES, S&SI, Stormwater Section Lead

Attachments: Attachment 1A – 2006-2009 Historical BMPs
Attachment 1B – 2009-2014 BMP credits
Attachment 2 – City Property Retrofits
Attachment 3 – Aggregate Accounting 2009-2014 Offsets
Attachment 4A – Grandfathered BMP Credits
Attachment 4B – Grandfathered Required Offsets

City of Alexandria Jan. 1, 2006 - June 30, 2009 BMPs **Attachment 1A**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
1995-0019 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	4/13/2006	1.65	0.95	1.83	23.07	1,236	60%	40%	80%	1.10	9.23	988.65	Chesapeake Bay Program
1995-0019 02	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	4/13/2006	1.05	0.86	1.47	16.41	1,041	60%	40%	80%	0.88	6.57	832.59	Chesapeake Bay Program
1998-0015 01	Stormceptor® Stormwater Treatment System	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	1/3/2007	5.40	0.93	3.34	60.69	1,875	20%	13%	50%	0.67	7.72	937.58	VA BMP Clearinghouse-MTD
1998-0015 02	Vegetated Buffer	Vegetated Open Channels C/D soils, no underdrain	Vegetated Buffer	1/3/2007	0.95	0.05	0.45	9.91	217	10%	10%	50%	0.05	0.99	108.39	Chesapeake Bay Program
2000-0009 01	Bioretention Filter	Bioretention C/D soils, underdrain	Bioretention Filter	1/17/2007	2.11	1.69	2.91	32.71	2,051	45%	25%	55%	1.31	8.18	1128.26	Chesapeake Bay Program
2001-0003 01	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	7/11/2008	1.15	1.15	1.86	19.39	1,347	60%	40%	80%	1.12	7.76	1077.61	Chesapeake Bay Program
2001-0003 02	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	7/11/2008	1.20	1.20	1.94	20.23	1,406	60%	40%	80%	1.17	8.09	1124.47	Chesapeake Bay Program
2001-0014 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	5/22/2008	1.00	1.00	1.62	16.86	1,171	45%	29%	80%	0.73	4.83	937.06	VA BMP Clearinghouse-MTD
2001-0014 03	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	5/4/2007	1.11	0.78	1.40	16.49	970	45%	29%	80%	0.63	4.72	776.14	VA BMP Clearinghouse-MTD
2001-0014-A 01	Regional Wet Pond	Wet Ponds and Wetlands	Regional Wet Pond	5/28/2008	225.00	133.00	253.18	3168.82	171,959	45%	30%	60%	113.93	946.73	102758.87	Retrofit Curves
2002-0001 01	Stormceptor® Stormwater Treatment System	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	8/19/2008	1.05	0.83	1.43	16.21	1,011	20%	13%	50%	0.29	2.06	505.44	VA BMP Clearinghouse-MTD
2002-0022 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	6/27/2007	2.02	1.37	2.49	29.64	1,719	45%	29%	80%	1.12	8.49	1375.18	VA BMP Clearinghouse-MTD
2002-0048 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	1/5/2009	1.06	0.42	0.94	13.49	599	20%	13%	50%	0.19	1.72	299.74	VA BMP Clearinghouse-MTD
2002-0048 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	1/5/2009	1.24	0.67	1.31	17.00	880	20%	13%	50%	0.26	2.16	440.01	VA BMP Clearinghouse-MTD
2003-0010 01	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	3/4/2008	0.96	0.96	1.56	16.20	1,126	60%	40%	80%	0.93	6.48	900.51	Chesapeake Bay Program
2003-0016 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	9/19/2008	0.28	0.19	0.34	4.11	238	45%	29%	80%	0.16	1.18	190.70	VA BMP Clearinghouse-MTD
2003-0016 02	Green Roof	NOT APPLICABLE	Green Roof	9/25/2008	0.07	0.07	0.11	1.10	76	53%	45%	56%	0.06	0.49	42.64	Retrofit Curves
2003-0035 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	9/8/2006	1.56	0.99	1.84	22.43	1,260	45%	29%	80%	0.83	6.43	1007.85	VA BMP Clearinghouse-MTD
2003-0039 01	Dry Vault Sand Filter	Filtering Practices	Dry Vault Sand Filter	3/6/2006	0.81	0.81	1.31	13.66	949	60%	40%	80%	0.79	5.46	759.02	Chesapeake Bay Program
2003-0041 01	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	10/16/2006	1.32	1.22	2.01	21.55	1,443	60%	40%	80%	1.21	8.62	1154.09	Chesapeake Bay Program
2003-0042 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	5/8/2009	1.20	0.12	0.64	12.90	330	20%	13%	50%	0.13	1.64	165.21	VA BMP Clearinghouse-MTD
2003-0042 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	5/8/2009	0.13	0.13	0.21	2.19	152	20%	13%	50%	0.04	0.28	76.14	VA BMP Clearinghouse-MTD
2004-0014 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	9/12/2006	0.15	0.10	0.19	2.22	130	45%	29%	80%	0.08	0.64	103.92	VA BMP Clearinghouse-MTD
2004-0014 02	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	9/12/2006	0.28	0.16	0.31	3.90	208	45%	29%	80%	0.14	1.12	166.01	VA BMP Clearinghouse-MTD
2004-0019 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	8/9/2006	0.38	0.38	0.62	6.41	445	60%	40%	80%	0.37	2.56	356.08	Chesapeake Bay Program
2004-0020 01	Delaware Sand Filter	Filtering Practices	Delaware Sand Filter	1/16/2006	0.35	0.28	0.48	5.43	340	60%	40%	80%	0.29	2.17	272.22	Chesapeake Bay Program
2004-0021 01	Delaware Sand Filter	Filtering Practices	Delaware Sand Filter	1/16/2006	0.57	0.45	0.78	8.80	548	60%	40%	80%	0.47	3.52	438.55	Chesapeake Bay Program
2004-0022 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	1/16/2006	0.75	0.62	1.06	11.76	749	60%	40%	80%	0.63	4.70	599.26	Chesapeake Bay Program
2004-0025 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	4/13/2007	1.40	1.05	1.84	21.23	1,291	60%	40%	80%	1.11	8.49	1033.13	Chesapeake Bay Program
2004-0025 02	CDS® Stormwater Treatment System	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	4/13/2007	7.83	7.57	12.37	130.25	8,913	20%	13%	50%	2.47	16.57	4456.30	VA BMP Clearinghouse-MTD

City of Alexandria Jan. 1, 2006 - June 30, 2009 BMPs **Attachment 1A**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2004-0025 03	CDS® Stormwater Treatment System	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	4/13/2007	1.77	1.29	2.29	26.58	1,595	20%	13%	50%	0.46	3.38	797.69	VA BMP Clearinghouse-MTD
2004-0041 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	8/8/2006	1.73	1.59	2.63	28.15	1,882	20%	13%	50%	0.53	3.58	941.16	VA BMP Clearinghouse-MTD
2005-0005 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	1/21/2008	2.99	2.82	4.64	49.26	3,333	60%	40%	80%	2.78	19.70	2666.41	Chesapeake Bay Program
2005-0011 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	10/10/2008	0.25	0.18	0.32	3.76	226	45%	29%	80%	0.15	1.08	180.90	VA BMP Clearinghouse-MTD
2005-0011 02	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	10/10/2008	0.44	0.42	0.69	7.29	497	45%	29%	80%	0.31	2.09	397.83	VA BMP Clearinghouse-MTD
2005-0015 01	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	2/23/2009	0.48	0.45	0.73	7.82	528	60%	40%	80%	0.44	3.13	422.15	Chesapeake Bay Program
2005-0019 PLT 01	Vegetated Filter Strip	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	8/30/2007	1.02	0.52	1.05	13.80	697	10%	10%	50%	0.10	1.38	348.49	Chesapeake Bay Program
2005-0019 PLT 02	Permeable Pavement	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	8/30/2007	0.01	0.01	0.01	0.15	11	20%	10%	55%	0.00	0.02	5.80	Chesapeake Bay Program
2005-0019 PLT 03	Permeable Pavement	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	8/30/2007	0.01	0.01	0.01	0.15	11	20%	10%	55%	0.00	0.02	5.80	Chesapeake Bay Program
2005-0020 01	D.C. Sand Filter	Filtering Practices	D.C. Sand Filter	1/21/2008	1.34	1.27	2.09	22.12	1,500	60%	40%	80%	1.25	8.85	1,200	Chesapeake Bay Program
2005-0028 01	Alexandria Compound Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	2/23/2009	0.57	0.57	0.92	9.61	668	60%	40%	80%	0.55	3.84	534	Chesapeake Bay Program
2005-0810 BLD 01	Green Roof	NOT APPLICABLE	Green Roof	3/25/2006	0.15	0.15	0.24	2.53	176	53%	45%	56%	0.13	1.13	98	Retrofit Curves
2006-0009 PLT 01	Infiltration System	Infiltration Practices w/o Sand, Veg.	Infiltration System	5/12/2007	2.10	0.00	0.86	21.15	369	85%	80%	95%	0.73	16.92	351	Chesapeake Bay Program
2006-0009 PLT 02	Infiltration System	Infiltration Practices w/o Sand, Veg.	Infiltration System	5/12/2007	4.09	0.00	1.68	41.15	718	85%	80%	95%	1.42	32.92	682	Chesapeake Bay Program
2006-0018 PLT 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	10/17/2007	2.26	1.60	2.87	33.64	1,993	45%	29%	80%	1.29	9.64	1,595	VA BMP Clearinghouse-MTD
2006-0018 PLT 02	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	10/17/2007	10.18	10.18	16.49	171.63	11,924	45%	29%	80%	7.42	49.17	9,539	VA BMP Clearinghouse-MTD
2006-0018 PLT 03	Stream Buffer Restoration	Wetland Restoration: Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal	Stream Buffer Restoration	10/17/2007	11.27	1.28	6.17	122.16	3,257	50%	25%	15%	3.09	30.54	489	Chesapeake Bay Program
2006-0036 PLT 01	Vortechs® Stormwater Treatment System	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	11/13/2008	0.68	0.34	0.70	9.21	463	20%	13%	50%	0.14	1.17	231	VA BMP Clearinghouse-MTD
2006-0101 01	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	1/26/2007	0.25	0.25	0.41	4.22	293	45%	25%	55%	0.18	1.05	161	Chesapeake Bay Program
2006-0101 02	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	1/26/2007	0.25	0.25	0.41	4.22	293	45%	25%	55%	0.18	1.05	161	Chesapeake Bay Program
2006-0101 03	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	1/26/2007	0.25	0.25	0.41	4.22	293	45%	25%	55%	0.18	1.05	161	Chesapeake Bay Program
2007-0004 PLT 01	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	5/3/2008	0.59	0.59	0.95	9.91	689	20%	13%	50%	0.19	1.26	344	VA BMP Clearinghouse-MTD
2007-0004 PLT 02	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	5/3/2008	0.67	0.67	1.09	11.30	785	20%	13%	50%	0.22	1.44	392	VA BMP Clearinghouse-MTD
2007-0004 PLT 03	Aqua-Swirl® Stormwater Hydrodynamic Separator	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	5/3/2008	0.52	0.46	0.77	8.35	548	20%	13%	50%	0.15	1.06	274	VA BMP Clearinghouse-MTD
2007-0010 PLT 01	Vegetated Filter Strip	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	8/8/2008	0.48	0.42	0.71	7.69	503	10%	10%	50%	0.07	0.77	251	Chesapeake Bay Program

City of Alexandria Jan. 1, 2006 - June 30, 2009 BMPs **Attachment 1A**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2007-0016 PLT 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	11/20/2008	2.13	1.71	2.94	33.06	2,077	45%	29%	80%	1.32	9.47	1,661	VA BMP Clearinghouse-MTD
2007-0101 01	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	8/16/2008	0.50	0.50	0.81	8.43	586	45%	25%	55%	0.36	2.11	322	Chesapeake Bay Program
2007-0101 02	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	8/16/2008	0.50	0.50	0.81	8.43	586	45%	25%	55%	0.36	2.11	322	Chesapeake Bay Program
2007-0102 01	Green Roof	NOT APPLICABLE	Green Roof	12/31/2007	0.01	0.01	0.01	0.13	9	53%	45%	56%	0.01	0.06	5	Retrofit Curves
2008-0018 PLT 01	StormFilter™ Stormwater Treatment System	Filtering Practices	StormFilter™ Stormwater Treatment System	2/12/2009	0.73	0.65	1.09	11.76	775	45%	29%	80%	0.49	3.37	620	VA BMP Clearinghouse-MTD
2008-0101 01	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	5/27/2009	0.26	0.20	0.35	3.98	245	45%	25%	55%	0.16	0.99	135	Chesapeake Bay Program
2008-0101 02	Tree Box Filter	Bioretention C/D soils, underdrain	Tree Box Filter	5/27/2009	0.30	0.21	0.38	4.45	262	45%	25%	55%	0.17	1.11	144	Chesapeake Bay Program
				Totals	**313**	**189**	**357.33**	**4,435**	**243,470**			**Totals**	**158.0**	**1,305.1**	**150,452**	

**TN Efficiency for the Manufactured Treatment Devices was estimated from the Retrofit Curves and the VA BMP Clearinghouse TP efficiency.*

City of Alexandria July 1, 2009 - June 30, 2014 BMPs **Attachment 1B**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
1995-0021 01	Dry Detention Ponds & Hydrodynamic Structures	Dry Detention Ponds and Hydrodynamic Structures	Regional Dry Pond	8/19/2013	34.65	22.72	41.70	503.19	28,710	10%	5%	10%	4.17	25.16	2870.97	Chesapeake Bay Program
1998-0019 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	7/21/2009	1.84	1.66	2.76	29.80	1,976	20%	13%	50%	0.55	3.79	988.02	VA BMP Clearinghouse-MTD
1999-0018 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	3/16/2011	0.0263	0.0263	0.04	0.44	31	45%	25%	55%	0.02	0.11	16.94	Chesapeake Bay Program
2000-0028 01	Underground Sand Filter	Filtering Practices	Dry Vault Sand Filter	9/21/2009	3.392	2.942	4.95	54.13	3,525	60%	40%	80%	2.97	21.65	2820.11	Chesapeake Bay Program
2000-0028 02	Underground Sand Filter	Filtering Practices	Dry Vault Sand Filter	9/21/2009	5.813	4.842	8.24	91.41	5,842	60%	40%	80%	4.95	36.57	4673.79	Chesapeake Bay Program
2000-0028 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	9/21/2009	1.73	1.73	2.80	29.17	2,026	20%	13%	50%	0.56	3.71	1013.19	VA BMP Clearinghouse-MTD
2000-0028 04	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	9/21/2009	1.55	1.55	2.51	26.13	1,816	20%	13%	50%	0.50	3.33	907.77	VA BMP Clearinghouse-MTD
2001-0012 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	9/1/2009	0.8	0.2	0.57	9.41	340	45%	25%	55%	0.26	2.35	186.86	Chesapeake Bay Program
2001-0012 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	9/1/2009	0.2	0.06	0.15	2.42	95	45%	25%	55%	0.07	0.61	52.19	Chesapeake Bay Program
2001-0012 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	9/1/2009	0.399	0.1	0.28	4.70	170	45%	25%	55%	0.13	1.17	93.33	Chesapeake Bay Program
2001-0012 05	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	9/1/2009	0.517	0.172	0.42	6.37	262	45%	25%	55%	0.19	1.59	144.16	Chesapeake Bay Program
2001-0012 06	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	9/1/2009	0.3	0.06	0.20	3.43	112	10%	10%	50%	0.02	0.34	56.24	Chesapeake Bay Program
2001-0012 07	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	9/1/2009	0.5	0.06	0.28	5.44	148	10%	10%	50%	0.03	0.54	73.82	Chesapeake Bay Program
2001-0012 08	Vegetated Open Channels	Vegetated Open Channels C/D soils, no underdrain	Grass Swale	9/1/2009	0.2	0.09	0.19	2.63	125	10%	10%	50%	0.02	0.26	62.38	Chesapeake Bay Program
2001-0012 PLT 01	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	9/1/2009	0.36	0.16	0.34	4.71	223	10%	10%	50%	0.03	0.47	111.29	Chesapeake Bay Program
2002-0009 01	Underground Sand Filter	Filtering Practices	Alexandria Compound Sand Filter	4/8/2011	0.23	0.23	0.37	3.88	269	60%	40%	80%	0.22	1.55	215.52	Chesapeake Bay Program
2002-0044 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Downstream Defender® Stormwater Treatment Vortex Separator	1/14/2010	1.22	0.862	1.54	18.14	1,073	20%	13%	50%	0.31	2.31	536.31	VA BMP Clearinghouse-MTD
2002-0044 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Downstream Defender® Stormwater Treatment Vortex Separator	1/14/2010	1.19	0.889	1.56	18.02	1,094	20%	13%	50%	0.31	2.29	547.11	VA BMP Clearinghouse-MTD
2002-0044 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Downstream Defender® Stormwater Treatment Vortex Separator	1/14/2010	0.755	0.503	0.92	11.02	633	20%	13%	50%	0.18	1.40	316.74	VA BMP Clearinghouse-MTD
2002-0044 04	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Downstream Defender® Stormwater Treatment Vortex Separator	1/14/2010	1	0.573	1.10	13.96	746	20%	13%	50%	0.22	1.78	373.12	VA BMP Clearinghouse-MTD
2002-0044 05	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	1/14/2010	2.898	2.512	4.23	46.24	3,010	45%	29%	80%	1.90	13.25	2408.17	VA BMP Clearinghouse-MTD
2002-0044 06	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	1/14/2010	3.19	1.489	3.11	42.23	2,043	45%	25%	55%	1.40	10.56	1123.72	Chesapeake Bay Program
2002-0044 07	Reduction of Impervious Surface	Already included in aggregate method for determining increase in impervious areas	Cistern	1/14/2010	5.892	5.892	9.55	99.34	6,901							Chesapeake Bay Program
2002-0044 08	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	1/14/2010	0.182	0.182	0.29	3.07	213	85%	80%	90%	0.25	2.45	191.86	Chesapeake Bay Program
2003-0006 01	Vegetated Open Channels	Vegetated Open Channels C/D soils, no underdrain	Grass Swale	5/20/2011	0.48	0.08	0.29	5.38	164	10%	10%	50%	0.03	0.54	82.01	Chesapeake Bay Program
2003-0007 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	6/11/2011	1.6	0.4	1.14	18.83	679	20%	13%	50%	0.23	2.40	339.74	VA BMP Clearinghouse-MTD
2003-0013 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	10/22/2012	0.28	0.25	0.42	4.52	298	20%	13%	50%	0.08	0.57	149.05	VA BMP Clearinghouse-MTD

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2003-0013 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	10/22/2012	0.35	0.31	0.52	5.63	370	20%	13%	50%	0.10	0.72	185.07	VA BMP Clearinghouse-MTD
2003-0013 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	10/22/2012	1.4	0.54	1.23	17.76	784	20%	13%	50%	0.25	2.26	391.85	VA BMP Clearinghouse-MTD
2003-0019 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	6/22/2012	1.39	1.1	1.90	21.47	1,339	45%	29%	80%	0.86	6.15	1071.55	VA BMP Clearinghouse-MTD
2003-0019 02	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	6/22/2012	0.259	0.259	0.42	4.37	303	85%	80%	90%	0.36	3.49	273.03	Chesapeake Bay Program
2003-0030 01	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	2/1/2010	1.65	0.11	0.81	17.36	400	10%	10%	50%	0.08	1.74	199.79	Chesapeake Bay Program
2003-0030 02	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	2/1/2010	1.85	0.56	1.44	22.43	883	10%	10%	50%	0.14	2.24	441.36	Chesapeake Bay Program
2003-0030 03	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	2/1/2010	0.114	0.114	0.18	1.92	134	20%	10%	55%	0.04	0.19	73.44	Chesapeake Bay Program
2003-0030 04	Dry Detention Ponds & Hydrodynamic Structures	Dry Detention Ponds and Hydrodynamic Structures	Dry Detention Pond	2/1/2010	0.68	0.14	0.45	7.80	259	10%	5%	10%	0.04	0.39	25.89	Chesapeake Bay Program
2003-0037 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	10/15/2012	1.83	0.56	1.43	22.23	879	20%	13%	50%	0.29	2.83	439.60	VA BMP Clearinghouse-MTD
2004-0010 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	11/12/2009	1.4	0.96	1.74	20.62	1,202	45%	29%	80%	0.78	5.91	961.46	VA BMP Clearinghouse-MTD
2004-0018 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	11/3/2010	1.84	1.4	2.45	28.03	1,717	45%	29%	80%	1.10	8.03	1373.76	VA BMP Clearinghouse-MTD
2004-0018 02	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	11/3/2010	0.54	0.5	0.83	8.83	593	45%	29%	80%	0.37	2.53	474.15	VA BMP Clearinghouse-MTD
2004-0032 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	10/18/2010	0.44	0.34	0.59	6.74	416	20%	13%	50%	0.12	0.86	207.91	VA BMP Clearinghouse-MTD
2004-0032 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	10/18/2010	0.13	0.11	0.19	2.06	132	45%	25%	55%	0.08	0.51	72.80	Chesapeake Bay Program
2004-0032 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	10/18/2010	0.17	0.15	0.25	2.73	179	45%	25%	55%	0.11	0.68	98.57	Chesapeake Bay Program
2004-0038 01	Urban stream restoration	600 ft of Stream Restoration - DSP 2007-0018	Stream Restoration	1/31/2012	2.7	0.9	2.20	33.30	1,371				40.80	45.00	26928.00	Chesapeake Bay Program
2004-0038 03	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	1/31/2012	0.104	0.104	0.17	1.75	122	20%	10%	55%	0.03	0.18	67.00	Chesapeake Bay Program
2005-0003 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	10/22/2009	0.83	0.76	1.26	13.52	903	20%	13%	50%	0.25	1.72	451.25	VA BMP Clearinghouse-MTD
2005-0003 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	10/22/2009	0.26	0.24	0.40	4.25	285	20%	13%	50%	0.08	0.54	142.32	VA BMP Clearinghouse-MTD
2005-0013 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	10/19/2012	0.62	0.54	0.91	9.91	647	45%	29%	80%	0.41	2.84	517.26	VA BMP Clearinghouse-MTD
2005-0013 02	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	10/19/2012	0.85	0.6	1.07	12.63	747	45%	29%	80%	0.48	3.62	597.39	VA BMP Clearinghouse-MTD
2005-0013 03	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	10/19/2012	0.54	0.39	0.69	8.09	483	45%	29%	80%	0.31	2.32	386.55	VA BMP Clearinghouse-MTD
2005-0016 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	12/28/2009	1.46	1.17	2.01	22.65	1,421	20%	13%	50%	0.40	2.88	710.71	VA BMP Clearinghouse-MTD
2005-0018 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	12/4/2013	0.66	0.56	0.95	10.45	674	20%	13%	50%	0.19	1.33	336.76	VA BMP Clearinghouse-MTD
2005-0024 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	9/17/2009	0.9	0.7	1.22	13.82	855	20%	13%	50%	0.24	1.76	427.54	VA BMP Clearinghouse-MTD
2005-0038 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	2.66	2.3	3.87	42.40	2,757	20%	13%	50%	0.77	5.40	1378.66	VA BMP Clearinghouse-MTD
2005-0038 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	3.01	2.61	4.39	48.03	3,127	20%	13%	50%	0.88	6.11	1563.73	VA BMP Clearinghouse-MTD
2005-0038 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	2.8	2.16	3.76	42.86	2,643	20%	13%	50%	0.75	5.45	1321.28	VA BMP Clearinghouse-MTD
2005-0038 04	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	5.07	4.03	6.96	78.42	4,903	20%	13%	50%	1.39	9.98	2451.63	VA BMP Clearinghouse-MTD

City of Alexandria July 1, 2009 - June 30, 2014 BMPs **Attachment 1B**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2005-0038 05	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	2.49	2.2	3.68	40.01	2,628	20%	13%	50%	0.74	5.09	1313.94	VA BMP Clearinghouse-MTD
2005-0038 06	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	9	7.06	12.23	138.57	8,611	20%	13%	50%	2.45	17.63	4305.29	VA BMP Clearinghouse-MTD
2005-0038 07	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	8.19	6.18	10.84	124.44	7,592	20%	13%	50%	2.17	15.84	3796.06	VA BMP Clearinghouse-MTD
2005-0038 08	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	1/31/2013	3.22	2.75	4.65	51.10	3,304	20%	13%	50%	0.93	6.50	1651.88	VA BMP Clearinghouse-MTD
2005-0041 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	12/16/2010	1.214	1.164	1.91	20.13	1,372	45%	29%	80%	0.86	5.77	1097.77	VA BMP Clearinghouse-MTD
2006-0012 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	8/18/2009	0.69	0.62	1.03	11.16	739	20%	13%	50%	0.21	1.42	369.26	VA BMP Clearinghouse-MTD
2006-0012 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	8/18/2009	2.41	2.28	3.75	39.75	2,693	20%	13%	50%	0.75	5.06	1346.73	VA BMP Clearinghouse-MTD
2006-0019 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	StormTech® Isolator™ Row Stormwater Management System	7/8/2013	0.24	0.22	0.36	3.91	261	10%	5%	10%	0.04	0.20	26.12	Chesapeake Bay Program
2006-0023 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	12/11/2009	0.738	0.463	0.86	10.58	591	20%	13%	50%	0.17	1.35	295.33	VA BMP Clearinghouse-MTD
2006-0023 02	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	12/11/2009	0.244	0.244	0.40	4.11	286	85%	80%	90%	0.34	3.29	257.22	Chesapeake Bay Program
2006-0025 01	Dry Detention Ponds & Hydrodynamic Structures	Dry Detention Ponds and Hydrodynamic Structures	Dry Detention Pond	12/1/2009	6.49	5.15	8.89	100.32	6,268	10%	5%	10%	0.89	5.02	626.79	Chesapeake Bay Program
2006-0025 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	12/1/2009	0.46	0.46	0.75	7.76	539	60%	40%	80%	0.45	3.10	431.05	Chesapeake Bay Program
2006-0025 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	12/1/2009	0.3	0.3	0.49	5.06	351	60%	40%	80%	0.29	2.02	281.12	Chesapeake Bay Program
2006-0025 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	12/1/2009	0.35	0.35	0.57	5.90	410	60%	40%	80%	0.34	2.36	327.97	Chesapeake Bay Program
2006-0030 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	9/11/2010	1.19	1	1.70	18.77	1,205	20%	13%	50%	0.34	2.39	602.36	VA BMP Clearinghouse-MTD
2006-0031 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	9/11/2010	0.285	0.224	0.39	4.39	273	45%	29%	80%	0.17	1.26	218.48	VA BMP Clearinghouse-MTD
2006-0031 02	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	9/11/2010	0.315	0.248	0.43	4.86	302	45%	29%	80%	0.19	1.39	241.81	VA BMP Clearinghouse-MTD
2006-0031 03	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	9/11/2010	0.197	0.155	0.27	3.04	189	45%	29%	80%	0.12	0.87	151.15	VA BMP Clearinghouse-MTD
2006-0031 04	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	9/11/2010	0.226	0.178	0.31	3.48	217	45%	29%	80%	0.14	1.00	173.55	VA BMP Clearinghouse-MTD
2006-0036 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	3/22/2013	0.587	0.587	0.95	9.90	688	20%	13%	50%	0.19	1.26	343.78	VA BMP Clearinghouse-MTD
2007-0003 PLT 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	11/29/2012	0.062	0.002	0.03	0.64	13	45%	25%	55%	0.01	0.16	7.09	Chesapeake Bay Program
2007-0003 PLT 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	11/29/2012	0.35	0.35	0.57	5.90	410	20%	13%	50%	0.11	0.75	204.98	VA BMP Clearinghouse-MTD
2007-0004 01	Underground Sand Filter	Filtering Practices	Delaware Sand Filter	6/3/2013	0.859	0.45	0.90	11.71	599	60%	40%	80%	0.54	4.68	479.20	Chesapeake Bay Program
2007-0008 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	12/23/2009	0.884	0.401	0.85	11.62	555	20%	13%	50%	0.17	1.48	277.31	VA BMP Clearinghouse-MTD
2007-0011 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	6/15/2011	0.115	0.0955	0.16	1.81	115	45%	29%	80%	0.07	0.52	92.23	VA BMP Clearinghouse-MTD
2007-0011 02	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	6/15/2011	0.0164	0.0164	0.03	0.28	19	20%	10%	55%	0.01	0.03	10.57	Chesapeake Bay Program
2007-0013 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	6/11/2010	1.81	1.4	2.44	27.73	1,712	20%	13%	50%	0.49	3.53	855.96	VA BMP Clearinghouse-MTD
2007-0014 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	6/24/2012	2.21	1.59	2.83	33.05	1,971	20%	13%	50%	0.57	4.21	985.70	VA BMP Clearinghouse-MTD
2007-0014 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	6/24/2012	7.37	5.56	9.75	111.97	6,831	20%	13%	50%	1.95	14.25	3415.37	VA BMP Clearinghouse-MTD

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2007-0024 PLT 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	4/19/2012	0.09	0.09	0.15	1.52	105	45%	29%	80%	0.07	0.43	84.34	VA BMP Clearinghouse-MTD
2007-0025 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	4/11/2011	0.433	0.433	0.70	7.30	507	45%	29%	80%	0.32	2.09	405.75	VA BMP Clearinghouse-MTD
2007-0025 02	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	4/11/2011	0.069	0.069	0.11	1.16	81	20%	10%	55%	0.02	0.12	44.45	Chesapeake Bay Program
2007-0025 03	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	4/11/2011	0.026	0.026	0.04	0.44	30	20%	10%	55%	0.01	0.04	16.75	Chesapeake Bay Program
2007-0027 PLT 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	12/28/2009	0.741	0.6726	1.12	12.03	800	20%	13%	50%	0.22	1.53	399.93	VA BMP Clearinghouse-MTD
2007-0027 PLT 02	Water Quality Inlet		Oil / Grit Separator	12/28/2009	0.1	0.1	0.16	1.69	117							Chesapeake Bay Program
2007-0030 01	Underground Sand Filter	Filtering Practices	Sand Filter	6/19/2012	0.244	0.148	0.28	3.46	190	60%	40%	80%	0.17	1.38	152.19	Chesapeake Bay Program
2007-0031 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	7/19/2013	0.79	0.44	0.86	10.94	577	20%	13%	50%	0.17	1.39	288.46	VA BMP Clearinghouse-MTD
2007-0037 01	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	7/10/2013	1.44	0.12	0.74	15.32	373	10%	10%	50%	0.07	1.53	186.31	Chesapeake Bay Program
2007-0037 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/10/2013	1.27	0.54	1.17	16.46	761	45%	25%	55%	0.53	4.11	418.47	Chesapeake Bay Program
2007-0037 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/10/2013	1.16	0.86	1.52	17.52	1,060	45%	25%	55%	0.68	4.38	583.04	Chesapeake Bay Program
2007-0037 04	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/10/2013	1.26	0.75	1.42	17.78	968	45%	25%	55%	0.64	4.45	532.48	Chesapeake Bay Program
2007-0037 05	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/10/2013	0.95	0.68	1.21	14.18	844	45%	25%	55%	0.55	3.55	464.18	Chesapeake Bay Program
2007-0037 06	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/10/2013	0.25	0.15	0.28	3.54	193	45%	25%	55%	0.13	0.88	106.30	Chesapeake Bay Program
2007-0037 07	Reduction of Impervious Surface	Already included in aggregate method for determining increase in impervious areas	Cistern	7/10/2013	0	0	0.00	0.00	0							Chesapeake Bay Program
2008-0008 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	11/27/2012	0.67	0.5624	0.96	10.57	678	20%	13%	50%	0.19	1.34	338.83	VA BMP Clearinghouse-MTD
2008-0008 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	11/27/2012	0.44	0.2827	0.52	6.35	359	20%	13%	50%	0.10	0.81	179.39	VA BMP Clearinghouse-MTD
2008-0008 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	11/27/2012	0.73	0.6996	1.15	12.10	825	20%	13%	50%	0.23	1.54	412.40	VA BMP Clearinghouse-MTD
2008-0012 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	3/27/2010	0.73	0.68	1.12	11.97	805	20%	13%	50%	0.22	1.52	402.64	VA BMP Clearinghouse-MTD
2008-0012 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	3/27/2010	1.1	1.1	1.78	18.55	1,288	20%	13%	50%	0.36	2.36	644.23	VA BMP Clearinghouse-MTD
2008-0012 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Vortechs® Stormwater Treatment System	3/27/2010	1.1	1.1	1.78	18.55	1,288	20%	13%	50%	0.36	2.36	644.23	VA BMP Clearinghouse-MTD
2008-0012 04	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	3/27/2010	0.61	0.56	0.93	9.95	665	45%	29%	80%	0.42	2.85	531.78	VA BMP Clearinghouse-MTD
2008-0013 01	Filtering Practices - MTD	Filtering Practices	BayFilter™ Stormwater Filtration System	12/8/2010	1.86	1.49	2.57	28.85	1,810	50%	32%	80%	1.28	9.18	1448.25	VA BMP Clearinghouse-MTD
2008-0017 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	6/29/2011	0.41	0.38	0.63	6.71	450	45%	25%	55%	0.28	1.68	247.71	Chesapeake Bay Program
2008-0017 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	6/29/2011	0.58	0.395	0.72	8.52	495	45%	25%	55%	0.32	2.13	272.36	Chesapeake Bay Program
2008-0017 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	6/29/2011	0.58	0.395	0.72	8.52	495	45%	25%	55%	0.32	2.13	272.36	Chesapeake Bay Program
2008-0035 PLT 01	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/Sand, Veg. C/D soils, underdrain	Permeable Pavement	2/27/2010	0.077	0.077	0.12	1.30	90	20%	20%	55%	0.02	0.26	49.61	Chesapeake Bay Program

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2008-0035 PLT 02	Dry Detention Ponds & Hydrodynamic Structures	Dry Detention Ponds and Hydrodynamic Structures	Dry Detention Pond	2/27/2010	0.82	0.08	0.43	8.80	224	10%	5%	10%	0.04	0.44	22.38	Chesapeake Bay Program
2008-0102 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	5/9/2011	9.195	4.667	9.42	124.28	6,263	20%	13%	50%	1.88	15.82	3131.29	VA BMP Clearinghouse-MTD
2009-0003 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	4/3/2012	2.46	2.38	3.89	40.93	2,802	20%	13%	50%	0.78	5.21	1400.90	VA BMP Clearinghouse-MTD
2009-0003 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	4/3/2012	2.45	2.23	3.70	39.81	2,651	20%	13%	50%	0.74	5.07	1325.36	VA BMP Clearinghouse-MTD
2009-0006 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	9/29/2012	2.89	2.13	3.76	43.57	2,629	20%	13%	50%	0.75	5.54	1314.26	VA BMP Clearinghouse-MTD
2009-0006 02	Reduction of Impervious Surface	Already included in aggregate method for determining increase in impervious areas	Cistern	9/29/2012	0.33	0.33	0.53	5.56	387							Chesapeake Bay Program
2009-0006 03	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	9/29/2012	0.33	0.33	0.53	5.56	387	85%	80%	90%	0.45	4.45	347.88	Chesapeake Bay Program
2009-0008 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	9/15/2011	0.057	0.057	0.09	0.96	67	60%	40%	80%	0.06	0.38	53.41	Chesapeake Bay Program
2009-0008 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	9/15/2011	0.056	0.056	0.09	0.94	66	60%	40%	80%	0.05	0.38	52.48	Chesapeake Bay Program
2009-0009 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	10/26/2012	1.5	0.841	1.63	20.82	1,101	20%	13%	50%	0.33	2.65	550.47	VA BMP Clearinghouse-MTD
2009-0009 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.1691	0.1691	0.27	2.85	198	60%	40%	80%	0.16	1.14	158.46	Chesapeake Bay Program
2009-0009 04	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	8/11/2011	0.15	0.15	0.24	2.53	176	85%	80%	90%	0.21	2.02	158.13	Chesapeake Bay Program
2009-0009 05	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	8/11/2011	0.0146	0.0146	0.02	0.25	17	85%	80%	90%	0.02	0.20	15.39	Chesapeake Bay Program
2009-0013 01	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Buffer	7/8/2012	0.26	0.26	0.42	4.38	305	10%	10%	50%	0.04	0.44	152.27	Chesapeake Bay Program
2009-0014 GRD 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	4/19/2010	0.068	0.066	0.11	1.13	78	45%	25%	55%	0.05	0.28	42.71	Chesapeake Bay Program
2009-0014 GRD 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	4/19/2010	0.069	0.067	0.11	1.15	79	45%	25%	55%	0.05	0.29	43.36	Chesapeake Bay Program
2009-0014 GRD 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	4/19/2010	0.052	0.046	0.08	0.84	55	45%	25%	55%	0.03	0.21	30.21	Chesapeake Bay Program
2009-0014 GRD 04	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	4/19/2010	0.052	0.046	0.08	0.84	55	45%	25%	55%	0.03	0.21	30.21	Chesapeake Bay Program
2009-0101 01	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	1/24/2012	0.0142	0.0142	0.02	0.24	17	85%	80%	90%	0.02	0.19	14.97	Chesapeake Bay Program
2009-0101 02	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	1/24/2012	0.0124	0.0124	0.02	0.21	15	85%	80%	90%	0.02	0.17	13.07	Chesapeake Bay Program
2010-0001 01	Filtering Practices - MTD	Filtering Practices	BayFilter™ Stormwater Filtration System	10/31/2011	1.73	1.34	2.33	26.52	1,638	50%	32%	80%	1.17	8.44	1310.50	VA BMP Clearinghouse-MTD
2010-0005 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 05	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 06	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 07	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0166	0.0166	0.03	0.28	19	60%	40%	80%	0.02	0.11	15.56	Chesapeake Bay Program
2010-0005 08	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0135	0.0135	0.02	0.23	16	60%	40%	80%	0.01	0.09	12.65	Chesapeake Bay Program

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2010-0005 09	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0135	0.0135	0.02	0.23	16	60%	40%	80%	0.01	0.09	12.65	Chesapeake Bay Program
2010-0007 GRD 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	10/9/2009	0.8829	0.1221	0.51	9.72	277	45%	25%	55%	0.23	2.43	152.22	Chesapeake Bay Program
2010-0007 GRD 02	Bioretention, no underdrain, A/B soils	Bioretention A/B soils, no underdrain	Green Roof	10/9/2009	0.0784	0.0784	0.13	1.32	92	85%	80%	90%	0.11	1.06	82.65	Chesapeake Bay Program
2010-0009 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0316	0.0316	0.05	0.53	37	60%	40%	80%	0.03	0.21	29.61	Chesapeake Bay Program
2010-0009 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0316	0.0316	0.05	0.53	37	60%	40%	80%	0.03	0.21	29.61	Chesapeake Bay Program
2010-0009 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0316	0.0316	0.05	0.53	37	60%	40%	80%	0.03	0.21	29.61	Chesapeake Bay Program
2010-0009 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0316	0.0316	0.05	0.53	37	60%	40%	80%	0.03	0.21	29.61	Chesapeake Bay Program
2010-0009 05	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0316	0.0316	0.05	0.53	37	60%	40%	80%	0.03	0.21	29.61	Chesapeake Bay Program
2010-0010 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 05	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 06	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 07	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 08	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 09	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0010 10	Filtering Practices	Filtering Practices	Flow Thru Planter Box	10/26/2012	0.0299	0.0299	0.05	0.50	35	60%	40%	80%	0.03	0.20	28.02	Chesapeake Bay Program
2010-0018 GRD 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	7/30/2011	0.28	0.02	0.14	2.96	69	45%	25%	55%	0.06	0.74	38.02	Chesapeake Bay Program
2010-0021 GRD 01	Urban Infiltration Practices	Infiltration Practices w/o Sand, Veg.	Infiltration System	9/7/2011	0.26	0.26	0.42	4.38	305	85%	80%	95%	0.36	3.51	289.32	Chesapeake Bay Program
2010-0023 GRD 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	7/20/2011	0.063	0.063	0.10	1.06	74	60%	40%	80%	0.06	0.42	59.03	Chesapeake Bay Program
2010-0024 GRD 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	7/20/2011	0.035	0.035	0.06	0.59	41	60%	40%	80%	0.03	0.24	32.80	Chesapeake Bay Program
2011-0003 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	11/19/2013	1.91	1.54	2.65	29.69	1,869	45%	29%	80%	1.19	8.51	1495.10	VA BMP Clearinghouse-MTD
2011-0008 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	11/14/2012	0.479	0.435	0.72	7.78	517	45%	25%	55%	0.33	1.94	284.49	Chesapeake Bay Program
2011-0008 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	11/14/2012	0.718	0.635	1.06	11.54	758	45%	25%	55%	0.48	2.89	417.11	Chesapeake Bay Program
2011-0015 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	4/2/2014	0.141	0.07	0.14	1.90	94	45%	25%	55%	0.06	0.47	51.96	Chesapeake Bay Program
2011-0015 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	4/2/2014	0.643	0.439	0.79	9.46	550	45%	25%	55%	0.36	2.36	302.54	Chesapeake Bay Program
2011-0015 03	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	4/2/2014	0.277	0.213	0.37	4.24	261	45%	25%	55%	0.17	1.06	143.41	Chesapeake Bay Program
2011-0015 04	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	4/2/2014	0.125	0.096	0.17	1.91	118	45%	25%	55%	0.08	0.48	64.65	Chesapeake Bay Program
2011-0015 05	Underground Sand Filter	Filtering Practices	D.C. Sand Filter	4/2/2014	0.8275	0.82	1.33	13.90	962	60%	40%	80%	0.80	5.56	769.44	Chesapeake Bay Program

City of Alexandria July 1, 2009 - June 30, 2014 BMPs **Attachment 1B**

BMP ID	BMP Type	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
2011-0015 06	Underground Sand Filter	Filtering Practices	D.C. Sand Filter	4/2/2014	0.8275	0.82	1.33	13.90	962	60%	40%	80%	0.80	5.56	769.44	Chesapeake Bay Program
2011-0015 07	Underground Sand Filter	Filtering Practices	Delaware Sand Filter	4/2/2014	0.211	0.198	0.33	3.47	234	60%	40%	80%	0.20	1.39	187.37	Chesapeake Bay Program
2011-0020 GRD 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	Stormceptor® Stormwater Treatment System	5/9/2012	0.66	0.51	0.89	10.11	624	20%	13%	50%	0.18	1.29	311.87	VA BMP Clearinghouse-MTD
2011-0022 01	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	5/12/2014	1.868	1.548	2.64	29.32	1,869	45%	29%	80%	1.19	8.40	1495.57	VA BMP Clearinghouse-MTD
2011-0026 GRD 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	9/6/2012	1.34	1.14	1.93	21.23	1,370	20%	13%	50%	0.39	2.70	685.23	VA BMP Clearinghouse-MTD
2011-0026 GRD 02	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	9/6/2012	0.43	0.27	0.50	6.16	344	45%	25%	55%	0.23	1.54	189.41	Chesapeake Bay Program
2011-0026 GRD 03	Underground Sand Filter	Filtering Practices	D.C. Sand Filter	9/6/2012	2.34	2.19	3.61	38.43	2,592	60%	40%	80%	2.17	15.37	2073.25	Chesapeake Bay Program
2011-0026 GRD 04	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	9/6/2012	0.014	0.014	0.02	0.24	16	20%	10%	55%	0.00	0.02	9.02	Chesapeake Bay Program
2011-0026 GRD 05	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	Permeable Pavement	9/6/2012	0.014	0.014	0.02	0.24	16	20%	10%	55%	0.00	0.02	9.02	Chesapeake Bay Program
2011-0032 GRD 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	8/1/2012	0.7575	0.0851	0.41	8.21	218	45%	25%	55%	0.19	2.05	119.84	Chesapeake Bay Program
2011-0032 GRD 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	CDS® Stormwater Treatment System	8/1/2012	0.69	0.35	0.71	9.32	470	20%	13%	50%	0.14	1.19	234.87	VA BMP Clearinghouse-MTD
2011-0032 GRD 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	8/1/2012	0.0448	0.0448	0.07	0.76	52	60%	40%	80%	0.04	0.30	41.98	Chesapeake Bay Program
2011-0032 GRD 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	8/1/2012	0.0052	0.0052	0.01	0.09	6	60%	40%	80%	0.01	0.04	4.87	Chesapeake Bay Program
2012-0013 01 GRD	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	11/25/2013	0.126	0.126	0.20	2.12	148	45%	25%	55%	0.09	0.53	81.17	Chesapeake Bay Program
2012-0034 01	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.062	0.062	0.10	1.05	73	60%	40%	80%	0.06	0.42	58.10	Chesapeake Bay Program
2012-0034 02	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.062	0.062	0.10	1.05	73	60%	40%	80%	0.06	0.42	58.10	Chesapeake Bay Program
2012-0034 03	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.014	0.014	0.02	0.24	16	60%	40%	80%	0.01	0.09	13.12	Chesapeake Bay Program
2012-0034 04	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.047	0.047	0.08	0.79	55	60%	40%	80%	0.05	0.32	44.04	Chesapeake Bay Program
2012-0034 05	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.04	0.04	0.06	0.67	47	60%	40%	80%	0.04	0.27	37.48	Chesapeake Bay Program
2012-0034 06	Filtering Practices	Filtering Practices	Flow Thru Planter Box	2/7/2014	0.04	0.04	0.06	0.67	47	60%	40%	80%	0.04	0.27	37.48	Chesapeake Bay Program
2012-0034 07	Filtering Practices - MTD	Filtering Practices	StormFilter™ Stormwater Treatment System	2/7/2014	9.195	4.667	9.42	124.28	6,263	45%	29%	80%	4.24	35.61	5010.06	VA BMP Clearinghouse-MTD
2012-0101 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Tree Box Filter	5/2/2012	0.25	0.25	0.41	4.22	293	45%	25%	55%	0.18	1.05	161.06	Chesapeake Bay Program
2012-0102 01	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	7/25/2013	2.05	1.42	2.56	30.29	1,774	20%	13%	50%	0.51	3.85	887.01	VA BMP Clearinghouse-MTD
2012-0102 02	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	7/25/2013	0.7	0.62	1.04	11.26	740	20%	13%	50%	0.21	1.43	370.14	VA BMP Clearinghouse-MTD
2012-0102 03	Hydrodynamic Structures - MTD	Dry Detention Ponds and Hydrodynamic Structures	BaySeparator™ Stormwater Treatment System	7/25/2013	0.25	0.22	0.37	4.01	263	20%	13%	50%	0.07	0.51	131.48	VA BMP Clearinghouse-MTD
2012-0383 PRJ 01	Bioretention, underdrain, C/D soils	Bioretention C/D soils, underdrain	Bioretention Filter	12/15/2012	0.31	0.31	0.50	5.23	363	45%	25%	55%	0.23	1.31	199.71	Chesapeake Bay Program
2012-0383 PRJ 02	Vegetated Treatment Area, C/D soils, no underdrain	Vegetated Open Channels C/D soils, no underdrain	Vegetated Buffer	12/15/2012	0.46	0.46	0.75	7.76	539	10%	10%	50%	0.07	0.78	269.40	Chesapeake Bay Program
			Totals		**27.96**	**19.81**	**35.44**	**416**	**24,637**			**Totals**	**14.88**	**110.24**	**17,051.59**	

**TN Efficiency for the Manufactured Treatment Devices was estimated from the Retrofit Curves and the VA BMP Clearinghouse TP efficiency.*

Retrofits on City Property

Attachment 2

Project	BMP ID	Chesapeake Bay Program BMP Type	BMP Name (Full)	Date Installed	Area Treated (ac)	Impervious Treated (ac)	TP LOAD [LB/YR]	TN LOAD [LB/YR]	TSS LOAD [LB/YR]	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
Fire Station #206	2012-0103 01	Filtering Practices	StormFilter™ Stormwater Treatment System	5/20/2015	0.55	0.55	0.89	9.27	644	45%	29%	80%	0.40	2.66	515.38	VA BMP Clearinghouse-MTD
Burke Library		Filtering Practices	StormFilter™ Stormwater Treatment System	5/1/2015	0.53	0.51	0.83	8.80	601	45%	29%	80%	0.38	2.52	480.71	VA BMP Clearinghouse-MTD
Burke Library		Bioretention C/D soils, underdrain	Bioretention C/D soils, underdrain	5/1/2015	0.78	0.41	0.82	10.64	545	45%	25%	55%	0.37	2.66	299.91	Chesapeake Bay Program
Charles Barrett Elementary	2012-0104 01	Filtering Practices	StormFilter™ Stormwater Treatment System	5/20/2015	0.73	0.62	1.05	11.56	746	45%	29%	80%	0.47	3.31	596.45	VA BMP Clearinghouse-MTD
Charles Barrett Elementary	2012-0104 03	Bioretention C/D soils, underdrain	Bioretention Filter	5/20/2015	1.62	1.38	2.33	25.68	1,659	45%	25%	55%	1.05	6.42	912.24	Chesapeake Bay Program
				Totals	**4.21**	**3.47**	**5.92**	**65.96**	**4,194.58**			**Totals**	**2.67**	**17.57**	**2,804.69**	

**TN Efficiency for the Manufactured Treatment Devices was estimated from the Retrofit Curves and the VA BMP Clearinghouse TP efficiency.*

Aggregate Accounting for Special Condition Requirement 7

Attachment 3

POC Loads as of June 30, 2009 (Pre-Development)

Subsource	Pollutant	Total Existing Acres Served by MS4 as of 6/30/2009	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load as of 6/30/2009 (lbs/yr)
Regulated Impervious	Nitrogen	3,417.24	16.86	57,614.7
Regulated Pervious		3,991.57	10.07	40,195.1
Regulated Impervious	Phosphorus	3,417.24	1.62	5,535.9
Regulated Pervious		3,991.57	0.41	1,636.5
Regulated Impervious	Total Suspended Solids	3,417.24	1,171.32	4,002,682
Regulated Pervious		3,991.57	175.80	701,718

Post-Development Conditions July 1, 2014

Subsource	Pollutant	Total Existing Acres Served by MS4 as of 7/01/2014	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load as of 7/01/2014 (lbs/yr)
Regulated Impervious	Nitrogen	3,422.04	16.86	57,695.6
Regulated Pervious		3,986.77	10.07	40,146.8
Regulated Impervious	Phosphorus	3,422.04	1.62	5,543.7
Regulated Pervious		3,986.77	0.41	1,634.6
Regulated Impervious	Total Suspended Solids	3,422.04	1,171.32	4,008,304
Regulated Pervious		3,986.77	175.80	700,874

Total Load Change from "New Sources" between June 30, 2009 and July 1, 2014

Subsource	Pollutant	Estimated Total POC Loads as of 7/1/2014 (lbs/yr)	Estimated Total POC Load as of 6/30/2009 (lbs/yr)	Load Change (lbs/yr)	Total Load Change (lbs/yr)
Regulated Impervious	Nitrogen	57,695.6	57,614.7	80.9	32.6
Regulated Pervious		40,146.8	40,195.1	-48.3	
Regulated Impervious	Phosphorus	5,543.7	5,535.9	7.8	5.8
Regulated Pervious		1,634.6	1,636.5	-2.0	
Regulated Impervious	Total Suspended Solids	4,008,304	4,002,682	5,622	4,778
Regulated Pervious		700,874	701,718	-844	

Pollutant	Net Load Change (lbs/yr)*	Required Reduction during first permit cycle	Additional Red. Reqd. by the end of first permit cycle (lbs/yr)
Nitrogen	32.6	0.05	1.6
Phosphorus	5.8	0.05	0.3
Total Suspended Solids	4,778	0.05	239

**Reductions for BMPs related to development and/or redevelopment projects during this time are included in the July 1, 2009 to June 30, 2014 BMP Credits*

Grandfathered Projects

Attachment 4A

Grandfathered Projects - BMP Reductions

Project	BMP ID	Chesapeake Bay Program BMP Type	BMP Name (Full)	Manufactured Treatment Device	Area Treated (ac)	Impervious Treated (ac)	TP Load [LB/YR]**	TN Load [LB/YR]**	TSS Load [LB/YR]**	TP BMP Efficiency	TN BMP Efficiency*	TSS BMP Efficiency	TP Removed [LB/YR]	TN Removed [LB/YR]	TSS Removed [LB/YR]	Efficiency Method
Partial Landbay I & Partial Landbay H Multi-Family	2011-0021 01	Filtering Practices	BayFilter™ Stormwater Filtration System	TRUE	0.695	0.21	1.27	8.80	598	50%	32%	80%	0.64	2.80	478.49	VA BMP Clearinghouse MTD
Lynn House - Proposed Addition	2003-0026 01	Filtering Practices	StormFilter™ Stormwater Treatment System	TRUE	1.16	0.69	1.02	7.07	481	45%	29%	80%	0.46	2.03	384.73	VA BMP Clearinghouse MTD
Lynn House - Proposed Addition	2003-0026 02	Hydrodynamic Structures	CDS® Stormwater Treatment System	TRUE	0.67	0.49	0.59	4.08	278	20%	13%	50%	0.12	0.52	138.88	VA BMP Clearinghouse MTD
Lynn House - Proposed Addition	2003-0026 03	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	FALSE	0.44	0.08	0.39	2.68	182	10%	10%	50%	0.04	0.27	91.21	Chesapeake Bay Program
Lynn House - Proposed Addition	2003-0026 04	Vegetated Open Channels C/D soils, no underdrain	Vegetated Filter Strip	FALSE	0.53	0.06	0.47	3.23	220	10%	10%	50%	0.05	0.32	109.86	Chesapeake Bay Program
Victory Center - Phase 1	2004-0037 01	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	4.49	3.44	7.72	53.28	3,623	20%	13%	50%	1.54	6.78	1811.60	VA BMP Clearinghouse MTD
5325 Polk Avenue	2005-0012 01	Hydrodynamic Structures	Downstream Defender® Stormwater Treatment Vortex Separator	TRUE	1.43	0.69	1.11	7.68	522	20%	13%	50%	0.22	0.98	260.99	VA BMP Clearinghouse MTD
Lindsay Lexus of Alexandria	2006-0006 01	Filtering Practices	StormFilter™ Stormwater Treatment System	TRUE	1.51	1.33	2.66	18.37	1,249	45%	29%	80%	1.20	5.26	999.43	VA BMP Clearinghouse MTD
Woodmont Park Apartments	2007-0003 01	Hydrodynamic Structures	Vortechs® Stormwater Treatment System	TRUE	0.91	0.91	1.07	7.38	502	20%	13%	50%	0.21	0.94	250.95	VA BMP Clearinghouse MTD
Woodmont Park Apartments	2007-0003 02	Hydrodynamic Structures	Vortechs® Stormwater Treatment System	TRUE	0.85	0.85	1.00	6.89	469	20%	13%	50%	0.20	0.88	234.40	VA BMP Clearinghouse MTD
Woodmont Park Apartments	2007-0003 03	Filtering Practices	StormFilter™ Stormwater Treatment System	TRUE	10.95	7.45	12.87	88.81	6,039	45%	29%	80%	5.79	25.44	4831.46	VA BMP Clearinghouse MTD
VEPCO - North Alexandria Electrical Substation	2007-0009 01	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	0.76	0.55	0.70	4.82	328	20%	13%	50%	0.14	0.61	163.99	VA BMP Clearinghouse MTD
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 20	2007-0017 01	Filtering Practices	Alexandria Compound Sand Filter	FALSE	0.96	0.82	1.38	9.51	647	60%	40%	80%	0.83	3.80	517.41	Chesapeake Bay Program
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 19	2007-0017 02	Filtering Practices	Alexandria Compound Sand Filter	FALSE	1.02	0.86	1.24	8.56	582	60%	40%	80%	0.74	3.42	465.45	Chesapeake Bay Program
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 19	2007-0017 03	Filtering Practices	Alexandria Compound Sand Filter	FALSE	1.86	1.55	2.26	15.60	1,061	60%	40%	80%	1.36	6.24	848.77	Chesapeake Bay Program
Hoffman Properties - Blocks 11 & 12	2009-0004 01	Filtering Practices	Dry Vault Sand Filter	FALSE	3.73	3.33	7.27	50.19	3,413	60%	40%	80%	4.36	20.07	2730.07	Chesapeake Bay Program
Hoffman Properties - Blocks 11 & 12	2009-0004 02	Bioretention C/D soils, underdrain	Bioretention Filter	FALSE	0.83	0.79	1.62	11.17	759	45%	25%	55%	0.73	2.79	417.65	Chesapeake Bay Program
Victory Center - Master Plan	2010-0011 01	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	4.43	3.83	7.22	49.83	3,388	20%	13%	50%	1.44	6.34	1694.08	VA BMP Clearinghouse MTD
Victory Center - Master Plan	2010-0011 02	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	1.03	0.88	1.68	11.58	788	20%	13%	50%	0.34	1.47	393.88	VA BMP Clearinghouse MTD
Victory Center - Master Plan	2010-0011 04	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	3.85	2.67	6.28	43.30	2,945	20%	13%	50%	1.26	5.51	1472.28	VA BMP Clearinghouse MTD
Victory Center - Master Plan	2010-0011 05	Hydrodynamic Structures	Aqua-Swirl® Stormwater Hydrodynamic Separator	TRUE	3.32	2.34	5.41	37.34	2,539	20%	13%	50%	1.08	4.75	1269.61	VA BMP Clearinghouse MTD
Potomac Yard Park (Pond P-2 Enlargement)	2010-0012 01	Wet Ponds and Wetlands	Wet Pond	FALSE	31.68	27.7	60.46	417.15	28,367	45%	20%	60%	27.21	83.43	17019.92	Chesapeake Bay Program
The Delaney	2011-0007 01	Filtering Practices	StormFilter™ Stormwater Treatment System	TRUE	1.3378	1.3378	2.16	14.92	1,014	45%	29%	80%	0.97	4.27	811.38	VA BMP Clearinghouse MTD
The Delaney	2011-0007 02	Bioretention C/D soils, underdrain	Tree Box Filter	FALSE	0.2826	0.2584	0.46	3.15	214	45%	25%	55%	0.21	0.79	117.84	Chesapeake Bay Program
Landmark Gateway - Phase 2	2013-0005 01	Filtering Practices	StormFilter™ Stormwater Treatment System	TRUE	0.83	0.73	1.33	9.21	626	45%	29%	80%	0.60	2.64	500.87	VA BMP Clearinghouse MTD
				Totals	**79.6**	**63.8**	**129.7**	**894.6**	**60,833.7**			**Totals**	**51.7**	**192.4**	**38,015.2**	

**TN Efficiency for the Manufactured Treatment Devices was estimated from the Retrofit Curves and the VA BMP Clearinghouse TP efficiency.*

***Simple Method was used*

Grandfathered Projects

Attachment 4B

Grandfathered Projects - Offset Loads

Project	Project ID	Pre-Site Total Area (ac)	Pre-Site Impervious (ac)	Pre-Site Loading TP Rate (lb/ac/yr)	Post Site Total Area (ac)	Post Site Impervious (ac)	Post Site TP Loading Rate (lb/ac/yr)	TP LOAD to Offset [LB/YR]	TN Load to Offset [LB/YR]	TSS Load to Offset [LB/YR]
Partial Landbay I & Partial Landbay H Multi-Family	2011-0021	1.607	1.347	1.83	1.607	1.347	1.83	2.24	15.46	1,051
Lynn House - Proposed Addition	2003-0026	3.52	1.2	0.81	3.52	1.32	0.88	1.56	10.77	733
Victory Center - Phase 1	2004-0037	16.00	13.71	1.87	16	12.52	1.72	20.48	141.29	9,608
5325 Polk Avenue	2005-0012	2.38	0.15	0.24	2.38	0.77	0.78	0.80	5.55	377
Lindsay Lexus of Alexandria	2006-0006	1.63	1.52	2.03	1.63	1.31	1.76	2.16	14.88	1,012
Woodmont Park Apartments	2007-0003	17.69	8.06	1.05	17.69	9.15	1.18	13.01	89.77	6,105
VEPCO - North Alexandria Electrical Substation	2007-0009	1.63	0.4	0.62	1.63	0.64	0.92	0.78	5.40	367
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 20	2007-0017	2.81	1.96	1.55	2.81	1.81	1.44	2.80	19.31	1,313
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 19	2009-0004	2.85	0	0.11	2.85	1.53	1.22	2.21	15.25	1,037
Hoffman Properties - Blocks 11 & 12	2009-0004	4.27	3.79	1.94	4.27	3.82	1.95	6.45	44.49	3,025
Victory Center - Master Plan	2010-0011	16.00	13.71	1.87	16	11.82	1.63	19.04	131.38	8,934
Potomac Yard Park (Pond P-2 Enlargement)	2010-0012	31.68	13.31	0.98	31.68	27.7	1.91	46.52	320.97	21,826
The Delaney	2011-0007	2.33	2.24	2.09	2.33	1.7051	1.62	2.74	18.90	1,285
Landmark Gateway - Phase 2	2013-0005	6.32	5.99	2.06	6.32	4.6	1.61	7.38	50.92	3,463
							Totals	**128.2**	**884.4**	**60,137**

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

December 29, 2015

Mark B. Jinks
City Manager
City of Alexandria
301 King St., Room 3500
Alexandria, VA 22314

Transmitted electronically: mark.jinks@alexandriava.gov

RE: Virginia Pollutant Discharge Elimination System (VPDES) MS4 Permit VAR040057, City of Alexandria, Chesapeake Bay TMDL Action Plan Approval

Dear Mr. Jinks:

The Department of Environmental Quality (DEQ) has reviewed the Chesapeake Bay TMDL Action Plan received on October 1, 2015 in accordance with Section I.C of the General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4). Based on this review, DEQ has determined that the items included in the Chesapeake Bay TMDL Action Plan are consistent with the permit requirements; however, additional information is required. Additional information was received on December 14, 2015.

The Chesapeake Bay TMDL Action Plan is *provisionally approved* and is considered an enforceable part of the MS4 Program Plan. This provisional approval is conditioned upon DEQ's receipt and review of requested revisions to the Chesapeake Bay TMDL Action Plan as communicated by DEQ staff (attached). Please submit the required revisions by January 12, 2016. After review DEQ will provide the final approval of the Chesapeake Bay TMDL Action Plan.

Thank you for your cooperation through the TMDL Action Plan review and approval process. Please contact Kelsey Brooks at (804) 698-4321 or at kelsey.brooks@deq.virginia.gov if you have any questions.

Sincerely,

Allan Brockenbrough II

Allan Brockenbrough II, P.E.
Manager, Office of VPDES Permits

Copies: File
Jesse Maines (Jesse.Maines@alexandriava.gov)

Bauer, Jaime (DEQ)

From: Brooks, Kelsey (DEQ)
Sent: Tuesday, December 29, 2015 1:33 PM
To: Jesse Maines
Subject: RE: VAR040057 Chesapeake Bay TMDL Action Plan - Additional Info Required

Hi Jesse,

Thank you for sending this additional information. We have a few follow up questions/comments:

1. As I mentioned in an email sent earlier today, the submission appears to be missing attachment 3. Please send that attachment.

2. We are unable to recreate the values in the summary table. If we add the reductions for each strategy provided in the table, we calculate the following values:

	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
Total Reductions	3383.58	421.5	340475.58

Please clarify whether the total proposed reductions provided in the addendum are correct or need to be updated.

If you have any questions, please let me know. Please provide this information no later than **January 12, 2016**.

Thank you,
Kelsey

From: Jesse Maines [mailto:Jesse.Maines@alexandriava.gov]
Sent: Monday, December 14, 2015 5:26 PM
To: Brooks, Kelsey (DEQ)
Cc: William Skrabak; Lalit Sharma; Brian Rahal; Joni Calmbacher; Jesse Maines
Subject: RE: VAR040057 Chesapeake Bay TMDL Action Plan - Additional Info Required

Kelsey,

Please find attached the City's response to the additional information request. Please feel free to call or email me if you have any additional questions. If I don't talk to you before, have a great holiday!

Thanks,

Jesse Maines, MPA
Watershed Management Planner
City of Alexandria
T&ES, Storm and Sanitary Infrastructure
703.746.4643 (direct)
571.414.8237 (mobile)

From: Brooks, Kelsey (DEQ) [mailto:Kelsey.Brooks@deq.virginia.gov]
Sent: Monday, November 30, 2015 11:43 AM
To: Jesse Maines
Subject: VAR040057 Chesapeake Bay TMDL Action Plan - Additional Info Required

Hello Jesse,

The Chesapeake Bay TMDL Action Plan for the City of Alexandria is currently under review. However, the following supplemental and/or clarifying information is necessary before the review of the Action Plan can be completed:

1. **Current Program and Legal Authority –** Please provide an affirmative statement that the permittee has sufficient legal authorities in place to meet the requirements of the TMDL.
2. **Service Area Delineation –** Please provide additional information on the method the permittee used to verify the forested acres that were excluded from the service area are greater than or equal to 900m^2 contiguous and are otherwise undeveloped.
3. **Gordon Recycling Limited Liability Corporation** – Our records indicate this facility is no longer active. The permittee should not exclude the lands draining from this site from its service area. Please revise the loading calculations appropriately.
4. **Historical BMPs –** Please provide the list of Historical BMPs that are being submitted for credit towards the TMDL. The list should include the following for each BMP:
    1. The date the BMP was installed
    2. The BMP type
    3. The method that was used to determine the BMP efficiency for each POC
    4. The BMP efficiency for each POC
    5. The reductions for each POC
5. **Lake Cook –** Please clarify if the lake is being expanded – it is unclear from the information provided how the lake is treating 15 acres in its present condition, but will treat 390 acres once it is upgraded.
6. **Eisenhower Pond 19 –** The method the permittee used to determine the efficiencies used to determine the reductions for this pond is unclear from the information provided. Please provide the following information:
    1. The project's required reductions (total acres, percent impervious)
    2. The pond's total reductions
    3. The RD value that was used to determine the BMP's efficiencies
    4. The date the BMP was implemented.

    In addition the TSS value provided in the description does not appear to match the value for TSS provided in Table 15. Please verify which value is correct.
7. **Cameron Station Pond –** Similarly to the Lake Cook project it is unclear to the Department why the pond is treating 94 acres prior to the ponds upgrade and 248.1 acres after the ponds upgrade if the facility's footprint is not increasing. Please provide additional information concerning the change in the pond's drainage area.
8. **Section 8.5 –** Please provide the following information for each BMP summarized in Table 12:
    1. The date the BMP was installed
    2. The BMP type
    3. The BMP efficiency for each POC

    Please note the values in Table 12 do not appear to match the values in Table 15. Please verify which of the reported values are correct.
9. **Four Mile Run Stream Restoration –** Please note that it is not appropriate to apply the stream restoration protocols to streams that are tidally influenced. Based on the information provided in this section, it does not appear that the application of Protocol 3 is appropriate.
10. **Aggregate Method Applications –** Please note that the calculations the permittee provided in Table 7 do not appear to match the method provided in Guidance Memo 15-2005. The permittee should also take in to account

the change in pervious acres when applying the aggregate accounting method. Please revise the provided calculations.

11. **Grandfathered Projects –** Please provide the list of grandfathered projects summarized in Table 8. Also, please provide the same information as requested in comment 3 for the BMPs that were included in Table 8.
12. **Public Comment Period –** This process should have been completed prior to the Action Plan submittal. If the permittee has posted the plan and solicited comments, please let us know. If not, this process should be undertaken as soon as possible.

Please provide the above information no later than **December 14, 2015**. If there is information in the Action Plan that explains these issues that has been overlooked, please let me know.

If you have any questions, please contact me at **804-698-4321** or **kelsey.brooks@deq.virginia.gov**.

Thank you,
Kelsey Brooks

MS4 Stormwater Specialist
Department of Environmental Quality
629 E Main St, Richmond, VA 23219
P: (804) 698-4321
E: kelsey.brooks@deq.virginia.gov

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January 7, 2016

Via Email: kelsey.brooks@deq.virginia.gov

Kelsey Brooks
MS4 Stormwater Specialist
Department of Environmental Quality
629 E Main St, Richmond, VA 23219

RE: City of Alexandria Response to DEQ Additional Information Request: MS4 VAR040057 Chesapeake Bay TMDL 5% Action Plan

Ms. Brooks:

The City received an electronic letter regarding the "Virginia Pollutant Discharge Elimination System (VPDES) MS4 Permit VAR040057, City of Alexandria, Chesapeake Bay TMDL Action Plan Approval" dated December 29, 2015 and signed by Allan Brockenbrough II, P.E. This letter was in response to the City's "Chesapeake Bay TMDL Action Plan for 5% Compliance" and the December 14, 2015 submittal of additional information based on a request from the Virginia Department of Environmental Quality (DEQ). The letter provided provisional approval of the City's Chesapeake Bay TMDL Action Plan conditioned upon DEQ's receipt and review of requested information, which is provided herein.

The responses below are provided to address the additional information and/or clarifications requested by DEQ staff in the December 29, 2015 provisional approval letter and will be considered as an addendum to the Action Plan. Your request is provided in italics below in its entirety, along with the City's responses in non-italics. With this additional information and clarification, we look forward to receiving DEQ's Final Approval of the Chesapeake Bay TMDL Action Plan.

Hi Jesse,

Thank you for sending this additional information. We have a few follow up questions/comments.

1. *As I mentioned in an email I sent earlier today, the submission appear to be missing attachment 3. Please send the attachment.*

   Response: Attachment 3 was inadvertently left off the previous response and isattached to this letter.

2. *We are unable to recreate the values in the summary table. If we add the reductions for each strategy provided in the table, we calculate the following values:*

	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
Total Reductions	3383.58	421.5	340475.58

Please clarify whether the proposed reductions provided in the addendum are correct or need to be updated.

Response: The proposed reductions provided in the December 14, 2015 response letter needed to be updated. The table below has been updated and the values match the total proposed reductions you outlined above.

Reduction Strategies	N (lbs)	100% Goal[2]	P (lbs)	100% Goal[2]	TSS (lbs/yr)	100% Goal[2]
2006-2009 BMPs	1305.10	17.2	158.00	15.48	150,452.00	8.69
Post-2009 BMPs	110.24	1.5	14.88	4.44	17,051.59	4.59
Regional Facilities – Lake Cook	1586.97	20.9	163.25	15.79	131,334.00	15.2
Regional Facilities – Pond 19	168.90	2.2	42.70	1.52	23,919.30	1.35
Retrofits on City Property	17.57	0.2	2.67	1.48	2,804.69	0.12
Urban Stream Restoration – Four Mile Run	194.80	2.6	40.00	3.87	14,914.00	1.73
Total Proposed Reductions	**3383.58**	**44.5**	**421.50**	**42.58**	**340,475.58**	**31.68**
Total Required Reductions (3 permit cycles)	*7,597.00*	*100%*	*1,004.40*	*100%*	*861,936.64*	*100%*

1. Assumes all grandfathered projects to be offset this permit cycle.

2. 100% goal is based on L2 scoping.

As noted in our December 14, 2015 response letter, the City will provide annual compliance reporting on the implementation of strategies to meet the City's Bay TMDL targets per the requirements of the MS4 general permit and DEQ's Guidance.

Please feel free to contact me at jesse.maines@alexandriava.gov or 703-746-4643 should you have any additional questions.

Sincerely,

Jesse E. Maines, MPA, CPESC
Watershed Management Planner
Transportation and Environmental Services
Stormwater & Sanitary Infrastructure Division

Cc: William J. Skrabak, Deputy Director, T&ES Infrastructure and Environment
Lalit K. Sharma, PE, Division Chief, T&ES, Stormwater & Sanitary Infrastructure Division
Brian Rahal, PE, T&ES, S&SI, Stormwater Section Lead

Attachment: Attachment 3 – Aggregate Accounting 2009-2014 Offsets

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

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January 12, 2016

Mark B. Jinks
City Manager
City of Alexandria
301 King St.
Room 3500
Alexandria, VA 22314

Transmitted electronically: mark.jinks@alexandriava.gov

RE: Virginia Pollutant Discharge Elimination System (VPDES) MS4 Permit VAR040057, City of Alexandria, Chesapeake Bay TMDL Action Plan Approval

Dear Mr. Jinks:

The Department of Environmental Quality (DEQ) has reviewed the Chesapeake Bay TMDL Action Plan received on October 1, 2015 in accordance with Section I.C of the General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4). Additional information was received November 19, 2015 and January 7, 2016.

As submitted, the action plan will result in the following annual reduction of pollutants of concern in the Potomac River Basin:

Pollutant of Concern	**Annual Load Reduction (lb/yr)**	**Percentage of L2 Reduction Achieved After Implementation**	**Percentage of New Source Reduction Achieved After Implementation**
Total Nitrogen	3,383.58	44.44%	5%
Total Phosphorus	421.50	39.01%	5%
Total Suspended Solids	340,475.58	39.24%	5%

The Chesapeake Bay TMDL Action Plan is hereby approved and is an enforceable part of the MS4 Program Plan. The approved action plan is based on the 2000 Urbanized Area as designated by the U.S. Census Bureau; and reductions were calculated based on land use data from 2009. Please note that additional reductions may be required to address loads from expanded urbanized area as a result of the 2010 Census in accordance with Section II.C.5 of the MS4 General Permit.

Please note any modifications to the Chesapeake Bay TMDL Action Plan shall be made in accordance with the Program Plan Modification Section of the MS4 General Permit (Section II.F).

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty (30) days from the date you received this decision within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Virginia Department of Environmental Quality.

Please contact Kelsey Brooks at (804) 698-4321 or at kelsey.brooks@deq.virginia.gov if you have any questions.

Sincerely,

Allan Brockenbrough II

Allan Brockenbrough II, P.E.
Manager, Office of VPDES Permits

Copies: File
Jesse Maines (Jesse.Maines@alexandriava.gov)

DEPARTMENT OF TRANSPORTATION
AND ENVIRONMENTAL SERVICES
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February 11, 2016

Via Email: kelsey.brooks@deq.virginia.gov

Kelsey Brooks
MS4 Stormwater Specialist
Department of Environmental Quality
629 E Main St, Richmond, VA 23219

RE: City of Alexandria Response to Calculation Table in DEQ Approval Letter: MS4 VAR040057 Chesapeake Bay TMDL 5% Action Plan

Ms. Brooks:

The City received an electronic letter regarding the "Virginia Pollutant Discharge Elimination System (VPDES) MS4 Permit VAR040057, City of Alexandria, Chesapeake Bay TMDL Action Plan Approval" dated January 12, 2016 and signed by Allan Brockenbrough II, P.E. This letter provided approval of the City's "Chesapeake Bay TMDL Action Plan for 5% Compliance."

We revisited the calculations related to the grandfathered projects and realized that the required pollutant reductions needed to be updated based on each project situation. The updated grandfathered calculations are attached. As a result, values for the "Percentage of L2 Reduction Achieved" also changed (see table below). This table follows the format and calculation methods that you previously provided.

Please keep in mind that the City's requirement for projects to meet the Water Quality Volume Default (1/2" treatment over the site's entire impervious surface) is a more stringent requirement beyond the application of the average land cover condition. Because of this, grandfathered projects achieved more reductions than would be expected if only the average land cover condition were applied.

Summary - Annual Reduction of Pollutants of Concern (lb/yr)

Pollutant of Concern	Total Reductions from BMPs	Special Condition 6 Req'd Reductions - Table 3b	Total Req'd Reductions - All Cycles	Special Condition 7 New Sources Reductions	Special Condition 8 Grandfathered Reductions	BMP Removal to Meet L2	Percent of L2 Achieved
Total Nitrogen	3,383.58	379.85	7,597.03	1.63	72.79	3,309.16	43.56%
Total Phosphorus	421.50	50.22	1,004.40	0.29	-12.61	433.81	43.19%
Total Suspended Solids	340,475.58	43,096.83	861,936.64	238.92	-19,327.02	359,563.68	41.72%

As noted in our January 8, 2016 response letter, the City will provide annual compliance reporting on the implementation of strategies to meet the City's Bay TMDL targets per the requirements of the MS4 general permit and DEQ's Guidance.

I agree that the best way to proceed is with a revised approval letter with an updated calculation table. Please feel free to contact Joni Calmbacher at joni.calmbacher@alexandriava.gov or 703-746-4174 should you have any additional questions.

Sincerely,

Jesse E. Maines, MPA, CPESC
Watershed Management Planner
Transportation and Environmental Services
Stormwater & Sanitary Infrastructure Division

Cc: William J. Skrabak, Deputy Director, T&ES Infrastructure and Environment
Lalit K. Sharma, PE, Division Chief, T&ES, Stormwater & Sanitary Infrastructure Division
Brian Rahal, PE, T&ES, S&SI, Stormwater Section Lead

Attachment: Updated Attachment 4b – Grandfathered Projects – Loads, BMP Reductions, and Net Loads

UPDATED Attachment 4B: Grandfathered Projects - Loads, BMP Reductions, and Net Loads

Project	Project ID	Pre-Site Total Area (ac)	Pre-Site Impervious (ac)	Pre-Site Loading TP Rate (lb/ac/yr)	Post Site Total Area (ac)	Post Site Impervious (ac)	Post Site TP Loading Rate (lb/ac/yr)	Existing % Impervious	Proposed % Impervious	Situation	TP Load to Offset [lb/yr]*	TN Load to Offset [lb/yr]*	TSS Load to Offset [lb/yr]*	TP Reduced by BMPs (lb/yr)	TN Reduced by BMPs (lb/yr)	TSS Reduced by BMPs (lb/yr)
Partial Landbay I & Partial Landbay H Multi-Family	2011-0021	1.607	1.347	1.83	1.607	1.347	1.83	84%	84%	SITUATION 3	0.29	2.03	138	0.64	2.80	478.49
Lynn House - Proposed Addition	2003-0026	3.52	1.2	0.81	3.52	1.32	0.88	34%	38%	SITUATION 1	0.25	1.70	116	0.67	3.14	724.68
Victory Center - Phase 1	2004-0037	16.00	13.71	1.87	16	12.52	1.72	86%	78%	SITUATION 3	0.55	3.82	260	1.54	6.78	1,811.60
5325 Polk Avenue	2005-0012	2.38	0.15	0.24	2.38	0.77	0.78	6%	32%	SITUATION 1	1.28	8.82	600	0.22	0.98	260.99
Lindsay Lexus of Alexandria	2006-0006	1.63	1.52	2.03	1.63	1.31	1.76	93%	80%	SITUATION 3	-0.10	-0.69	-47	1.20	5.26	999.43
Woodmont Park Apartments	2007-0003	17.69	8.06	1.05	17.69	9.15	1.18	46%	52%	SITUATION 3	3.89	26.86	1,827	6.21	27.26	5,316.81
VEPCO - North Alexandria Electrical Substation	2007-0009	1.63	0.4	0.62	1.63	0.64	0.92	25%	39%	SITUATION 1	0.49	3.40	231	0.14	0.61	163.99
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 20	2007-0017	2.81	1.96	1.55	2.81	1.81	1.44	70%	64%	SITUATION 3	0.13	0.87	59	0.83	3.80	517.41
Eisenhower East Small Area Plan (E.E.S.A.P.) - Block 19	2009-0004	2.85	0	0.11	2.85	1.53	1.22	0%	54%	SITUATION 2	2.21	15.25	1,037			
Hoffman Properties - Blocks 11 & 12	2009-0004	4.27	3.79	1.94	4.27	3.82	1.95	89%	89%	SITUATION 3	0.89	6.13	417	5.09	22.87	3,147.72
Victory Center - Master Plan	2010-0011	16.00	13.71	1.87	16	11.82	1.63	86%	74%	SITUATION 3	-0.88	-6.09	-414	4.12	18.08	4,829.86
Potomac Yard Park (Pond P-2 Enlargement)	2010-0012	31.68	13.31	0.98	31.68	27.7	1.91	42%	87%	SITUATION 3	30.19	208.31	14,165	27.21	83.43	17,019.92
The Delaney	2011-0007	2.33	2.24	2.09	2.33	1.7051	1.62	96%	73%	SITUATION 3	-0.61	-4.22	-287	1.18	5.06	929.22
Landmark Gateway - Phase 2	2013-0005	6.32	5.99	2.06	6.32	4.6	1.61	95%	73%	SITUATION 3	-1.55	-10.70	-728	0.60	2.64	500.87
										Totals	**37.0**	**255.5**	**17,374**	**49.6**	**182.7**	**36,701**
										Grandfathered Net Loads	**-12.6**	**72.8**	**-19,327.0**			

***Negative values indicate a pollutant credit**